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Sustainability of the Polyculture Plantation Model

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The ecology zone of southern West Java is dominated by dryland with a high level in slope, therefore it is vulnerable towards extreme climate change. The mismanagement of the ecology zone could create a negative impact on the social, economic, and environmental condition. The Polyculture Planation Model (PPM) is agreed as the conducive farming model to lead environmental protection and the improvement of dryland. The question remains as to whether the PPM model is conducive towards the farmer's economic and social-culture sustainability. This research intended to analyse the sustainability and influence factors of the PPM. The research was conducted in the District Tasikmalaya, West Java, and was designed quantitatively using the survey method. The primary data was randomised from 250 farmers and collected via a questionnaire. The data was then analysed both descriptively and with inferential statistics using PLS. The secondary data was collected from an institution and literature study. The result showed that the PPM positively influenced environmental sustainability, contributed to economic sustainability and constructed on social sustainability. The capitals of agricultural potential and multifunction influenced the PPM sustainability either partially or simultaneously. The increasing creation added value of the multifunction product and the PPM agent regeneration is needed in order to suite between social, economic, and environmental aspects of PPM.

Key words: *Sustainability, model, plantation, polyculture.*

Introduction

The critical issue in Indonesian agriculture development, especially of dryland in the ecology zone, is how to maintain the sustainability of the economic, social, and environment aspects. The collective perspectives of Munasinghe (1993), Hess and Auburn (1990), Balfour (1977) dan UU Nomor 32 Tahun 2009, look on development sustainability as the effort that integrates social, environmental and economic aspects to ensure environmental wholeness, safety, capability, wealth, and life quality for the current and next generation. A long time before SDGs became mainstream, sustainable development was implemented earlier in the agricultural sector and was called sustainable agriculture development (Reijntjes et al., 1992). The problem is, the bias implementation between the lowland and highland agroecosystem zone. In fact, the program go-organic that was implemented by the government in 2010, was biased on developing organic rice on the lowland agroecosystem and organic vegetables on the highland agroecosystem. Paradox to both, the dryland agroecosystem zone is dominant and is in a critical condition, without any attention being paid from any party or institution.

One of the provinces that dominates the dryland agroecosystem zone is West Java (60 per cent). It covers an area of 35,378 square kilometres, and since the 1990s, includes about 2,128,680 acres (15 per cent) that is a dryland agroecosystem in a critical condition (KLHK, 2018). Any efforts to lead the rehabilitation of critical land have been conducted by the government, community, and other related parties. A critical land rehabilitation model that is conducive to be implemented at the dryland ecological zone in southern West Java is the Polyculture Plantation Model (PPM). This model integrates any commodity of the plantation, crop, livestock, and forestry at once (A*grosilvoforestry*). The PPM has for a long time being institutionalised as a dryland society culture. In fact, the PPM implementation was various enough. According to Forita et al. (2011) and Russella et al. (2007), it is the conditions that are influenced by landholding and farming scale.

Nevertheless, Irianto (2010) explained that polyculture pattern remains to contribute to both increasing farmer income and ecological maintenance. Hairiah et al. (2003) and Xu et al. (2011) emphasised that tree diversity, such as in the North Korean agriculture landscape which plants more than 60 kinds of tree, contributes to the nutrient states and cited farmer income.

The problem is that geographically, the sustainability of dryland agriculture is strongly influenced by climate, as well as the length of the wet season. Demographically, the agriculture in the dryland ecologic zone has the lowest, so it pushed the young population to migrate to urban areas. Those implicated in agriculture and environment at the dryland ecologic zone lack attention. Dariah & Las (2010) and Setiawan (2015) emphasised that dryland is susceptible to three constraints, such as depending on the ecosystem for rain, is labile in the sociosystem due to migration (urbanisation), and the land is vulnerable to erosion. The fast housing growth, season farming (corn, cassava, potato, beans) and a lack of trees, makes the dry ecologic zone vulnerable to erosion. Goodwin (2003) stated that the dry ecologic zone is also influenced by ecological condition, technology, financial, social, human beings, and infrastructure. Thus, dryland management is not yet receiving full attention regarding an ecosystem service (equilibrium, harmony) or *provisioning, regulation*, *cultural*, and *support.*

The critical dryland at West Java has statistically not been rehabilitated, particularly at the southern ecological zone. The height of urbanisation, a lack of innovation, a decrease of a local institution, social capital weakness, a lack of any parties' attention, reduced local wisdom, increased land conversion, imbalanced land utility and uncontrolled forest exploitation have resulted in the dryland ecologic zone becoming vulnerable to climate change impact and external pressure. Therefore, integrated farming with agriculture, forestry, and livestock — that is called agrosilvoforestry — in multifunctionality, was hypothesised as the solution to rehabilitate the critical land at the dryland ecologic zone. This research aimed to analyse the social, economic, and ecological sustainability of polyculture (*agrosilvoforestry*) at the dryland ecologic zone, the influence of multifunctionality and also development capitals.

Research Method

The research was designed quantitatively and conducted by survey method in 2019, in District Tasikmalaya, West Java. The selected location was identified due to its specification as dryland agriculture, that included the southern ecological zone. Besides dryland domination, the soil condition was unfertile due to hardened soil domination, hills, and minimal water supply. The dryland farmers planted with plantation, hard tree (forestry plant) and livestock. A sample amount of 250 farmers was determined using Slovin's Formula with simple random sampling. Primary data was gained from farmers using a questionnaire after testing their validity and reliability on an ordinal scale that was symbolised by 5, 4, 3, 2 and 1.

The data was analysed to gain median (me) and deviation standard deviation (ζ) for each variable. Based on both, we determined class interval such as: Very high (> median + ζ), High (median + ζ), Middle (median), Low (median - ζ) and Very Low (< median - ζ). In terms of statistical parametric necessity, we did transformation of ordinal data (the lowest until the high score was 1 – 5) toward interval or ratio data. The indicator had score 0 - 100 in indicator index transformation. The lowest score to the highest score was 0 – 100 from each indicator (Sumardjo, 1999). The formula toward index transformation is as follows:

(1) Indicator index =
$$\frac{\text{(the reached indicator score – sum minimal indicator score)}}{\text{(sum of maximum indicator score – the sum of minimum indicator score)}} \; x\ 100$$

(2) Variable Index = $\frac{\text{Sum of reached variable score}}{\text{Sum of Maximum variable score}} \; x\ 100$

Calculating by using the formulas above, described data scatter changed to ratio scale between 0 – 100 scoring. The score could interpret toward 4 level group such as (1) Very low, 0–20; (2) Low, 21–40; (3) Middle 41-60; (4) High 61–80; dan (5) Very high 81–100.

The collected primary data was tabulated and analysed by the descriptive and inferential statistics. Inferential statistics was used to determine the influence of potential capitals on PPM sustainability. For all those needs, we used the Partial Least Square (PLS) tool. The established outline and constructs used a path diagram and shown model equation as follows:

$$\boldsymbol{\eta = \gamma 1\xi 1 + \gamma 2\xi 2 + \gamma 3\xi 3 + \gamma 4\xi 4 + \gamma 5\xi 5 + \gamma 6\xi 6.}$$

Noted: γ (path coefficient); δ,ε (measurement Error); ξ1 (variabel of nature resource capital); ξ2 (variable of economic capital); ξ3 (variabel socioculture capital); ξ4 (variable of human resource capital); ξ5 (variable physic/infrastructure capital); ξ6 (variabel PPM multifunction); η1(variabel PPM sustainability); η and ξ (latent variable); X_1 (Land/soil); X_2 (water); X_3 (Vegetation); X_4 (Mineral/ nutrient); X_5 (PPM manure); X_6 (Cash money); X_7 (Credit); X_8 (Savings); X_9 (Institution); X_{10} (Trust); X_{11} (Partnership); X_{12} (Norm); X_{13} (Health); X_{14} (Education); X_{15} (Experience); X_{16} (Man power/employ); X_{17} (Technology); X_{18} (Transportation); X_{19} (communication); X_{20} (Information); X_{21} (Economic); X_{22} (Social); X_{23} (Ecology); X_1–X_{21} (Exogenic Variable observable); Y_{11} (Economic); Y_{111} (Income); Y_{112} (Productivity); Y_{113} (Efficiency); Y_{12} (Social); Y_{121} (Mobility); Y_{122} (Partisipation); Y_{123} (Pemberdayaan); Y_{13} (Ecology); Y_{131} (Integrity of ecosystem); Y_{132} (Nature resource); Y_{133} (biodiversity); Y_{134} (Ecological support capability); Y_{21} (Income Structure); Y_{22} (Outcome Structure); Y_{23} (NTPRP); Y1–Y_2 (Endogenic Variable observable).

Validity Analysis of Gauge (measurement) and Structural Model

The evaluation of the measurement model indicator included individual observation item reliability, internal consistency or composite reliability, average variance extracted, and discriminant validity. The three of the first measurements were grouped as convergent validity. Convergent validity consisted of three tests, such as reliability item, composite reliability, and average variance extracted (AVE). Convergent validity is used to measure how much the present indicator could explain the dimension. The more the value of convergent validity, the more dimension capability in implementing its latent variable. The reliability/validity indicator test depends on the loading factor (standardised loading). Loading factor score indicates the correlation among its indicator and constructs where the score > 0.7 is ideal. It means the indicator is valid to measure the construct. However, the standardised loading factor value > 0.5 could be accepted. Whereas standardised loading factor value < 0.5 could be excluded from the model (Chin, 1998).

The calculation result showed that loading for Nature Resource capital (X_1) consisted of land (X_{11}) was 0.784; water (X_{12}) was 0.644; vegetation (X_{13}) was 0.727 and mineral/nutrient (X_{14}) was 0.660; and manure (X_{15}) was 0.754. Loading for economic capital indicator consisted of 0.676 for cash capital (X_{21}); credit capital (X_{22}) was 0.849; and savings (X_{23}) was 0.631. Figure 3 explained that the total loading value was more than 0.5, so, it is not necessary to be set apart. Therefore, every indicator is valid to explain their latent variables, such as agriculture potential development, PPM multifunction, and sustainability capital. Besides indicating the item validity from each indicator, the loading factor also indicated how much each indicator contributes to its factor. In relation to the Nature Resource capital factor, the indicator with the most significant loading was land/soil (X_{31}). Economic capital factor had the most significant loading leads to credit capita (X_{32}). Social capital leads to the most significant loading factor on the norm (X_{33}). The most significant loading factor due to human resource capital was education (X_{42}), while due to Physical capital it was transportation, (X_{51}) and for PPM multifunction it was social (X_{62}).

Whereas, for PPM sustainability factor, the most significant loading factor on economic was income Y_{111}), social was participation (Y_{122}), and ecology was ecosystem integrity (Y_{131}). The statistic used in *composite/construct reliability* was Cronbach's alpha and D.G rho (PCA). Whenever the Cronbach's alpha and D.G rho (PCA) score was more than 7.0, it indicated that the construct had a high reliability as a gauge tool. The threshold upper 0.7 meant acceptable, and upper 0.8 and 0.9 meant satisfying (Nunnally & Bernstein, 1994 in Sofyan Yamin and Heri Kurniawan, 2011:19). The result of *composite reliability* indicated that score of *composite reliability* of X_1 was 0.839; X_2 was 0.765; X_3 was 0.769; X_4 was 0.874; X_5 was 0.932; and X_6 was 0.760. The six latent gained a score of composite reliability of more than 0.7; it meant the whole factor, due to capitals of potential agriculture development and PPM multifunction, had excellent reliability as a gauge tool. Regarding PPM sustainability, Y_{11} reached 0.795 *composite reliability*; Y_{12} reached 0.870; and Y_{13} reached 0.883. The three latent gained an upper 0.7 composite reliability. It meant the whole factor on PPM sustainability had an excellent reliability as a gauge tool.

Average Variance Extracted (AVE) described the variance that can be explained by items other than measurement error. The standard reached when the AVE score was more than 0.5 showed the construct has good convergent validity, and the latent variable could explain the average of more than a half indicators variance. The AVE value/score to X_1 was 0.513; X_2

0.525; X_3 0.526; X_4 0.635; X_5 0.872; and X_6 0.515. For those six variables was an upper of more than 0.5, so that construct had a good convergent validity, where the latent variable could explain the average more than a half variance of their indicators. In order for PPM sustainability, on Y_{11} gained composite reliability 0.569; Y_{12} 0.698; and Y_{13} 0.660. Those three variables had an AVE score of more than 0.5, and the construct had a good convergent validity where the latent variable could explain the average of more than half of the indicator's variance. The observation was towards the discriminant validity of the reflective measurement model. That value was based on cross-loading and compared the value between AVE and the correlation square among constructs. Cross loading is used to compare the correlation of an indicator with construct and construct from another block. The good discriminant validity will be able to explain their indicator variable higher than the variance from another construct indicator. The value of discriminant validity, due to each indicator, is as follows.

The discriminant validity index or loading factor toward X_{11} was 0.784. The indicator correlation X_{11} on capital factor (X_1) was higher than X_2 and reached 0.413; moreover, on X_3 (0.374); X_4 0.298; X_5 0.624; and X_6 0.675. The indicator correlation X_{12} on the capital factor (X_1) (0,644) was higher than X_2, (0.427); moreover, on X_3 (0.223); X_4 0.365; X_5 0.326; and X_6 0.198; and continue to rage. Of all the loading factor values, each variable had a higher correlation than the others variable. As did the indicators in variables. It determined that the placement of the indicator in each factor has been correct. The first step to evaluate the structural model, is the significance between the construct and path coefficient that was describing the strength of correlation between the construct. The sign/code in the path coefficient must be suitable to hypothesised theory. To value the path coefficient significance, it could be seen from a t-test (critical ratio) that was gained by the bootstrapping process (resampling method).

The t-test result is generated from a bootstrap way compared with t table. The test criteria such as: refuse Ho when t count > t table for $\alpha=0.05$ and dk=n-2 = 250-2 = 248, so the t table was 1.970. The table above is showed as follows:

a) The t statistic value due to natural resource capital on PPM sustainability was 6.2439 higher than t table (1.970), rejected/refused Ho. Nature resource capital significantly influenced PPM sustainability. The biggest influence was 0.399, positive. The positive path coefficient determined the bigger/better the natural resource capital, the better the PPM sustainability.
b) The t statistic value due to economic capital on PPM sustainability was 3.744, higher than t table. The economic capital significantly influences PPM sustainability. The score of economic capital was 0.170, positive. The positive path coefficient determined the bigger/better the economic capital, the better the PPM sustainability.

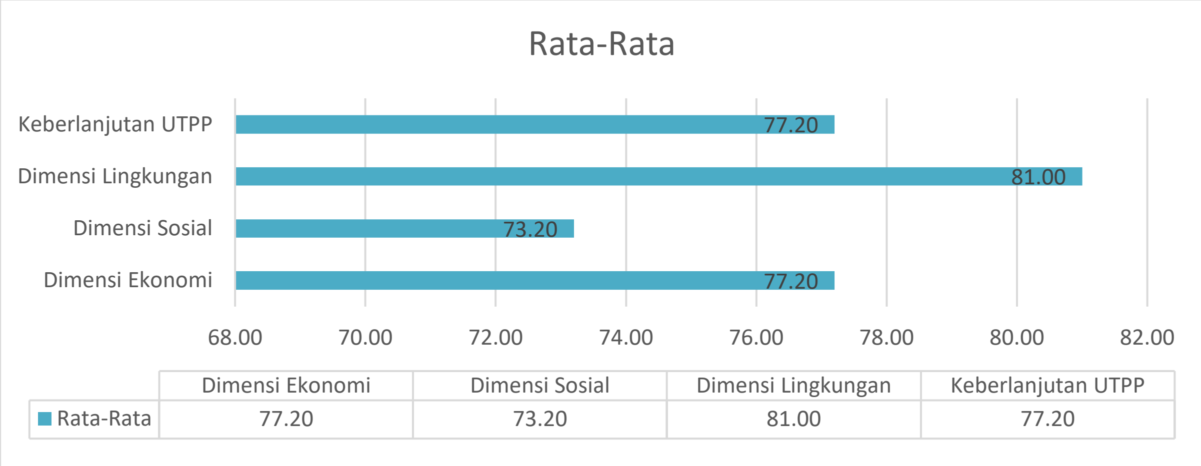
c) The t statistic value due to social capital on PPM sustainability was 1.312, lower than t table (1.970). Ho was accepted. Social capital did not significantly influence PPM sustainability. The value was still positive: 0.075. The positive path coefficient determined the bigger/better the social capital, the better the PPM sustainability.
d) The t statistic value due to human resource capital on PPM sustainability was 3.243, higher than t-table (1,970), Ho is refused/rejected. Human resource capital influenced PPM sustainability significantly. The biggest influence of human resource capital on PPM sustainability was 0.201. The positive path coefficient determined the bigger/better the human resource capital, the better the PPM sustainability.
e) The t statistic value due to physical capitals on PPM sustainability was 0.501, whereas the table was 1.970. The hypothesis is received, the physical capital did not significantly influence on PPM sustainability.
f) The t statistic value due to PPM multifunction leads to sustainable PPM was 3.720, while the table is 1.970. Ho was refused. Multifunction PPM significantly influenced sustainable PPM with 0.208 scores. The positive path coefficient determined the better the multifunction of PPM, the better the PPM sustainability.

The R^2 value described the capital resources of potential agricultural development and PPM multifunction influenced sustainable PPM either partially or simultaneously within 74.1 per cent, whereas the left 25.9 per cent was from others construct. The whole models used were validated by the goodness of fit (GoF) index introduced by Tenenhaus *et al.* (2004) in Yamin and Heri Kurniawan (2011:21). The GoF index is the single gauge to validate associated model measurement and structural performance. The GoF index was gained by the average communalities index multiplied with the value of R^2 model and square rooting. The GoF index was 0.656. More than 0.36 is regarded as a high GoF. The model was excellent in a category that has a high capability in explaining empirical data.[1]

Result

Simultaneously, PPM sustainability is in a high category (77.20 per cent). Whereas partially, the level of environmental sustainability is in a very high category (81.00 per cent), and social and economic sustainability needs the effort to increase. The score respectively is 73.20 per cent and 77.20 per cent (Figure 1).

Figure 1. Level of PPM Sustainability



The Influence of Potential Capitals on PPM Sustainability

The capital is a productive resource in which capacity leads to meet desired economic output flow. It is crucial to sustainable economic development goals by maintaining and improving nature, financial, social, and human resources capital. The economic welfare will decrease when the capacity/ability to produce goods and services declines because of the failure in maintaining its productive resources (Neva R. Goodwin, 2003). Agricultural Multifunctionality, according to OECD (2001), is various services or positive functions contributed by agriculture. The effort to maintain and build up agricultural functionality became the key for agricultural sustainability and rural environment (Ryohei Kada, 2006). Sustainability, meant by Hartwick (1977), is the consumption that has never gone down timely. Supporting to Hartwick, Solow (1974) stated that economic sustainability is human welfare (utility) that has never gone down timely. WCED (1987) mentioned that sustainable development is the effort to fulfil the necessity and aspiration of the recent and now, without any sacrificing capacity to meet future need. The result of the influence of agricultural potential development capital resources and PPM sustainability follows this statistical equation:

$$\eta = 0{,}399\xi 1 + 0{,}170\xi 2 + 0{,}075\xi 3 + 0{,}201\xi 4 + 0{,}020\xi 5 + 0{,}281\xi 6$$

Nature resources influenced significantly on PPM sustainability (t counted (6.249) > t table (1.970): refused Ho). The positive path coefficient (0.399) indicated that the better the natural resources capital, the better the PPM sustainability. District Tasikmalaya is on the ring of fire Volcano and quake path, making this area vulnerable to erosion disaster. Hence, the implementation of conservation principles in utilising and managing dryland must be wise and prudent. This means the need for maintaining and preventing due to land degradation causes and factors. PPM is one of the approaches in which environmental functionality to minimise erosion can be achieved through the presence of trees and kinds of farming commodities that can hold and absorb water and minimise surface flow. Generally, erosion is linked to many factors, particularly land slope, which has the potential to result from the erosion of higher than low land. The land at District Tasikmalaya has hills and scarp (high slope) and is vulnerable towards erosion. The study of a widely ranged area of slope, based on the topographic map, included slope classification of 0–2 per cent, 2–15 per cent, 15–40 percent, and > 40 per cent. Hence, the land at the research site has potential to erode.

Nevertheless, due to a few mistakes in implementing the agricultural system in the conservation area, we cannot avoid disaster and people will feel the impacts. Nasution (2004) states the acceleration of erosion in the upstream caused critical land due to not only land environmental degradation and climate, but it was also leveraged by unfeasible land tillage and with conservation principles. Arsyad's research (2007) proved that erosion and surface flow is the primary cause of environmental degradation on dryland in Indonesia. The impacts are not only erosion such as the physical, chemical, biological, and land productivity degradation at the upstream, but also the increased and widened flood, sedimentation, pollution, and socio-economic at the downstream.

The efforts that can be undertaken to minimise erosion include the implementation of mechanical soil conservation techniques, such as terracing activity. Arsyad (1989) said that the terrace could decrease the slope length and hold water flows until it could decrease surface flow velocity and deal with the possibility of the soil to absorb water, decreasing the erosion. PPM is polyculture farming with perennial and annual plants that can assist in increasing the terracing function throughout root and canopy growth. This aims to decrease erosion and topsoil surface depth at once by producing humic and green manure into the soil and then maintaining topsoil depth.

The economic capital influenced sustainability ($t_{counted}$ (3,744) > t table (1,970): refused Ho). The positive path coefficient (0.170) indicated that the better the economic capital, the better the PPM sustainability. PPM is farming that needs a high enough cost related to the amount/number of commodities and has a variation input price, particularly to provide livestock. Tipraqsa (2007) explained to obtain the benefit from resource integration, it requires a high initial cost. Thus, it can demotivate the farmer to shift to integrated farming. Banerjee, et., al. (1990) said the limited capital amount became a primary constraint to bringing integrated farming into reality. This was because a poor farmer cannot invest their capital as an initial investment due to the need to fulfil their requirements of daily food, education, health, credit payments from the agriculture yield.

Nageswaran et., al. (2009) identified constraints in integrated farming included supply to increase livestock generation, fish infant and feed on time, low energy cost, efficient pump machine, government scheme information and credit support from the financial institutions. PPM is farming that can help the farmer to retain money. Because of PPM, the farmer can gain revenue resources from many agriculture commodities, including from livestock. Hasan (2008) explained that planting two or more kinds of plants at the same time, or in a one-time interval on land, enables efficiency to obtain the maximum yield. This farming system could increase farmer income. Radhamani et al. (2003) explained integrated farming as a component of the farming system that calculates the risk and minimises the concept, and increases production yield and profit by producing organic and plant waste to use as compost. Sing dan Ratan (2009) said that the integrated farming system is the integrated element sets of equipment and activity shown by the farmer on livestock resources they owned to maximise sustainable productivity and net income from farming.

The social capital resource was not different from PPM sustainability (t counted (1.312) < t table (1.970): Ho accepted), but it still has a positive path coefficient (0.075). PPM has social functionality for the dryland farmer community, as the space of farming activity, participation, farmer group activity, and regeneration, while also strengthening society culture. Historically, PPM has been a culture of the dryland farmer, as has the farming activity been hereditary. PPM has been a norm based on local wisdom. The implemented plant pattern has been the result of a long journey of farming adaptation to several factors such as climate, soil, economic, culture, and market. By their thought capability, the farmer has been able to change and adapt towards conditions by inventing local wisdom technology to improve their crop condition. (Setiawan, 2009).

PPM as local wisdom has become the norm rule of dryland sociality, which is unified within religion, culture, and tradition. The dry nature and dependence on the forest, forces the people to adapt by empowering local wisdom to shape insight, knowledge, ideas, and equipment in guidance of the traditional norms, to manage the ecosystem to meet their needs of life. To emphasise socioculture, PPM has been the dryland society culture in West Java. Russele *et al*., (2007) stated that before the agricultural industry developed the agroecosystem function in the dryland, the traditional agriculture system was designed adaptively toward complexity and diversity. Plant pattern for dryland farmers that integrate plant and livestock has been a source of social capital.

Human resources capital has influenced on PPM sustainability t counted (3.243) > t table (1.970): Ho refused). The positive path coefficient (0.201) indicated that the better the human resources capital, the better the PPM sustainability. According to FAO (2001), the integrated business of plant and livestock often impresses as a progress step, but for the little farmer, he has to have enough access to knowledge, assets and input to manage this system to be sustainable economically and environmentally in the long-term, in order to reach an optimum production to increase income. Djoko Prajitno (200) stated that even though integrated farming (plant-livestock-fish) seems to become the interested innovation technology, the aspect of management is not that easy. This is because, not only does it add one or more commodities, but it also introduces a new system of a farming that requires one set of equipment, including its management, also called a technology package.

According to Clark (2004; Russel, et., al, 2007), integrated farming requires expertise in both agriculture commodities, such plant and livestock. It is a disappearing art for many farmers. Notably, the farmer has no experience, training or job background with livestock. Meanwhile, the skill and knowledge of the farmer is about integrated farming, and he has committed to implement integrated farming.

The educational background of farmers at research site on the PPM was commonly low. Effort is required to increase farmer competence in eclectic thinking skills, mental attitude, and skill-to-action in farming. Prijono (2015) stated that in order to increase the number of adopters of integrated plant-livestock, it requires extension support and strong institution to transfer the technology to the farmer. Physical Capital as communication and transportation facilities is not influenced on PPM sustainability, but still has a positive path coefficient (t counted (0.501) < t table (1.970): Ho accepted on 0.020. It indicated that the better the physical capital, the better the PPM sustainability. A communication facility that is easy to use and own and a suitable transportation facility condition are staple needs. PPM is dynamical farming because of the various commodities. The farmer must follow, create, and upgrade the growth and change of information of their commodities, including transportation facility, to accelerate input production factors and marketing of the products.

Suitable communication and transportation facility support also need to accelerate the interaction between and among the farmer group, including with institutions to support PPM sustainability. The farmer at the site commonly has a mobile phone as the communication facility, which is ready to use at any time to communicate everything they need for production factors, marketing, and extension. A younger farmer for application helped the farmer. Besides, communication between farmers by mobile phone is also used for sharing information related to conducting group activities, activity matter, setting an appointment for a meeting, etc. PPM multifunctionality on PPM sustainability was different significantly at 0.208. The positive path coefficient indicated the better the PPM multifunctionality, the better the PPM sustainability. PPM is one of the models of dryland farming activity that is not only concerned with various commodities, but also has adaptive, protective, and anticipative functionality.

Undang Kurnia et al., (2010) explained that cultivation in dryland has various functions, such as agricultural product, job supplier, flood controller, water resources conservation, maintaining soil water stock, CO_2 filter or air cleaner, beauty sightseeing keeper, biodiversity protector, air cooler, organic matter recycler, and so on. Poorani et al. (2011) said that integrated farming increased productivity, profitability, creates job opportunities until 48, 40, 45, respectively, more than conventional agriculture at District West Palladam Zone Tamilnadu.

The whole of validation result used *the goodness of fit* (GoF) (Tenenhaus *et al.* (2004) in Yamin and Heri Kurniawan (2011:21). The GoF score was 0.656 and is upper than 0.36, so the category is high. That is a good model with high capability to explain empirical data.

Farming and dryland management sustainability is influenced by access towards land, ecosystem, social environment, economic and capability of technology, population (sociosystem), geological condition (geosystem) and geographical position (Mufid, 2014; Adiwibowo et al., 2015; Setiawan, 2015; Abdoelah, 2017). Climate change can undoubtedly multiply the opportunities and challenges for dryland farmers in managing their land and farming systems. To face it, the farmer must have the capability to improve adaptably and anticipatable agriculture, as well as have a climate change perspective as the opportunity to increase productivity and farming innovation. Dryland farming must be created and innovated in order to be able to obtain high production and contribution. It is emphasised that dryland farming has adaptive and anticipative strategies to mitigate climate change's negative impact (Sutrisno *et al*., (2010).

Adaptive and anticipative farming on dryland could be conducted by integrating any approaches or technology based on local knowledge and global innovation, like the integrated farming system (Coen dan Bartus, 1992; Abdurrahman *et al*., 1997). Polyculture farming with livestock is one of the integrated farming systems as the model is not only concerned in production function but many functions, called multifunctionality. Biswas (2010) explained that the mixed farming system or integrated farming provides a greater benefit towards time, financial, resources, and workforce/employment. Besides, it provides more open space to a farmer family to secure a job throughout the year. The condition and assurance that the farmer family has an income and standardised life, is better than small scale farming. Ecologically, growing the annual plant in the high slope has potential and assurance of land and water conservation. Application of the vegetative method will reduce erosion velocity and landslide (Suwarto et al., 2012).

In social-special ways, dryland farmers in southern West Java have implemented integrated farming approaches, including with livestock. One of the initiative regions that has implemented the PPM in West Java is District Tasikmalaya. Something unique at District Tasikmalaya is established throughout the localism approach internalised by institutionalisation towards innovation that is introduced from the outside (social engineering).

Conclusion

The Polycultural Plantation Model (PPM) had a high capability to describe empirical data. The capitals of potential agricultural development and the Polycultural Plantation Model influenced PPM simultaneously. Whereas, only natural resources, economic, and human resources capital partially influenced sustainable PPM, except for physical and social capital.

The potential capital of agricultural development and multifunctionality influenced Sustainable PPM simultaneously. Whereas, nature resources, economic, human resources capital and multifunctionality PPM partially influenced sustainable PPM, except for physical and social capital which were not significant to influence sustainable PPM.

Suggestion

Support is necessary in order to increase farmer competency as human capital throughout thinking skill capacity (insight), mentality attitude, and action (skill) for the sake of sustainable PPM. The PPM is a farming activity that requires an expertise in at least two commodities. Financial Institution support is also needed nearby, which farmers can access easily to facilitate their needs.

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