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Analyzing Agricultural Trade-Off and Composing Strategies to Advance Sustainable Development

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Abstract

Agriculture takes an important role for economy by more than 14% of economic contribution. Nevertheless, it has indirective effects, where it has commonly a negative impact, but somehow in the long term, offers a better environmental service. This study, therefore, aimed to evaluate both impact by estimating the Indonesia food barn to estimate how far the impact to environment through the Environmental Kuznets Curve (EKC). In order to improve the environmental quality in the long term, the sustainable practices through ecolabelling product have to be conducted. Thus, the evaluation of consumers' WTP for ecolabelling product has been observed through 300 respondents depicting their preferences. Following by AHP analysis to construct the priority of strategies to develop the sustainable agriculture. Based on the results, EKC model showed it initially leads to environmental damage, but at a certain level, people begin to increase environmental awareness by a decrease of methane (CH4) about 0.12%. It is proved by their WTP where 82.6% respondents were willing to pay for ecolabelling product. Finally, to support sustainable agriculture, reforming the market access is a top priority (0.312 points) which aimed to progressively encourage the farmers' supply. Otherwise, the pricing strategy becomes the consumers' main perspective to buy (0.264 points).

Key words : Agricultural Trade-offs, Environmental Kuznets Curve, Willingness to Pay, Environmental Degradation.

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INTRODUCTION

Indonesian agricultural sector takes an important role as the income generating for the social economy of the people particularly through its GDP development which contributes to a massive workforce labor. Its development has become a driven factor for the government economy by more than 14% of economic contribution for annual Indonesian GDP. However, the advanced development of agriculture slightly put influence on the environmental services which is contributing through its residuals such as the gas residue (CO_2, CH_4, and SO_2 etc.) as well as the other solid particle in the environment. The outcomes from production to biodiversity are not independent each other, otherwise, they have been interacting in both positive and negative ways, as well as creating the potential of synergies and trade-offs (David et al., 2018). The development of agriculture raises the issue of economic trade-off where the needs of consumption will lead to a massive means of production, therefore, it will lead to the environmental issue due to the use of some particular agricultural input factors where commonly farmers used the chemical-based agricultural practices. The Indonesia agriculture farm-land has been counted as many as 8 million hectares or 6.5% of global agricultural fields, which are the source of greenhouse gas (GHG) emission, particularly methane (CH_4), N_2O, and CO_2 (Las et al., 2006). The agricultural development has indirective environmental effects, especially as it displaces local farmers onto marginal land-uses which leads to the deforestation and soil erosion (Balogh and Jámbor, 2020). Empirical study shows that from around 70% of GHG which has been emerged due to human activities, 14% are contributed by the agricultural sector (Fauzi, 2004). Regarding Sejian et al., (2015), agriculture sector is one of the leading GHG contributors caused emission with a share of 24% from the total anthropogenic emission.

Nevertheless, Jha & Murthy (2003), depicted that there are not yet a concrete consensus which is clearly explaining the decrease of global environmental services caused by the economic activities. This clarified the findings of Beckerman (1994), where the increase of income has a positive impact to the environmental protection. Otherwise, an inverse finding by Kuznets (1995), shows that the exact impact of trade-offs between the economic development and the decrease of environmental services which is formulated through Environmental Kuznets Curve (EKC). The EKC model explains an inverted U-shaped relation between economic growth and the environmental degradation where the environmental pressure increases in the early stage of economic growth through its massive pollutants along with the extensive and intensive exploitation of natural resource. As income rises, environmental challenges have been decreased, probably due to the growing of public awareness and concerns about environmental (Maneejuk et al., 2020). The role to balance the sustainable agriculture practice become a particular agenda for the government since the agrichemical manners have been changed the ecosystem, reduced the water and air quality, followed by the increase of resistant pest attacks, therefore, it endangered the sustainable agricultural production system (Sumarno, 2018). Thus, a measurement of EKC hypothesis will be required to define the exact condition during short and long-term development, whether agriculture impact to the environment including the analysis of what sign of impact driven by the Indonesian agricultural practices.

The sustainable policy issued by Indonesia government will determine the more environmentally agriculture practice together with the improvement of environmental market perspective, where consumer might have more awareness on the green product. However, it

needs some innovations to achieve the sustainable consumption and production, which could be enhanced through eco-labelling of agricultural products (Kim et al., 2018; Wojnarowska et al., 2021; Khan et al., 2019). The certification of certain agricultural productions is ordered to deliver the message for consumer about different environmental impact within a single product by a symbolized label named eco-labelling, thus, consumer could decide the better important impact to themselves particularly in respect to environment (Tzilivakis J., et al., 2012; Taufique et al., 2019). However, Sörqvist et al., (2013), explains that the price gap for organic product relied around 6 to 300% higher than the conventional ones, thus the price become a decisive determinant for the demand of eco-labelling product. The more gap, the less consumer would be willing to buy the eco-labelling organic product with a premium price (Heinzle & Wüstenhagen, 2011).

The price gap could become a real threat to market the ecolabelling product, where the perception among Indonesian consumers have not been built up as advanced as other developed countries such as European and United Stated countries. Therefore, a particular priority set to improve the awareness of consumer behavior on eco-labelling product has to be consider by government, both in demand side regarding consumers' WTP on price tag and the supply side to deal with its high production cost on organic certification. Finally, it could fit the hypothesis of EKC where the more development of agriculture practices would improve the environment condition.

METHOD

The mixed methods have been used to identify about environment degradation due to agricultural production. Secondary data have been collected from (1) the growth of agricultural production by the sector, and (2) the environmental quality index during the last 10 years to establish the EKC model. Otherwise, the primary data have been collected from 300 respondents in West, Central, and East Java Province as the representative of main agricultural producers, to measure the level of willingness to pay (WTP). Finally, the strategies to market the organic label to consumers are measured by analysis hierarchy process (AHP) through experts' judgement, consisted of (1) government, (2) universities, (3) agricultural traders, (4) farmers, (5) organic certificatory, and (6) consumers.

A model of VECM (Vector Error Correction Model) adjusts to both short run changes in variables and deviations from equilibrium (Andrei & Andrei 2015).

$$\Delta Y_t = \sum_{i=1}^{k-1} i\Delta y_{t-1} + \mu_0 + \mu_1 t + \alpha\beta Y_{t-1} + \varepsilon_t \quad (1)$$

Note:

ΔY_t = vector containing estimated variables
μ_o = vector intercept
μ_1 = vector regression coefficient
t = time trend
α = matrix loading (adjustment)
Y_{t-1} = variable in-level
k-1 = ordo regression coefficient
ε_t = error term

Moreover, the Granger Causality model used to find the interaction between the dependent and independent variable in the model explained as below (Junaidi, 2012).

$$X_t = \sum_{i=l}^{m} \alpha_i Y_{t-i} + \sum_{j=l}^{m} \beta_j X_{t-j} + \mu_{t1} \quad (2)$$

$$Y_t = \sum_{i=l}^{m} \lambda_i X_{t-i} + \sum_{j=l}^{m} \delta_j Y_{t-j} + \mu_t \quad (3)$$

Note:
X_t = log of the GDP growth on agricultural sub-sector
Y_t = log methana emission (CH_4)
M = total lag
U_{t1} U_{t2} = error variable
α, β, λ, δ = coofesien each variable

To measure the value of WTP (Willingness to Pay) of consumers, this study evaluates the average of each consumer's WTP. It is formulated as below.

$$EWTP = \sum_{i=1}^{n} WiPfi \quad (4)$$

Note:
EWTP = the average WTP value
Wi = the value of WTP n-i
Pfi = relative Frequency
n = total respondent
i = respondent n-i willing to pay

The equation of factors influencing consumers' WTP is explained as below:

$$Logit\ (Y) = \beta o + \beta 1Xi + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \beta 7X7 + \beta 8X8 + \beta 9X9 \quad (5)$$

These are consisted of (X1) the gender, (X2) the age, (X3) education, (X4) the workplace, (X5) the marriage status, (X6) the household size, (X7) the income, (X8) the price, and (X9) the awareness to environment.

AHP (Analysis Hierarchy Process) considers the personal or group of experts to build the ideas and definitions in order to solve the problem by their experts' assumptions and evaluation to some possible strategies, therefore, concluded by set of priorities based on their judgements (Pratama & Hardiansyah, 2014).

RESULTS AND DISCUSSION

VECM Model 1 is estimating the agricultural sector contribution to environment co-integration test. Based on co-integration test, it depicts the trace value as co-integration 1, where from two variables, at least, there is one co-integration by the level of significance 5%.

Table 1. Co-Integration Test of Estimated Variable Agriculture Trade-off to Environment

No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.524984	32.00881	15.49471	0.0001
At most 1 *	0.156445	5.954557	3.841466	0.0147

Source: Analysis data, 2021.

The causality in the study uses a significant degree level 5 % and 10 %.

Table 2. Granger Causality Agriculture and Methane Gas (CH_4)

Variabel	D(LMETHANE_EMS)	D(LGDP_PERTANIAN)
D(LGDP_AGRICULURE)	25.55285 (0.0195)	-
D(LMETHANE_EMS)	-	23.95654 (0.0315)

Source: Analysis data, 2021.

There is a bi-direct causality relationship between economic growth in the agricultural sector and CH_4. Where if there is a 1% increase in the GDP of the agricultural sector in the previous 8 years, it will increase methane gas in the current year by 1,018%.

This study found a bi-directional causality between agricultural growth and CH_4 emissions indicating a short-term and long-term bi-directional cause between agricultural growth and CH_4 emissions. This is thought to stem largely from inefficient livestock rearing systems, feed production, and poor manure management in developing countries.

Table 3. Short-term Impact of Agriculture to Environment

Error Correction:	D(Lmethane_Ems)	T-Stat
Cointeq1	1.446920	[0.98784]
D (Lgdp_Agriculture (-1))	0.828243	[0.96146]
D (Lgdp_ Agriculture (-2))	-0.263731	[-0.29128]
D (Lgdp_ Agriculture (-3))	0.648232	[1.01960]
D (Lgdp_ Agriculture (-4))	0.070041	[0.20421]
D (Lgdp_ Agriculture (-5))	0.208702	[0.61977]
D (Lgdp_ Agriculture (-6))	0.018800	[0.05765]
D (Lgdp_ Agriculture (-7))	-0.008653	[-0.02715]
D (Lgdp_ Agriculture (-8))	1.018458***	[2.91315]
D (Lgdp_ Agriculture (-9))	-1.039913	[-1.90667]
D (Lgdp_ Agriculture (-10))	0.645084	[1.05519]
D (Lgdp_ Agriculture (-11))	-0.641863	[-1.13609]
D (Lgdp_ Agriculture (-12))	-0.123877	[-0.21830]
D (Lgdp_ Agriculture (-13))	0.235939	[0.69170]
C	0.027947	[1.43639]

Source: Analysis data, 2021.

EKC model shows that economic development initially leads to environmental damage, but at a certain level, people begin to increase environmental awareness.

Table 4. Short-term Impact of Agriculture to Environment

Cointegrating Eq:	Cointeq1	T-Stat
Lgdp_Agriculture (-1)	-0.127543	[-15.3791]

Source: Analysis data, 2021.

Although this effect is positive and significant in the short term, in the long term the agricultural sub-sector GDP variable has a negative effect on methane gas emissions by 0.12 point. That is, if there is an increase in GDP of the agricultural sub-sector by 1%, it will cause a decrease in methane (CH_4) of 0.12% in the long term.

The relationship between LGDP_ HORTICULTURE and environmental index (EI) implies that stimulus policy on horticultural growth will play a role in controlling the environmental quality index, where if there is a 1% increase in horticulture GDP during the previous 3 years, it will reduce the current year's environmental quality index by 1.66%.

Table 5. Granger Causality Horticulture Sub-sector to Environment

Error Correction:	D(EI)	T-Stat
Cointeq1	-0.533379	[-1.63725]
D (LGDP_ Horticulture (-1))	-0.949294	[-1.18274]
D (LGDP_ Horticulture (-2))	0.476325	[0.70937]
D (LGDP_ Horticulture (-3))	-1.660909***	[-3.05076]

Source: Analysis data, 2021.

On the other hand, the food crops sub-sector does not significantly affect the EI in both short and long term. This condition is predicted because the planting period of food crops is relatively long so that the use of pesticides could be minimized.

Table 6. Granger Causality Food Crop Sub-sector to Environment

Error Correction:	D(EI)	T-Stat
Cointeq1	-0.514596	[-1.11727]
D (LGDP _Staple Food (-1))	-1.059351	[-1.54463]
D (LGDP _Staple Food (-2))	-0.420242	[-0.49339]
D (LGDP _Staple Food (-3))	-0.465586	[-0.57641]

Source: Analysis data, 2021.

On the plantation GDP, the value obtained is negative and significant in the long term, by 0.078 point. Therefore, if there is an increase in the GDP of the plantation sub-

sector by 1%, it will cause a decrease in EI by 0.078 %.

From the results observed on consumers of agricultural products in 3 provinces, not all consumers are willing to pay additional costs for environmentally agricultural products.

Table 7. Granger Causality Plantation Industry Sub-sector to Environment

Error Correction:	D(Liklh)	T-Stat
Cointeq1	-0.195773	[-0.20828]
D (LGDP_Plantation Industry (-1))	1.268455	[0.86026]
D (LGDP_Plantation Industry (-2))	0.331264	[0.22974]
D (LGDP_Plantation Industry (-3))	-1.013122	[-0.81790]

Source: Analysis data, 2021

Table 8. Willingness to Pay Respondents for Eco-labelling Product

Location	Responden	Jumlah	Persentase
West Java	Willing	82 respondents	82%
	Not Willing	18 respondents	18%
	Total	100 respondents	
Central Java	Willing	77 respondents	77%
	Not Willing	23 respondents	23%
	Total	100 respondents	
East Java	Willing	89 respondents	89%
	Not Willing	11 respondents	11%
	Total	100 respondents	
	Total	300 respondents	100%

Source: Analysis data, 2021.

It is showed from a total of 300 respondents, about 82.6% respondents were willing to pay for environmentally friendly agricultural label products. The offering payment of that organic labelled product ranged as much as 2,000 IDR, 5,000 IDR, 10,000 IDR, 15,000 IDR, and 20,000 IDR.

Tabel 9. Mean Value of WTP

No	WTP Values	Total			Frequency (Pf_i) (%)			Mean Value of WTP		
		West Java	Central Java	East Java	West Java	Central Java	East Java	West Java	Central Java	East Java
1.	2,000 IDR	20	30	31	20%	30%	31%	400 IDR	600 IDR	620 IDR
2.	5,000 IDR	29	18	39	29%	18%	39%	1,450 IDR	900 IDR	1,950 IDR
3.	10,000 IDR	18	11	8	18%	11%	8%	1,800 IDR	1,100 IDR	800 IDR
4.	15,000 IDR	9	8	5	9%	8%	5%	1,350 IDR	1,200 IDR	750 IDR
5.	20,000 IDR	6	10	6	6%	10%	6%	1,200 IDR	2,000 IDR	1,200 IDR
Total			82	77	89	100%	100%	100%	6,200 IDR	5,800 IDR

Source: Analysis data, 2021.

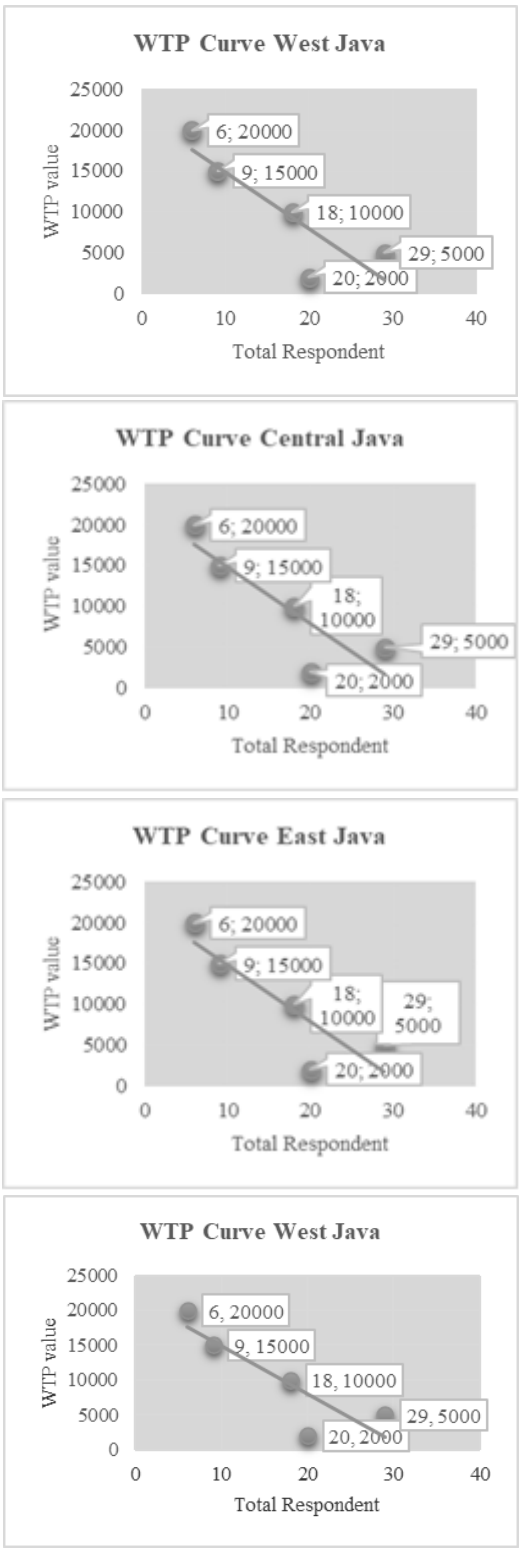


Figure 1. Consumers' WTP Slope Curve

The curve has a negative slope, where the greater the cost assigned to eco-labelling products, the lower the number of people willing to pay. Furthermore, the results of the Wald test showed several factors that influence the WTP level of consumers.

Table 10. Wald Test Result

West Java			
Test Statistc	**Value**	**Df**	**Probability**
t-statistic	-2.519360	90	0.0135
F-statistic	6.347174	(1.90)	0.0135
Chi-square	6.347174	1	0.0118
Central Java			
t-statistic	-1.991169	90	0.0495
F-statistic	3.964753	(1.90)	0.0495
Chi-square	3.964753	1	0.0465
East Java			
t-statistic	-1.107617	90	0.0145
F-statistic	0.115810	(1.90)	0.0145
Chi-square	0.115810	1	0.0143

Source: Analysis data, 2021.

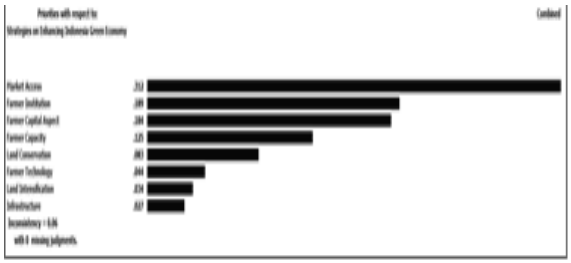
The value of Chi Square in West Java is 6.347174, Central Java is 3.964753, and East Java is 0.115810. All Chi Square values are smaller than Chi Square table 114.2679, so the hypothesis is accepted that there are influences on several related factors of the willingness to pay, depicted as below logit result.

Based on the expert judgment through the AHP method, market access is a top priority effort to restore Indonesia's green economy with a priority value of 0.312 points, which indicates that market access must be progressively encouraged by relevant stakeholders.

Table 11. The result of Logit Regression Based on Province Dummy

Variable Independen	Coeff.	Odd Ratio	Prob.	Description
West Java				
Gender	2.628912	13.88172	0.0241	Significant
Age	2.660385	14.32585	0.1558	No Sign.
Education	0.253569	1.288822	0.0366	Significant
Works Status	0.392135	1.480504	0.8029	No Sign.
Marital Status	3.944576	51.78334	0.0042	Significant
Household Size	-8.234007	0.000264	0.0138	Significant
Income	2.113394	8.287343	0.0475	Significant
Price	-0.207222	0.812732	0.7486	No Sign.
Awarness on Environment	1.055124	2.874246	0.0066	Significant
C	-19.69445	2.763159		
Central Java				
Gender	1.005350	2.734600	0.4880	No Sign.
Age	0.702901	2.020500	0.0060	Significant
Education	0.848659	2.337765	0.0152	Significant
Works Status	0.004575	1.004588	0.6296	No Sign.
Marital Status	0.157239	1.170392	0.5039	No Sign.
Household Size	-1.695407	0.183328	0.0471	Significant
Income	0.007189	1.007219	0.0044	Significant
Price	-3.299402	0.036828	0.0036	Significant
Awarness on Environment	0.739930	2.096769	0.6005	No Sign.
C	-10.49554	0.000027		
East Java				
Gender	0.455175	1.576903	0.0060	Significant
Age	0.244528	1.277216	0.8435	No Sign.
Education	0.046672	1.047809	0.0460	Significant
Works Status	4.904308	135.288148	0.6058	No Sign.
Marital Status	0.405161	1.499928	0.0423	Significant
Household Size	-3.291287	26.933388	0.0073	Significant
Income	0.195274	1.215794	0.5915	No Sign.
Price	-1.390262	4.019432	0.0314	Significant
Awarness on Environment	4.255226	70.662484	0.0009	Significant
C	0.455175	1.576903	0.0060	

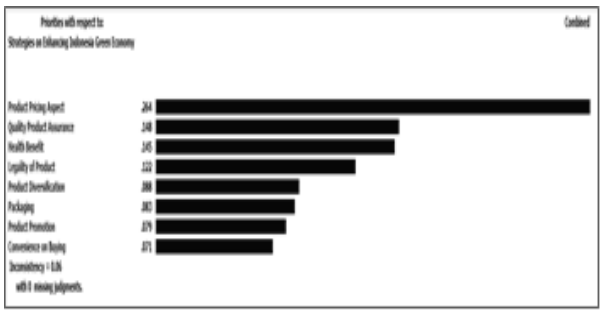
Source: Analysis data, 2021.



Source: Analysis data, 2021.

Figure 2. Strategies on Green Economy Development from Producers' Perspective

Based on the AHP analysis, the most important factors in improving organic agriculture in Indonesia at the consumer level is (1) determining economic and competitive prices to consumers with a weighted value of 0.264 points. The price determination component is the most priority for the Indonesian government to respond in regulating the expansion of organic products to the public.



Source: Analysis data, 2021.

Figure 3. Strategies on Green Economy Development from Consumers' Perspective

Based on the results of the Granger causality test in the table 1, there is a bi-direct causality relationship between economic growth in the agricultural sector and CH_4 and vice versa. According to the VECM results, in the short term, it appears that agricultural LGDP during the previous 8 years significantly affected the current increase of methane gas. So that, if there is a 1% increase in the GDP of the agricultural sector in the previous 8 years, it will increase methane gas in the current year by 1,018%. This result is in line with research conducted by Rosa-do-Anastacio (2018), revealed a U-shaped EKC between GDP growth and CH_4 emissions in Argentina, indicating that agricultural growth further increases emissions. The EKC model in the national scope shows that economic development initially leads to environmental damage, but after a certain level of economic growth, society begins to improve its relationship with the environment and the rate of environmental degradation decreases. Economic growth and the environment are two different phenomena, but the relationship between the two in the short and long term is undeniable (Alam et al., 2016). For example, CH_4 gas emissions in rice production centers in Central Java Province, it was found that CH_4 emissions in several areas varied, the highest was 798 kg CH_4 ha in 1 season and the lowest was 107 kg CH_4 ha. Variations in CH_4 emissions are not only significantly affected by soil type, but also the way of managing soil and plants, all of which have a significant role in CH_4 emissions from paddy fields.

The direct causality relationship between LGDP_HORTICULTURE and Environmental Index (EI) implies that the horticultural growth stimulus policy will play a role in controlling the environmental quality index, where if there is a 1% increase in GDP of the horticulture in the previous 3 years, it will reduce the current year's environmental quality index by 1.66%. These results are in accordance with Idris (2012), in Indonesia, the initial growth phase from the agricultural sector to the industrial sector, the impact of using non-environmentally friendly production factors, excessive use of natural resources, and the use of chemical fertilizers in farming activities will have an impact on environmental damage. Based on the facts, the income growth in agricultural sector will be followed by a decrease in EI.

In 3 provinces of West Java, Central Java, and East Java, horticultural crops occupy the

second largest contribution to the GDP of the agricultural sub-sector. As one of the biggest contributors to the GDP, in the short term it has been shown to reduce the environmental quality index, but in the long term, horticultural crops can improve the quality of the environment, where every increase in the GDP variable of the horticultural sub-sector has a positive relationship to the environmental quality index equals to 0.28. Thus, if there is an increase in GDP of the agricultural sub-sector as much as 1%, it will cause an increase in EI by 0.28% in the long term. The negative impact of using chemical pesticides in the short term will be carried out continuously a long-term impact to the texture, structure, chemical and biological soil, environmental pollution, and pest resistance, so the transfer of environmentally friendly technology to farmers absolutely needs to be implemented immediately. One of the environmentally friendly technologies that are easy and eco-nomical for farmers is the use of biological agents. Al-Mulali et al., (2015), also agree that technology affects the turning point where environmental degradation begins to decrease, because energy efficiency and use of renewable energy increases significantly. On the contrary, the foodstaple crops sub-sector does not significantly affect EI in both the short and long term. This condition is predicted because the planting period of food crops is relatively long so that the use of pesticides and land management tends to be less than the horticultural crops. The growing period tends to be long and the stagnation of food crop productivity causes the short-term and long-term relationship to the environmental quality index not to be seen in this study.

Moreover, in line with the results of research in the food crops sub-sector GDP, the output of VECM in the plantation sub-sector does not show a short-term relationship but in the long term has a negative relationship to Environmental quality index (EI). The results of the VECM output in this study are in line with Shahbaz et al., (2017), who explained that the exploitation of natural resources by plantation industrial activities has exceeded the carrying capacity of the ecological condition, resulting in excessive exploitation of natural resources. The negative relationship between the GDP of the agricultural sub-sector and EI is thought to be in line with the method most often used by entrepreneurs to meet the needs of plantation land by converting forest areas, because the mechanism to obtain it is relatively easy and benefits from logged timber. Deforestation is high due to activities including planting, plantation, and land clearing. The monoculture system makes the soil run out of one of the nutrients due to being continuously absorbed by one type of plant and susceptible to pests. The use of excess chemicals such as fertilizers and pesticides cannot be easily absorbed by microorganisms in the soil, so that in the long term it will settle and cause the land to be infertile and polluted. This Critical land does not function well for production, which is estimated become the initial awareness for the industry to be more protecting the environment in the long term through more efficient production, renewable energy use, and environmental technology adoption.

In the estimation of the gender factor, consumers in West Java and East Java are influenced by gender in the decision to buy organic products with odds ratios of 1.38542 and 1.24542. While in Central Java Province shows that gender does not have a significant effect with an odd ratio value of 1.099094. The results in West Java and East Java are in line with research conducted by Hidayati & Suryanto (2015), and Pramudita (2017), where the gender variable has an effect on people's willingness to pay.

Meanwhile, on the age factor, the Provinces of West Java and East Java showed

that age did not have a significant effect on the willingness to buy environmentally friendly agricultural products with odd ratio values of 1.076091 and 1.065091. This is different from the estimation results for consumers in Central Java which shows a positive influence with an odd ratio value of 1.295632. The results of research in Central Java Province are in line with research conducted by Prasetyo & Saptutyningsih (2013), and Pramudita (2017), which state that age has a significant effect on people's WTP. Age is a factor that has an influence in determining people's willingness to pay for environmentally friendly agricultural products, but it depends on their knowledge, experience and concern for health and the environment.

Regarding the level of education, the results of research in 3 provinces showed identical results, namely education had a positive and significant effect on the willingness to buy agricultural products labeled as environmentally friendly. The results of this study are in line with research conducted by Prasetyo & Saptutyningsih (2013), stated that education has a significant influence on people's WTP. Education is an important element in people's lives. Through education, a knowledgeable and broad-minded generation will be formed. Someone who has a higher level of education will have broad knowledge and insight, including in terms of health and the environment. Thus, he has more understanding on the benefit of buying organic product.

In other side, the work status has no influence on a personal WTP level. The results of this study are in line with research conducted by Dipeolu (2016), Rofiatin, (2018), and research by Yunus et al., (2019), which states that employment status does not have a significant effect on people's willingness to pay for organic products. Based on the study, the average respondents have been working, but this status is not a significant influence to enhance their motivation to consume the organic product. It is assumed due to Indonesian workers have a low level of income for their works which will be a decisive influence to buy.

Based on the estimation on West and East Java, it shows that marital status has a significant influence on the willingness to buy environmentally friendly agricultural products with odds ratios of 1.276514 and 1.206514. On the other hand, Central Java Province shows that marital status does not have a significant effect. Marital status can be a factor that can change the mindset of a consumer. Someone who is married commonly has a more mature mindset, especially an attitude of caring for the family, for example, caring for family health. This makes married people have a tendency to choose a healthier lifestyle.

Based on the estimation results of the logistic regression model in the provinces of West Java, Central Java, and East Java simultaneously, it shows that the number of family has a significant negative effect on the willingness to buy organic agricultural products. The results of this study are in line with research conducted by Yunus et al., (2019), which states that the number of family members has a significant influence on willingness to pay for organic products. The higher the consumption needs, the higher the amount of budget that must be spent. This makes someone who has a large number of family members, the willingness to pay for organic products will be lower.

While the income factor has a positive influence on the consumer's WTP. Consumers in the Provinces of West and Central Java stated that the higher income would increase the level of consumer affordability in buying. However, this is different for consumers in East Java, which shows the opposite result. The results of research in West Java and Central

Java are in line with research conducted by Pramudita (2017), Priambodo & Najib (2016), and Riana et al., (2019), stated that income has a significant influence on people's WTP. This is due to the premium price that consumers have to pay for environmentally friendly products, thus requiring a budget for the consumption of these products.

Meanwhile, the estimation results of the logistic regression model in the Provinces of Central Java and East Java show that price has a significant effect on the willingness to buy environmentally friendly agricultural products with odd ratio values of 1.040183 and 7.607526, respectively. However, this is different from consumers in West Java who stated that the price level was not an obstacle in consuming organic products. Price is one of the factors that play a role in consumer decisions in buying a product. Consumers will usually have a lower willingness to pay. However, unlike people who are used to consuming organic products and care about health, usually the willingness to buy organic products is not influenced by price (Handoko & Setiawan, 2021).

Based on the results of AHP analysis with expert keypersons, at the producer level, it was found that market access is a top priority in efforts to restore Indonesia's green economy with a priority value of 0.312 points, which indicates that market access must be progressively encouraged by relevant stake-holders, starting from the government and producers, included about product knowledge facilities to consumers. At the producer level, market access is the main thing that is important for the Indonesian government to encourage in providing further understanding of the importance for consuming organic products. This is in line with the identification of the determinants of the level of consumption for organic products in the community Nguyen et al., (2019), that market access can significantly increase the annual purchase rate of consumers. However, marketing patterns that recognizes premium prices for organic products will also be an obstacle in the level of consumer purchases. So that intensive intervention is needed from relevant stakeholders, starting from policy makers, retailers, food producers, and socio-environmental organizations, including Organic Certification Institutes (*Lembaga Sertifikasi Organik*) (LSOs) in order to find alternative premium costs that are more affordable for the community. Several studies from Stobbelaar et al., (2007), Fuentes Pez (2008), and Roitner-Schobesberger et al., (2008) in Manuela et al., (2013), states about the important role of understanding organic knowledge products to consumers and their impact on the pattern of demand for organic products. Thus, an intensive market access formation scheme is needed in building organic market branding at the producer level.

The importance of the government's role in strengthening market access for organic products is very necessary, this is in accordance with the study from Ashari et al., (2018), stated the role of the government is very important, especially to convinces farmers about the benefits of organic farming, providing information, as well as technical assistance. The form of organic agriculture policy in Indonesia has less branding for the producer's side. Organic products marketed only by included organic labels and product manufacturer logos on the packaging display, without the intensity of a strong emphasis on the market side (push factor influencing). As the most important factor, market access for organic products must be supported, not only in terms of government policies through certification regulations, but also in terms of the distribution process for marketing organic products from producers to consumers. Marketing schemes carried out in Indonesia so far consist of marketing distribution through (1) supermarkets, (2) direct selling from

farmers, (3) social media, (4) organic agriculture specialty stores, (5) online platforms, and (6) organic farming community market (as described in the following appendix).

Overall, the distribution of organic products is still dominated by a partnership pattern through supermarkets. Farmers who already have contracts with supermarkets will have market access to distribute their organic agricultural products to consumers in supermarkets. This method is a strategy that is classified as conventional, but it has a significant deficiency in the distribution of consumer segmentation which only reaches middle and upper consumers mainly in the Indonesian market, considering the level of price that consumers have to pay (willingness to pay) is relatively high. This high cost (consumer price tag) is also caused by a longer supply chain to reach the consumer level. Starting from (1) farmers (harvest), (2) collector farmers, (3) distributors, then headed to (4) supermarkets. From the distribution of marketing and distribution of organic products, there is potential for the use of online platforms which are increased significantly during the current Covid-19 pandemic. This is also a potential product boom for the community considering the prices offered can be much cheaper than supermarket prices, through a more concise supply chain. Although it has been stated basically that the development of digital marketing in terms of promotion of organic products is still in its infancy Novytska et al., (2021), it depends on the structure of producers, which are formed according to the principles of family farming. It has been proven that social networks are the main channel of digital marketing for organic producers, as long as they do not cost extra to attract marketing specialists.

The second most important factor is Farmer Institutions with a value of 0.189 points which indicates that the organizational structure of farmers is very influential in strengthening organic agricultural production. Based on the results of indepth interviews, it was found that the power of farmers in obtaining organic certification is from the collective action of farmer institutions. In Indonesia, farmers who plan to certify organic agriculture must go through a fairly long process and stages of certification. Explained by the organic certification agency (LSO), this process can take several months or even up to 1 year in order to carry out the stage of verifying the feasibility of farmers in implementing organic operational procedures. This long process makes the certification cost quite expensive, starting from 5-10 million for the most concise certification process, to the range of 30-50 million for the certification process which requires many stages of visitation from the LSO. To develop the collective agribusiness institutions, it is necessary to conduct a policy analysis concerning input, cultivation, product, marketing and trade policies (Nuraini et al., 2016).

The third most important factor to accelerate organic agriculture in Indonesia is the access to capital of farmers which has a weight value of 0.184 points. This indicates that farmers are in dire need of financial access that is quite large in the process of implementing organic farming to the certification process and marketing of organic products to consumers. Basically, to certify organic agriculture, the average farmers have to pay around 30-50 million Rupiah for the price of the process and validation of the certification by an organic certification agency (LSO). These costs do not include productivity losses resulting from the implementation of organic farming, cultivation time costs, and special marketing of organic products. Thus, farmer capital is a crucial

aspect that needs to be taken seriously by the government. The development of organic agriculture really needs financial support to farmers Brelik et al., (2020), especially that organic agriculture requires less consumption of fertilizers and pesticides, but is high in terms of maintenance and agricultural labor which can be the main differentiator of organic agriculture and the conventional one (EC, 2019).

The fourth and fifth factors in strengthhening the acceleration of organic agriculture at the producer level, in terms of economic criteria are (4) farmer capacity with a weighted value of 0.125 and (5) land conservation with a weighted value of 0.083 points. The farmer capacity criterion plays an important role to accelerate organic farming. The ability of farmers is the main thing in completing a series of evaluations and validations of organic farming conducted by LSOs. With the technical requirements that are quite strict for farmers to follow, this requires quite complex ecological relations to achieve the required GAP (Ashari et al., 2018). Meanwhile, in terms of conservation, organic agriculture is agriculture that is identical to the environmental condition concern. So that this factor is considered quite important through the revitalization in conservation-based concept. Finally, the last factors that received less consideration were (6) the provision of equipment with a value of 0.044 points, (7) intensification of agricultural land with a weighted value of 0.034 points, and (8) infrastructure with a weighted value of 0.027 points. These three factors are considered less important in priority than the previous factors, considering that these only are supporting factors that can only be maximized after the main factor components are completed.

Based on AHP analysis with expert keypersons, the results of the most important factors in improving organic agriculture in Indonesia at the consumer level are mainly economic criteria, namely (1) determining economic and competitive prices to consumers with a weighted value of 0.264 points. This is in line with the results of the study on the analysis of willingness to pay (WTP) which found the fact that people are willing to pay extra money for agricultural products labeled organic with guaranteed quality and safety of these products. The range of prices that are willing to be paid by the public as consumers of organic products generally varied from 2,000 IDR - 10,000 IDR. Purchasing decisions can be influenced by pricerelated emotions, as some consumers have understood the role of costs in the production process of organic products (Peine et al., 2009; Zielke, 2011; Rödiger & Hamm, 2015). Negative price emotions are identified to consumers who have a more passive/ lower attitude respon for purchasing organic products. While positive price emotions can indicate consumers are more proactive towards organic products Peine et al., (2009), where consumers will assume that if the price of organic products increases, it will increase consumer perceptions of product quality.

Apart from price determination, in this analysis there are other factors that can affect the intention for strengthening organic products in Indonesia from the perspective of consumers, such as (2) standardized product quality assurance (trust consumers on product) which has a weighted value of 0.148 points, which become a second priority factor after pricing factor. Followed by (3) health benefits with a value weight of 0.145 points, (4) a clear product legality with a weight value of 0.122 points, and (5) diversification of organic agricultural products with a weight value of 0.088 points, also (6) Packaging of organic products with 0.083 points, (7) Promotion of products to the public with a value weight of 0.079 points, and the last is (8) the ease and convenience of buying organic products with a weighted value of 0.071 points.

CONCLUSION

The environmental trade-offs due the agricultural sector has been identified as the important agenda for Indonesia government. It is observed that a 1% increase in the GDP of the agricultural sector in the previous 8 years, it will increase methane gas in the current year by 1,018%. Specifically, in the short-term period, this environmental damage has been arisen due to some inefficient livestock rearing systems, feed production, and poor manure management in developing countries. However, in the long-term period, the EKC model shows that economic development initially leads to environmental damage, but at a certain level of economic growth, people begin to increase environmental awareness. That is, if there is an increase in GDP of the agricultural sub-sector by 1%, it will cause a decrease in methane (CH_4) of 0.12% in the long term. Moreover, based on its sub-sector, the relationship between Lgdp_Horticulture and environmental index (EI) implies that stimulus policy on horticultural growth will play a role in controlling the environmental quality index, where if there is a 1% increase in horticulture GDP during the previous 3 years, it will reduce the current year's environmental quality index by 1.66%. On the other hand, the food crops sub-sector does not significantly affect the EI in both short and long term, which is predicted because the planting period of food crops is relatively long so that the use of pesticides could be minimized. Finally, on the plantation industry side, the value obtained is negative and significant in the long term, by 0.078 point. Therefore, if there is an increase in the GDP of the plantation sub-sector by 1%, it will cause a decrease in EI by 0.078 %. As a green economic strategy, the measurement of WTP has been presumed to understand the range of consumers' willingness to buy an organic product. It is showed from a total of 300 respondents, an average of 82.6 respondents were willing to pay for environmentally friendly agricultural label products. The offering payment of that organic labelled product ranged as much as 2,000 IDR, 5,000 IDR, 10,000 IDR, 15,000 IDR, and 20,000 IDR. It is affected mainly by the factors such as (1) sex gender, (2) age, (3) education level, (4) marriage status, (5) household size, (6) income, and (7) price of product, as well as (8) consumers' perspective on environmental awareness. Thus, to enhance this WTP on organic product, the strategies of market access become the most priority to establish by 0.312 points from producers' side, while on consumers' side, the competitive price of organic product become the most consideration by 0.264 point.

The implication of policy, therefore, has to be taken into account, particularly to enhance the awareness on the sustainable development as well as market for green eco-labelling. As below some recommendation to improve the development of ecolabelling product, (1) the government needs to issue a strong policy about minimum production quota for organic product with respect to nature for annual Indonesia production, (2) it needs a consideration on the certification process, which required more stimulus on the payment for producers, (3) the initiation of government certification body, instead of third party will be helped to support the reduction of certification cost for producers, and (4) the development of organic market place will be needed to short-cut the supply chain.

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