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The Motivation Factors and Farmer Group Clusters on Sustainable Horticulture Practices Adoption in Yogyakarta Province

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Abstract

The decision to apply sustainable horticulture practices can be categorized as pro-environment behavior where motivation or needs are one of the determinants of behavior. The objective of this study was to analyze the factor and discover the farmer group compositions and motivation of farmers to adopt sustainable horticultural practices. The surveys involved 350 members of horticulture farmer groups in Yogyakarta Special Region Province, Indonesia. The results of second-order confirmatory factor analysis show the highest score of the underlying subs-construct of motivation construct is social needs (healthy family and group reference). The highest score of the underlying subs-construct of the level of sustainable horticulture practices (SHP) adoption are inputs (organic fertilizer and superior seeds). There are two clusters of SHP adoption and three clusters of motivation. This study provides information to make an effective strategy for extension education that makes farmers adopt sustainable horticulture practices based on their needs (motivation).

Keywords: sustainable horticulture; organic; adoption; motivation; extension education.

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1. Introduction

Agriculture in Indonesia has great potential to develop supported by a land area of 25 percent of the total land area of Indonesia [1]. In addition, as much 22 percent of Indonesians productive manpower with the aged over 15 years working in agriculture, fishing, hunting and forestry [2]. On the other hand, Indonesia faces challenges in ensuring the continuance of food production, for example, hydro-meteorological disasters due to weather and climate changes such as floods to drought. This type of disaster was caused by anthropogenic (human) factors that act to destroy nature. The green revolution of the mass guidance program which succeeded in achieving self-sufficiency in rice [3, 4] resulting in the overuse of agricultural inputs as side effects. It was also causing environmental damage on the land [5], an increase in pest attacks [6], lack of water, and biodiversity reduction to climate change [7, 8, 9] and threaten agricultural sustainability [10, 8]. The natural disasters that occur cause the greatest damage and losses in the agricultural sector in developing countries by 22 percent [11].

The damage and loss information is used to monitor and measure the development of the Sustainable Development Goals (SDGs) target and objectives, particularly on the 2nd objective of "End hunger, achieving food security and improved nutrition, and promote sustainable agriculture," Sendai Framework for Disaster Risk Reduction 2015-2030 and FAO Universal Climate Change Agreement. Recent evidence suggests that climate change, biodiversity loss, and other pressures have reached levels of change that threaten the capacity of Earth's ecosystems [12]. Sustainable Agriculture is an important step towards achieving the goal of the second SDG, given the current global ecosystem conditions of increasing food production must be achieved in a sustainable and environmentally sound manner.

Douglas introduces the concept of Sustainable Agriculture in 1984 [13]. The author in [13] discussed the definition of Sustainable Agriculture grouped on the issue of motivation [14] as an ideology, strategy, ability to achieve goals and ability to continue. The United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro introduced the new concept of sustainability as the most important paradigm in 1992 [15]. The author in [15] mentions a gap between theory and practice. The gap can be closed by combining multidisciplinary science to see the paradigm of Sustainable Agriculture, determining the right indicators, determining the formulation of management guidance are also called counseling to apply the Sustainable Agriculture.

Sustainable Agriculture was defined as a food fulfillment approach for humans without damaging nature with low inputs [16]. The importance of Sustainable Agriculture is also implicit in The Law of Government of Indonesia Number 16/2006 on Agriculture, Fishery and Forestry Extension System (AFFES) and Number 32/2009 on Environmental Protection and Management. The Government of Indonesia has issued General Agricultural Practices - Standard Operating Procedure (GAP-SOP) for fruits and vegetables so it is safe for consumers to consume and produced without damaging the environment or threatening the health of their workforce. Farmers that already met the GAP-SOP criteria will be awarded prima certificate. Food Security Agency & Extension (BKPP) of Yogyakarta Special Region (DIY) Province in 2014 has given prima certificates to 10 farmer groups from 2500 existing horticulture farmer groups.

The statistics data [17] showed that the population of DIY Province in 2013 was 3.594.854 people with agriculture as the highest business field compared to other sectors. The data was also showed that the area of land use was increasing, but the productivity was decreasing and worse than the national productivity. National productivity also declined in 2014 compared to 2013 [18]. If this is not immediately addressed, then it will reduce the productivity of land and indirectly affect the welfare of farmers. It is confirmed by author in [19] that the highest poverty rate occurs in areas with populations that are mostly farmers.

FAO discloses that to improve agricultural productivity and diversification in order to increase employment and income opportunities in tackling poverty, the policy was needed to maintain the sustainability of agriculture in the rural sector with specific strategies [20]. Agriculture in the field of horticulture, especially fruits and vegetables have high economic value, only require narrow land, can be planted in the dry land, the market was very wide and potentially for export (fruits imported valued IDR12 trillion per year to Indonesia) [21].

Prior research has shown that farmers' decision to apply sustainable horticulture can be categorized as pro-environmental behavior. It was influenced by socio-economic demographic factors [22], government policy, motivation and mental attitude Farmers [5, 23]. One societal model of behavioral changes shows the determinants of behavior (internal and external) that is the model needs, opportunities and abilities (Needs, Opportunities, and Abilities) or NOA Model [24]. In accordance with the model, the author in [24] noted that needs, opportunities, and abilities determine environmental-related behavior. This model provides a framework for identifying farmers' behavioral drivers both at the macro level of the whole community and at the micro level of the household and focuses on motivation issues, whereas sustainable horticulture has been classified based on issues of motivation. With this model, the given policy will be more effective when directed to the group because the group shaped and limited individual choice and independent action [25].

The government's extension and policy programs have not been fully effective in encouraging farmers to implement sustainable horticulture. For that, we need to know how far the implementation of sustainable horticulture in DIY Province, especially on fruit and vegetable farmers. In addition, it needs to be studied motivation in the form of needs as a factor behind the implementation of sustainable horticulture. The objective of this study was to analyze the factor and discover the group compositions of sustainable horticulture practices (SHP) adoption, and motivation in DIY Province. Analyzing this issue could provide information to create a strategy for government and extension workers or university-based extension about how a farmer’s motivation influences adoption of sustainable horticulture practices.

2. Research Methods

The research population is all members of 209 Horticulture Farmer Groups in DIY Province with total members of 2621 farmers. The sampling method was done by the probability of multistage random sampling. Determination of minimum sample amount as many as 347 respondents (rounding to 350 respondents) was using Slovin formula. This research was conducted in three regencies located in DIY Province; Sleman (13 villages), Kulonprogo (7 villages) and Bantul (1 village).

In accordance with the proportion of the population, 13 groups of horticultural farmers and 57 horticultural farmer groups were taken as samples. The group that has received the PRIMA certification and already registered the domestic product as much as 17 horticultural farmer group were selected, while the remaining 53 groups (13 groups of farm women and 40 farmer groups) were randomly selected. This study started with the preliminary survey that was conducted from August 2015 to February 2016 by visiting BPKP DIY, Sleman Agriculture Office, Agriculture Office and BPKPP Bantul and KP4K Kulonprogo. Quantitative data collection using survey method (interview) has been conducted in June 2016 until August 2016.

The level of SHP adoption was identified using Good Agricultural Practices (GAP) of Fruits and Vegetables in Indonesia and combines with the previous study [22, 16, 26]. Sustainable Horticulture Practices is defined as the high level of implementation in the management of horticulture commodity (especially vegetable and fruit farming) with the consideration of the environment insight continuously taking into aspects. It was including the use of input (superior seed, organic fertilizer), application of cultivation techniques (land conservation, crop rotation, mulch, irrigation, integrated pest management (IPM) and labor), and post-harvest quality handling, marketing management, and partnership management. The level of SHP adoption was measured with 22 items (Table 1) of closed questions on Likert scales of 1-4 i.e. never (score 1), rare (score 2), often (score 3) and always (score 4).

The motivation of SHP adoption is identified by combining the criteria of previous research [27] and theory [28]. The motivation of SHP adoption was defined as a factor that encourages people to carry out the environmentally friendly practices of vegetable and fruit agriculture with the consideration of need aspect. They were consisting of: (1) survival needs: safety, physiological needs, and subsistence; (2) social needs: togetherness, affection, and participation; and (3) need for personal growth: recognition, self-actualization, understanding, identity, and freedom.

The motivation of SHP adoption was measured with 20 items (Table 2) of closed questions on Likert scales of 1-4 i.e. disagree (score 1), disagree (score 2), agree (score 3) and strongly agree (score 4). Data were analyzed using LISREL to conduct second-order CFA and Statistica to conduct cluster analysis. Model fit for second-order CFA was assessed by the following fit indices: Comparative Fit Index (CFI), Goodness of Fit Index (GFI) and root mean square error of approximation (RMSEA). This study employed Ward's method as amalgamation (linkage) rule, 1-Pearson r as distance measure and using dlink/dmax*100 to scale the tree plot in the cluster analysis.

3. Results and Discussion

3.1. The Farmer's Adoption of Sustainable Horticulture Practices

Cluster analysis was performed to divide the SHP adoption into two groups, five groups, eight groups up to multiple groups (Figure 1). There are two big clusters/groups of the SHP adoption in DIY Province. The first group is consisting of the farmers who applied only cultivation techniques. The second group is consisting of the farmers who applied input, cultivation techniques, post-harvest quality handling, marketing management, and

partnership management.

Table 1: The SHP adoption indicator measurements (for the last 2 years)

No	**Un-observe Variables**	**Measurement**	**Indicators name**
	Input		
1	Superior seed	How farmer get superior seed	Iseed1
2	Organic fertilizer	How much using chemical, or/and organic fertilizer	Iorganic2
3		How to get organic fertilizer	Isourceorganic3
4		The last time using organic fertilizer	Itimeuseorganic4
	Cultivation Techniques		
5	Land cultivation	The frequency of tiling and hoe	Btile1
6		The frequency of using calcium	Bcalcium2
7		The frequency of organic substance	Borganic3
8		Frequency of terracing	Bterace4
9		Crop rotation	Bcroprotation5
10		Mulch	Bmulse6
11		Irrigation system	Birigation7
12	Integrated Pest Management (IPM)	The frequency of using chemical substance	Bchemical8
13		The frequency of manual treatment	Bmanual9
14		The frequency of using natural enemies	Bnatenemies10
15		Frequency of biological/natural pesticides	Bnatpest11
16	Labor	Worker safety	Bworksafety12
17		Worker skills	Bworkskill13
	Post-harvest quality handling		
18	Value-added activity	Hygiene, packaging	Valuesadded
	Marketing Management		
19	Marketing	Traditional market, wholesaler, modern market	Marketing
	Partnership Management		
20	Partnership (last year)	How many partnership activities	Korganization1
21	Sponsorship (last year	How many sponsorships have attained	Ksponsor2
22	Charity (last year)	How many times has given charity	Kcharity3

Second-order CFA was applied for 22 items of five groups of sustainable horticulture practices. The initial CFA of theoretical model did not meet fit criteria's. Figure 2 shows the result of modification theoretical model of SHP adoption after removed low factor loading. Loading close to -1 or 1 indicates that the factors greatly affect the variable. Loading close to zero indicates that the factor has a weak influence on the variable. The Comparative Fit Index (CFI) = .99, Goodness of Fit Index (GFI) = .99 and Root Mean Square Error of

Approximation (RMSEA) = .047. Those values indicate overall model fit is good. The factor loading estimates revealed that the indicators were strongly related to their latent factors. It shows that the first-order factors of Input, Cultivation Techniques and Partnership Management accounted for 23% to 74% of the variance in the indicators. How frequently farmer has used the chemical substance for IPM (Bchemica) have the highest loading factors (0.86) among others indicators. It means less frequency will lead to the high score for SHP.

Table 2: The Motivation of SHP adoption indicator measurements

No	**Un-observe Variables**	**Measurement**	**Indicators name**
	Survival needs	I adopt SHP because	
1	Income	to increase my income	Income
2	Price	the price of agricultural produce will increase	Price
3	Cost	the cost to apply SHP is low	Cost
4	Wholesaler	the demand of SHP products from a wholesaler	Wholesaler
5	Regulation	to obey government regulations	Regulation
6	Healthy worker	It is good for the health of farm workers	Healthyworker
7	Market	market/community demand for SHP products	Market
8	Extension advice	to obey advise from extension workers	Extensionadvice
9	Religion	It is according to my religious beliefs	Religion
	Social Needs		
10	Group reference	in line with the farmer groups that apply it	LGroup
11	Healthy family	SHP products are good for the health of family	LFam
12	Marketing network	SHP products marketing network is better than conventional	LMarknet
	Needs for personal growth		
13	New technology	It is the latest technology	Newtechnology
14	Training	I have attended various related training	Training
15	Certification	I can obtain certification (organic etc.)	Certification
16	Knowledge	It is according to my knowledge	Knowledge
17	Healthy consumer	healthier for consumers	Consumerhealthy
18	Environment	preserve the environment	Environment
19	Ecosystem	maintaining the agricultural ecosystem	Ecosystem
20	Next generation	can sustain future generations	Nextgeneration

Factor loading estimates show that the first-order constructs were either moderately to strongly related to the second-order construct. The second-order factor of Farmer's adoption of SHP accounted for 26% to 38% of the variance in the first-order factors. Input has the highest loading factor (1.62) among others indicators. These study results are a more likely combination of the prior study of input [16, 22], cultivation techniques [22] and partnership [26].

3.2. Farmer's Motivation to Adopt SHP

Cluster analysis was performed to divide farmers based on the motivation of SHP adoption into two groups, three groups, four groups up to multiple groups (Figure 3). There are three big clusters/groups of the SHP adoption in DIY Province. The first group was consisting of farmers who motivated by survival needs. The second group was consisting of the farmers who motivated by personal growth needs. The third group was consisting of the farmers who motivated by survival needs, social needs, and personal growth needs.

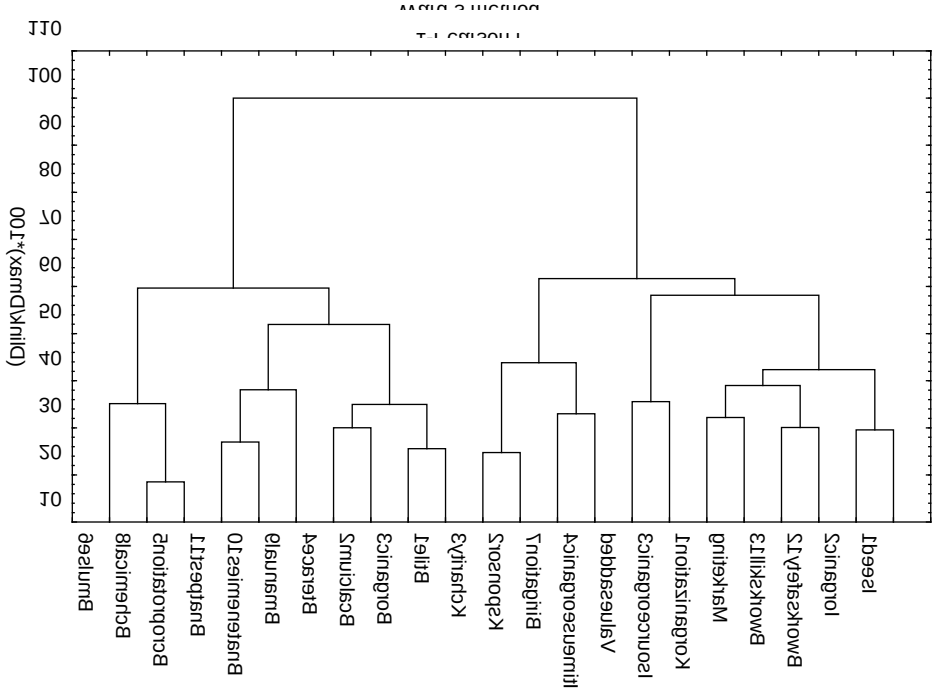

Figure 1: Tree diagram for 22 variables of SHP adoption (*N*=350)

Second-order CFA was applied for 20 items of three groups of variables to show the most motivating factor that encourages farmers to adopt SHP. The initial CFA of theoretical model did not meet the fit criteria's.

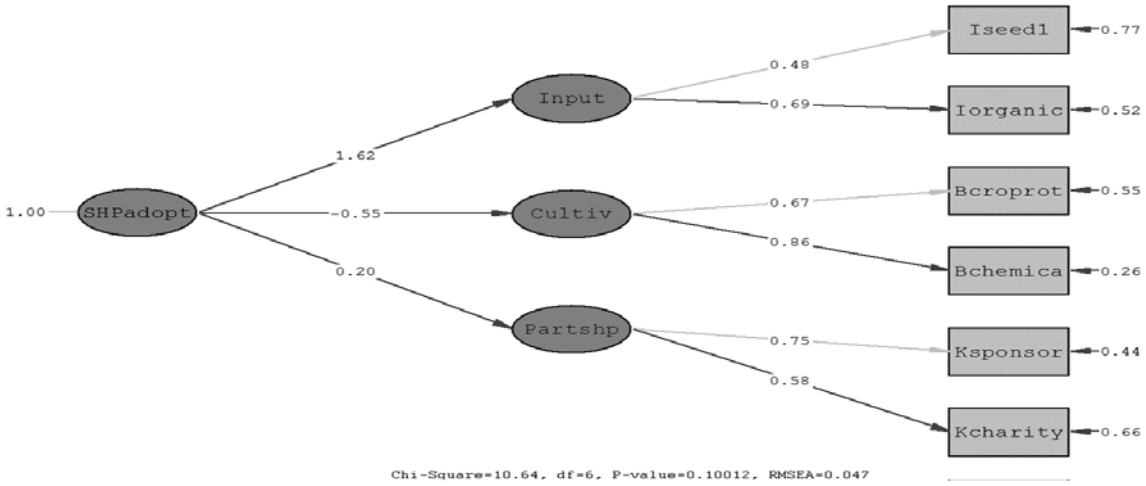

Figure 2: Second-order CFA of the farmer's adoption of SHP (standardized solution)

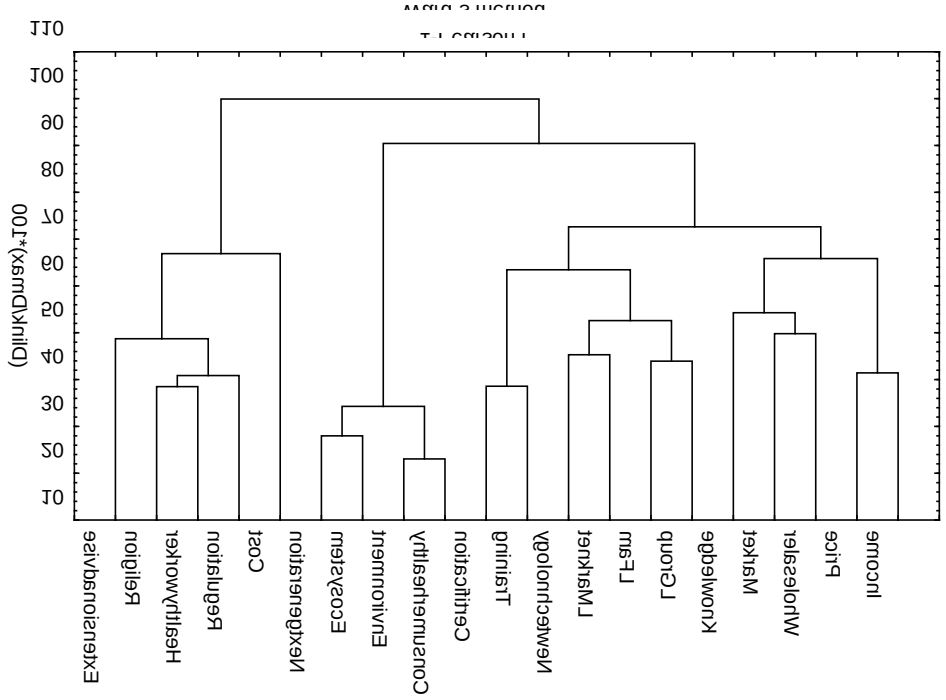

Figure 3: Tree diagram for 20 variables of motivation (*N*=350)

Figure 4 shows the result of modification theoretical model of motivation after removed low factor loading. The Comparative Fit Index (CFI) = .95, Goodness of Fit Index (GFI) = .96 and Root Mean Square Error of Approximation (RMSEA) = .065. Those values indicate overall model fit appears good.

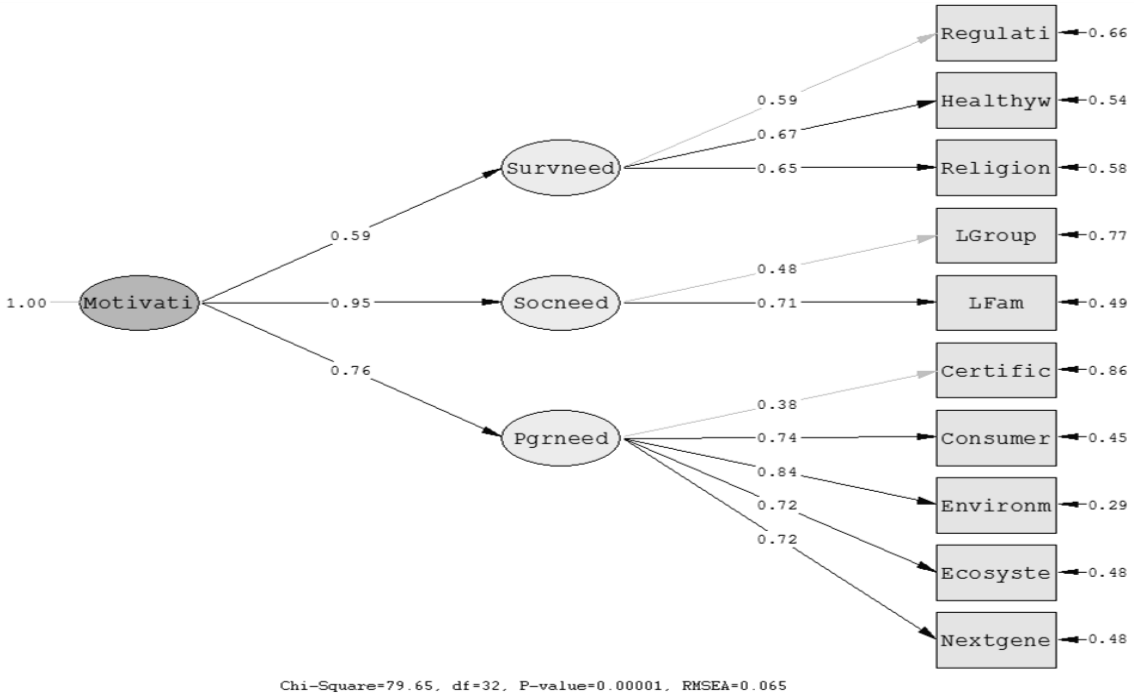

Figure 4: Confirmatory factor analysis of motivation of the farmers to adopt SHP (standardized solution)

The factor loading estimates show that the indicators were strongly related to their latent factors. It is indicating that the first-order factors of Survival Needs, Social Needs, and Needs for Personal Growth accounted for 14% to 70% of the variance in the indicators. Factor loading estimates show that the first-order constructs were either moderately to strongly related to the second-order construct. It is indicating that the second-order factor of Farmer's motivations to adopt SHP accounted for 35% to 91% of the variance in the first-order factors.

The highest factor loading of SHP adoption motivation was social needs (0.95). This is very reasonable because DIY Province has a culture of high togetherness reflected in the proverbs of Javanese language "mangan ora mangan sing penting kumpul" (it doesn't matter we can eat or not, as long as we are together). It is community attitude of life that prioritizes to maintaining the harmony of others (gathering) rather than just to meet personal needs (survival needs). The highest loading of the indicator is to preserve the environment (0.84). According to previous study [29] that the farmers were strongly motivated by environmental concerns and beliefs.

The prior research mentioned that to identify the motivation was very important in terms of successful implementation of sustainable agriculture [26, 30, 31]. The prior research also shown that the needs of farmers are a key indicator of the acceptance of technological interventions within the agricultural community [32]. The encouragement as like extension education would likely contribute to increasing farmers' motivation [33].

This second-order CFA of SHP adoption and motivation can provide appropriate information for stakeholders (government, extension officer, university-based extension, researcher) in formulating strategies how to strengthening SHP adoption in the future. The farmers already have awareness in terms of certification, consumer health, environmental sustainability, and future generations. Therefore, extension strategies that need to be improved are a downstream extension education strategies emphasis on togetherness. It can be done by farmer group method. The government regulation also still effective to support strategies of SHP adoption. The smallest loading factor but still important is certification. The lack of time and the length of time to certify for organic farming were the two most reasons for the farmers not followed organic certification [34]. However, it needs to be given a definite solution how farmers market their organic products and also to get a certification which seems costly for their agriculture land area. Some of the farmers were adopting SHP but their SHP products still valued at the same price with conventional products because they did not get organic certification.

4. Conclusions and Recommendations

The study results revealed that the valid and reliable indicators to predict latent variable SHP adoption are inputs (organic fertilizer and superior seeds), cultivation techniques (land cultivation by crop rotation and not using a chemical for IPM) and partnership management (sponsorship and charity). There are two groups of farmers that shared the same type of the adoption of sustainable horticulture practices and all groups were adopt organic practices as part of sustainable horticulture practices.

The valid and reliable indicators to predict motivation are survival needs (need to obeying regulations, religious compliance (to protect nature), and to keep workers healthy), social needs (farmer groups preferences, healthy family), and need for personal growth (certification, healthy consumer, and to protect the environment,

ecosystem and next generation). These results demonstrate the high potential for successful implementation of sustainable horticultural practices in the future. The government policies will still effective if applied through a good extension education. It is requiring collaboration from various ministries to motivate farmer to adopt sustainable horticulture practices. It should be involved religion extension workers (Ministry of Religious Affairs), health extension workers (Ministry of Health) and agricultural extension workers (Ministry of Agriculture). The government should conduct a campaign to farmers and consumers to use sustainable horticultural practices products. Further research is needed to see how far the adoption rate can support the sustainability of quality of life for farmers and communities.

The limitations of this study are not yet showing the causal relationship between motivation and SHP adoption and other factors that influence SHP adoption. According to NOA model, further research is needed by adding more factors as like the opportunity and ability factors of farmers that determine SHP adoption.

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