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Research Article

Optimization of critical land empowerment through coffee plant extensification as an effort to improve the economic level of coffee farmers in Indonesia

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Abstract

Critical land in Indonesia is the result of weather disturbances, natural disasters, farming behavior without considering the preservation of nature, and the unwise use of chemical fertilizers. Critical land tends to be acidic and has a soil structure that does not support cultivation. Coffee plants are flexible plants, and their root systems and ecology can improve soil structure. The need for coffee at home and abroad tends to increase along with the development of coffee consumption as a lifestyle for Generation Z (Gen-Z). The economic value of coffee, which tends to increase, opens the insight of farmers to continue to develop this coffee plantation area. In the development of planting areas, knowledge of critical land optimization is needed, which is a principal factor as the basis for implementing critical land extensification. For this reason, the purpose of this study was to determine the level of knowledge of farmers on optimizing critical land into strategic land and efforts to develop coffee agribusiness in critical land. This study used a quantitative descriptive method and used the SmartPLS3 analysis tool. The results showed that internal factors, external factors, and motivation of farmers affect the level of knowledge about optimization of critical land, critical land management must meet ecological conservation and improve the community's economy in a structured manner, the extensification of critical land using coffee plants is one of the strategic steps for critical land optimization, as well as the development of coffee agribusiness, both seeds and waste as an effort to increase farmers' income.

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Introduction

Indonesia is a country where most of the population lives in agriculture. Initially, farmers managed agricultural land to meet the daily food needs of the family, but as time-shifted, conditions in the agricultural sector are expected to become a source of family income. Various efforts have been made to optimize land use to support increased income. In line with this, the Indonesian government in the 1960s launched the Panca Usaha Tani program, which included the selection of superior plant seeds, soil management, irrigation management, fertilization (using chemical fertilizers), and pest control (using

chemical pesticides). The positive impact of the green revolution in Indonesia is that agricultural production has increased tremendously, especially for food crops, so that in 1979 and 1985, it achieved self-sufficiency in rice. In addition, modern technology is starting to be recognized that supports progress in the agricultural sector. The negative impact is that farmers have the point of view that they will succeed in increasing their income by changing land that is possible but not suitable for rice into rice fields. This has a very large impact, considering that not all land locations have soil properties suitable for rice and different water availability.

The level of land degradation is an urgent issue because it determines the level of vulnerability and vulnerability of land to food availability (García et al., 2022). The next impact that affects the chemical properties of the soil is the excessive use of chemicals due to the exploitation of the soil using incorrectly measured chemicals. Critical land ecology must be considered for economic value and stability as an effort to take strategic steps in the effectiveness of land use (Huang et al., 2022). Critical and very critical land conditions are presented in Figure 1, showing a decrease in critical and very critical land in 2011 (BPS, 2019). This shows that the efforts of various parties to optimize critical land have made positive progress.

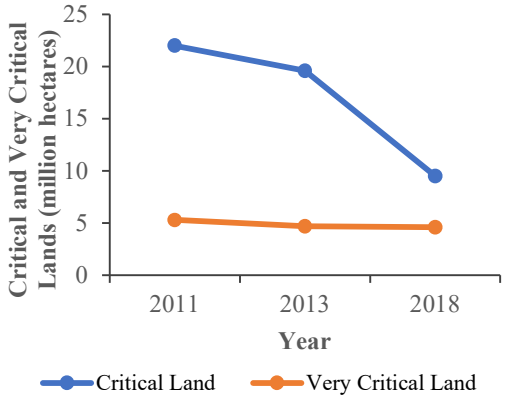

Figure 1. Critical and very critical lands in Indonesia 2011-2018 (Source: BPS, 2019).

Numerous programs and alternatives in agriculture can increase the potential and income of farming communities in Indonesia. Critical land in Indonesia largely results from reduced organic matter content, erosion due to the large degree of land slope, land conversion, and errors in managing productive land. Plantation land is the most widely affected by poor land management, and plantation farmers tend to exploit crops and soil on a large scale, not accompanied by providing the best nutrition for land and crops. This is because there is still land conversion for horticultural commodities, which generate huge profits in a moment but do not support the declining ecological conditions of the soil. Plantation crops are a source of passive income even though they have good productivity because the main harvest is very dependent on the season and climate of the region. In contrast, seasonal crops are able to make a real contribution when the harvest is immediately sold fresh so that farmers' income can be active and their economy can rotate quickly. The amount of interference in the management of plantation crops weakens the contribution of labor and the economic impact of smallholders (Hall et al., 2017). Farmers on degraded land have low levels of income due to limited arable land and commodities cultivated, in addition to limited access to market information and Good Agriculture Practices technology which makes farmers' products more commercial (Bannor et al., 2022). Small farmers have the satisfaction of passing on their land and livelihoods to the next generation even though they have many extreme climatic and ecological limitations. These have led to various kinds of technology adoption to deal with these limitations, including critical land conditions due to cultivation methods and natural disturbances (Melvani et al., 2022). The decline in the economic level was very striking during the Covid-19 pandemic for small farmers whose income was relatively low, forcing farmers to have a level of management in both cultivating and farming to utilize existing resources but have high economic value (García et al., 2022).

Regarding optimizing marginal land into promising land, a different perspective is needed in responding. Some aspects that need to be done are (1) improvement of the cropping ecosystem on critical land, (2) selection of commodities that are suitable for soil conditions, and (3) efforts to develop agricultural-based socio-economic enterprises (agribusiness). Various commodities can be considered cover crops or rehabilitating critical land, such as perennials or agroforestry, hard-trunked plantation crops, or other ground cover crops. Among plantation crops, plantations that are suitable for improving critical soil structures are coffee plants. Coffee plants are commodities that have strong roots and the formation of an adequate root system as a stand.

The basic function of roots is to improve soil and substrate structure (Ferreira et al., 2019). The stem of the main plant has orthotropic characteristics that grow vertically, and the nature of coffee branches is that when one branch dies, a new branch will be replaced, which strengthens the position of the coffee plant as a perennial plant. Indonesian coffee is a commodity that is quite considered in the national and international markets. Domestic coffee needs are only fulfilled by the rest of the fulfillment of foreign needs. Coffee is one of the most popular drink icons in Indonesia. According to data from the International Coffee Organization (ICO), Indonesia's coffee consumption volume will reach 300 million kilograms during 2020-2021. Making this period the year of the highest

consumption in the last 10 years. Based on BPS data in 2022, coffee production in Indonesia has experienced an increasing trend in the last few years. As depicted in Figure 2, starting in 2019, there was a positive trend, namely 752.51 thousand tons in 2019, 762.38 thousand tons in 2020, and 774.60 thousand tons in 2021.

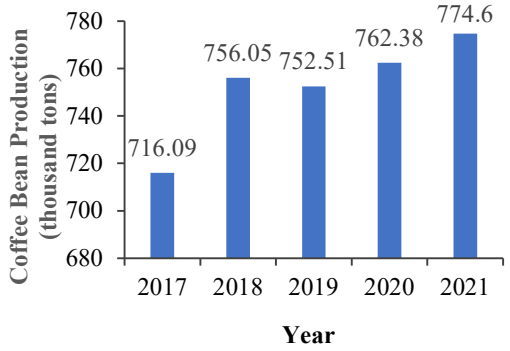

Figure 2. Coffee bean production in Indonesia (Source: BPS, 2022)

The increasing trend can be seen that coffee farmers are starting to pay attention to the cultivation system and the maintenance of coffee plants intensively. This is done to fulfill the need for coffee which is still very lacking. The most coffee production in Indonesia is exported to America (shown in Figure 3) at 54.49 thousand tons, with a value of US$ 202.45 million (BPS, 2021). Therefore, it is necessary to make a breakthrough to meet the target of Indonesian local coffee production both to meet the domestic market and for export purposes.

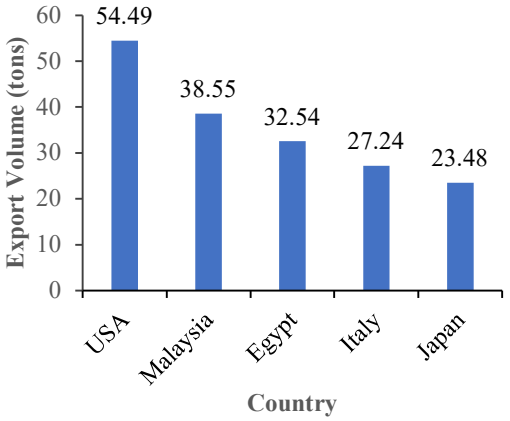

Figure 3. The largest export volume of coffee beans (Source: BPS, 2021).

A specific locality of coffee is needed to raise the uniqueness of a region so that its existence is recognized by the world and has high selling power. In addition to coffee beans which have high economic value for national and international trade, coffee waste can also be used as animal feed and alternative biological fertilizers that are urgently needed by farmers when the price of animal feed increases and subsidies for chemical fertilizers decreases. The application of organic fertilizer derived from coffee bean husks can save the cost of purchasing chemical fertilizers. Given that coffee is very good if fertilized properly using organic fertilizers. The application of this coffee bean husk waste must be carefully observed for the fermentation process. When the waste skin is still raw (red skin), it should not be directly applied close to the stems or roots of the coffee. This can cause plant death due to chemical reactions that are too hot (because it can make the coffee plant die due to the heat reaction process produced from the coffee husk, so that the making of *rorak* (hole for fertilization) by farmers is not close to the coffee stem (Mahyuda et. al., 2018). Based on the description above, it is necessary to intensify and extensify coffee plants on critical (marginal) lands so that farmers in these areas can continue to increase coffee production and increase income.

This study aimed to determine (1) the knowledge of coffee farmers on the optimization of critical land into strategic land and (2) efforts to develop coffee agribusiness in critical land.

Materials and Methods

Data collection and research started from March to August 2022. The primary research data used data from questionnaires and observations of the behavior of 100 coffee farmers on marginal land in Indonesia using a random purposive sampling technique. The sampling technique uses the Slovin method, using the following formula:

$n=N/(1+N\alpha^2)$ …….(1)

where:

n : number of samples
N : number of populations
α : degree of accuracy 5% (0.05)

Based on the formula below, the research sample was as follows

$n = N/(1+N\alpha^2)$
$= 133/(1+133(0.05)^2)$
$= 99.81 \approx 100$ samples

The criteria for interviewed farmers are as follows:

1. Domiciled around critical land
2. Member of farmer group or coffee association active for 1 (one) year
3. Managing people's land or sharing with plantations or the private sector
4. Active coffee agribusiness actors.

Data were collected using a mixed questionnaire, namely a combination of closed questionnaires (with the answer choices strongly agree, agree, doubt, and disagree) and open questionnaires (brief explanations from respondents). The questionnaire contains 15 (fifteen) questions related to critical land and coffee agribusiness. Questionnaire testing uses validity and reliability tests.

Data from research results through the process of normality test according to Kolmogorov Smirnov (with a level of normality >0.05%) and linearity test using Multiple Linear Regression. The level of knowledge is the dependent variable (Y), while the independent variable (X) consists of:

1. Internal factors (X_1) are characteristics of age, formal education, and informal education of coffee farmers
2. External factors (X_2) are technology information channel support and market information
3. Motivation (X_3) are understanding and application of information

The analysis of multiple linear regression data is formulated as follows:

$$Y=\alpha+\beta_1X_1+ \beta_2X_2+ \beta_3X_3+e \quad \text{.....(2)}$$

where:

Y	:	The level of knowledge
α	:	Constant
β_1	:	Regression coefficient on X_1
β_2	:	Regression coefficient on X_2
β_3	:	Regression coefficient on X_3
X_1	:	Internal factors
X_2	:	External factors
X_3	:	Motivation
e	:	Standard error

The secondary data used by the researcher is time series data from the Central Statistics Agency (2017-2022) as well as related journals and research relevant to critical land and coffee plants in 2001-2022. This research uses a quantitative descriptive method and the SmartPLS3 analysis tool. The stages of conclusions and suggestions are used as a reference for future research and input for policymakers in the relevant government.

Results and Discussion

Internal factor

Coffee farmers who live around critical lands in Indonesia have various characteristics that affect their concern for the environment and the ecosystem of their coffee fields. There are still many coffee farmers who leave arable land that is no longer productive for another land that is considered productive. In fact, this kind of behavior causes the land to become more critical, considering that the previous cultivation method did not refer to soil conservation. The results of the analysis of the age characteristics of coffee farmers on critical land in this study (Figure 4.) show that farmers who live around critical land vary widely with age ranges from 19-70 years. Farmers aged 33-45 years are the largest sample population, as much as 32%, while the second largest age range is at the age of 19-32 years, which is 28%. From these data, farmers of productive age still dominate the area. The higher the age of the farmer, the better the level of performance due to the more experience and increased skills in work. The level of intelligence in analyzing and problem-solving techniques in farming when entering a productive age is considered capable of supporting career success (Huang and Rust, 2018). Population characteristics (age, gender, education, experience in business) greatly influence cultural patterns that have been applied for years so that it can easily distinguish socio-economic life and behavior in a network (Burton, 2014).

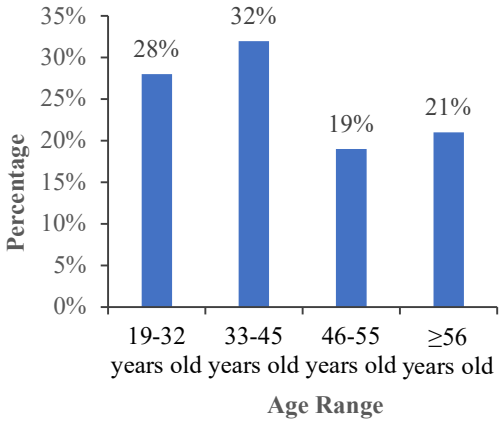

Figure 4. Age distribution of respondents.

The formal education of coffee farmers (respondents) is moderately average. It is shown that the majority of respondents graduated from high school (high school) with an education period of 12 (twelve) years, as many as 43 respondents. Respondents who graduated from junior high school (junior high school) or the equivalent were 35 people. While respondents graduated from elementary school (elementary school) or the equivalent were 20 people, and 2 people graduated with bachelors. This shows that the quality of the economy and the perspective of farmers are still limited. Farmers still think that higher education does not guarantee someone to be able to succeed in work and be able to advance their area of origin; in addition, according to respondents, skills in farming are not positively correlated with higher education. The distribution diagram of formal education is depicted in Figure 5 below. The knowledge that is more modern and broad is able to answer experience in farming and adopting technology as an effort to increase integrity and improve land economy (Burton, 2014; Behailu et al., 2016).

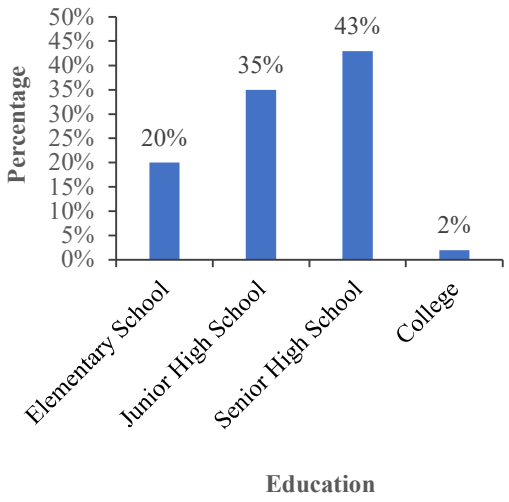

Figure 5. Distribution of respondents' formal education characteristics.

The analysis of the characteristics of non-formal education taken by coffee farmers in critical land (Figure 6) shows that farmers rarely receive non-formal education or training. In Figure 6, it is shown that education (training) can only be accessed by members of certain farmer groups because organizers usually have limited funds so not all group members can participate directly. Non-formal education organized by related parties in a period of 1 (one) year at most 5 times. The majority of respondents as much as 70% who attend non-formal education with material on coffee cultivation and critical land management, conducted only 1 (one) time each year. While 25% of respondents attend non-formal education 2-3 times a year, and only 5% of respondents attend training more than 3 times a year.

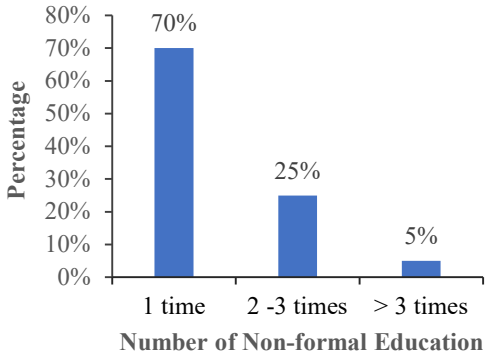

Figure 6. Characteristics of non-formal education taken by respondents (within 1 year).

The non-formal education that farmers really want is coffee cultivation in accordance with GAP (Good Agriculture Practices). This was conveyed by the respondent when the questionnaire was distributed. Coffee cultivation according to GAP is an innovation that can be applied in efforts to handle critical land through efforts to improve soil structure and increase support for the surrounding ecosystem. The hope of farmers when doing extensification of critical land, the product of the commodity being cultivated has optimal quality and can meet market needs. Non-formal education that farmers have followed is able to influence the decisions and desires of farmers to adopt or apply the information that has been obtained so that farmers can apply the principles of sustainable agriculture (Debie, 2021).

The analysis of the respondents' internal factors indicates that their capacity and educational background are relatively low and strongly influence individuals assessing and analyzing the surrounding environment. Formal education is very important to support the capacity of farmers who have broad insights and perspectives. Non-formal education supports farmers' efforts to increase and develop the available potential as well as strategies to face challenges in critical land areas.

A person's education level can determine behavior and affect individual rationality in adopting information, technology, and decisions or policies as well as technology decision-making. However, respondents still guided that experience is the best "teacher" for farming, in line with Effendy et al. (2013), the more and longer the experience of farmers in farming, the wider the insight and information to innovate. However, respondents also have low participation in non-formal education; this shows that access to information and new technology is also experiencing obstacles.

External factor

The results of the analysis of access to information technology received by respondents (Figure 7) are low. It is very difficult to access technology information directly or face-to-face with competent sources in their fields. This is related to the condition of the area that is far from the city center, limited internet access, and the lack of innovation of respondents in finding information centers because it is related to educational background and limited perspective on new information. In fact, according to Rasak and Amusat (2012), the availability of relevant sources of information greatly facilitates farmers in accessing information and technology related to their farming. Access to the information provided by agencies and institutions related to the conservation and rehabilitation of critical land to become productive is still very lacking given the enormous cost requirements; in addition to that, during the pandemic, the mobility of individuals and groups is very limited. The speed in adopting innovations and technology is directly influenced by the distance of the settlement to the location or farmland and the distance of the settlement to the source of information.

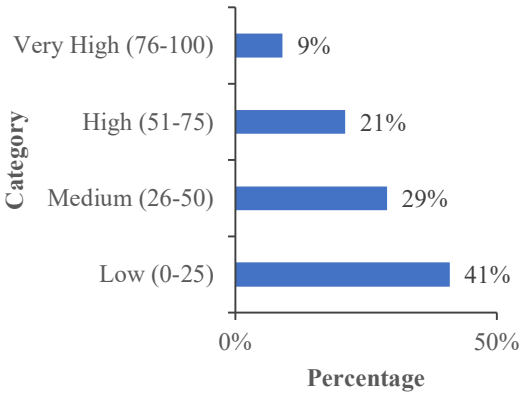

Figure 7. Information channel support and respondent technology.

The results of the analysis of respondents' access to market information for coffee commodities (Figure 8) are classified as high, considering that currently, there are many market demands that require large and small traders to seek quality products even in remote areas. Apart from having traders come to the respondent's location, limited internet access has been used to obtain market information, including product needs and prices. By having gadgets, many young farmers are looking for distribution channels through the tools they have, even though they are not supported by internet access, in line with Johnson and Gueutal's (2017) statement that the use of information technology still has limitations and challenges related to production costs and the level of competence of human resources. Entrepreneurial farmers with many business networks and partners have better income because their business performance is also better (Etriya et al., 2019).

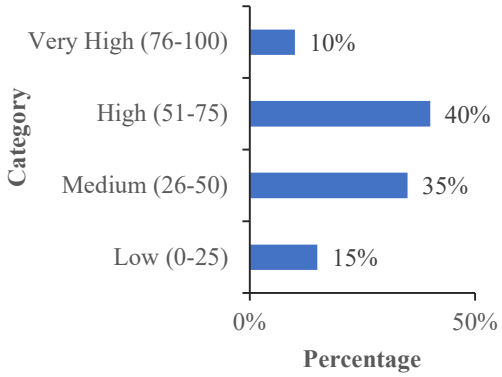

Figure 8. Respondents of market information access.

Motivation

The results of the data analysis on the motivation of coffee farmers in critical land to improve soil structure through commodity extensification according to the area are included in the medium category (shown in Figure 9). Farmers who have high motivation to optimize critical land are farmers who have educational backgrounds up to a bachelor's degree and most of them graduated from high school. This relates to the widely held knowledge of soil conservation, the impact of ecosystem damage, and the broad perspective of agribusiness. Farmers' understanding of the importance of extensification is that managing natural land resources requires a broad perspective, thought, and policy, in addition to using the right method through a structured organization, planning, implementation, assistance, and supervision. Efforts need to be made to minimize the rate of increase in critical land areas by carrying out massive efforts such as integrated land conservation through reforestation and the provision of other infrastructure facilities.

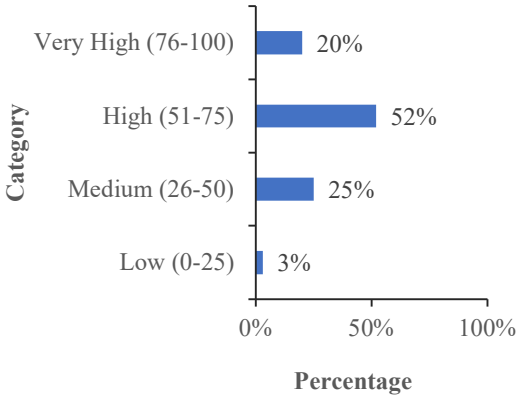

Figure 9. Motivation on respondents' understanding of critical land management.

The results of data analysis on the motivation of farmers towards the use of telecommunications equipment and digital networks to increase income (Figure 10) are included in the medium criteria. This is related to the number of farmers whose age is relatively large, above 50 years, who do not attach importance to the use of modern communication tools. In addition, the level of adoption of the use of information technology is also low. Farmers who use information networks for marketing are young farmers. Young farmers are more relevant in the use of modern communication tools, and the reach for information outside the region is very wide, including information on needs and market prices for coffee products. Around 90% of coffee agribusiness actors use digital marketing methods to expand market reach. In line with this statement, limited marketing problems can be solved by developing telecommunications and information technology, especially during the Covid-19 pandemic and the new normal era (Lin and Zhang, 2020; Hayakawa and Mukunoki, 2021). Motivation as an effort to protect the land from ecological criticality is very necessary, considering that the development of critical land areas is an object that local residents and

the government must consider as a support for the economic activities of small farmers (Huang et al., 2022).

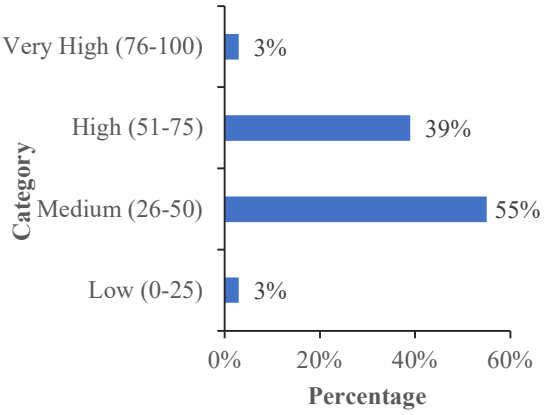

Figure 10. Motivation for the use of respondents' digital communication tools and networks.

Level of knowledge about optimization of critical land

The results of multiple linear regression analysis show that the independent variables (internal factors, external factors, and motivation) affect the dependent variable (level of knowledge about optimization of critical land), with an R^2 value of 0.738 which means that 73.8% of this model can explain the dependent variable. The results of the multiple linear regression test are described in Table 1. Farmers' competence in optimizing critical land in their area can be identified through competency clusters, namely opportunity, administration, networking, personality, and commitment, where the five clusters support each other. Farmers' competence in optimizing critical land shows that these farmers can contribute socially and economically (Lee et al., 2016).

Based on Table 1, the largest value is on the variable X_3, namely the motivation in improving critical land and using digital marketing networks, while the smallest is X_1, namely the characteristics of farmers' human resources. This shows that the characteristics of human resources have the smallest effect on the knowledge level about optimizing critical land. The most dominant variable is determined by the value of β and p-value. The dominant variable to influence the level of knowledge about the optimization of critical land is X_3, namely the mastery of information technology in efforts to improve critical land and increase income through digital coffee marketing networks, which are determined by the value of 0.5843 and P-Value of 0.0233. Motivation comes from understanding the importance of conserving critical land to be productive and using digital communication infrastructure suggestions to build small farmers in degraded land areas to have a "sense of ownership" and efforts to develop areas based on healthy ecosystems.

Table 1. Multiple linear regression test results.

No	Variable (X)	β	p-value*
1	Internal factor (X_1) - Farmer age - Formal education - Non-formal education	0.4207	0.0386
2	External factor (X_2) - Access information - Market access and marketing	0.4545	0.0217
3	Motivation (X_3) - Motivation towards understanding the optimization of critical land - Motivation towards the use of digital communication tools and networks	0.5843	0.0233

*α=0.05.

Motivation within the farmers to carry out the movement is also influenced by the internal and external factors of the farmers themselves. Business experience, education or training that has been attended, and information received from various information networks are able to instill self-motivated values well. The key to the success of farmers in making changes is the need to conserve both themselves and their environment. The motivation to make this change can be obtained through a very broad social network as a process of adopting knowledge or technology (Prokopy et al., 2019).

Efforts to develop agribusiness for coffee farmers in critical land

In order to meet the increasing demand for coffee and the increasingly varied product prices, coffee farmers are trying to open up opportunities to expand the area of coffee plantations. The extensification step taken by farmers with support from various parties in the field is one of the strategic steps to optimize critical land while increasing the income of coffee farmers in these critical areas (Tufaila et al., 2014). Coffee plants can be developed as an agroforestry system by intercropping with other plants, and optimum production is still achieved when using a monoculture system in accordance with GAP (Good Agriculture Practices). This relates to the application of fertilizers and the treatment of coffee ecology (Nandini, 2018; van Wyk and Prinsloo, 2019). The characteristics of coffee that have specific locality are good if planted at an altitude above 400 m, a slope of less than 30%, soil pH between 5.5-6.5, with moderate rainfall and a little

dry season and a strong root system capable of minimizing soil erosion. The need for coffee plants in 1 (one) hectare is 1,000 trees. The recommendation for national fertilization using 860 kg NPK fertilizer/ha and 500 kg organic fertilizer/ha can be used to improve soil structure and nutrient fulfillment (Saha et al., 2016). The use of coffee bean husk waste as an alternative organic fertilizer because the coffee bean husk contains potential nutrients that are suitable for organic fertilizer. The organic matter contained in the coffee bean shell is 45.3% organic C, nitrogen 2.98% nitrogen (N), 0.18% phosphorus (P), and 2.26% potassium (K). With such element content, farmers can save on purchasing NPK chemical fertilizers.

The prospect of coffee plants as a superior product and increasing demand in the broad market, both domestic and foreign. The shift in domestic demand for coffee is very positive. If in the past, consumers or coffee drinkers were identical to old people, and now the paradigm has changed. Generation Z, as the driving force of the trend, has an important role in these changes. Coffee consumption is not only a necessity but a lifestyle. Even coffee consumption in 2021 is the highest consumption year for 1 (one) decade. Agribusiness managerial skills are needed in developing businesses so that they can control and resolve obstacles that occur (Minello et al., 2014). The learning process for business actors must be carried out starting from small things, habituation of disciplined behavior and character.

Conclusion

The internal factors, external factors, and motivation of farmers affect the knowledge about optimization of critical land because it can grow and develop farmers' motivation and efforts to continue optimizing critical land based on the knowledge gained and motivation to increase income on a household scale. Critical land management must fulfill ecological conservation and community economic improvement in a structured manner, bearing in mind that sustainable agriculture requires a healthy and "steady" ecology to support the lives and income of farmers in degraded land areas. Extensification of critical land using coffee plants is one of the strategic steps for optimizing critical land by cultivating coffee. According to GAP (Good Agriculture Practices), coffee-derived products are currently and, in the future, very promising both in terms of quantity and financially. And then the development of coffee agribusiness, both seeds and waste, as an effort to increase farmers' income. the researcher suggests that the government massively expand access to information about the importance of conserving critical land through extending coffee plants to cultivation training according to GAP and expanding product marketing networks with the main goal of increasing the income of farmers in degraded land.

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References

Bannor, R.K., Amfo, B., Oppong-Kyeremeh, H., Hope, L., Chaa Kyire, S.K. and Djimatey, R. 2022. Land tenure system and harvesting time's influence on the marketing behaviour of cashew farmers in the Bono Region of Ghana. *Heliyon* 8(11):e11392, doi:10.1016/ j.heliyon.2022.e11392.

Behailu, B.M., Pietilä, P.E. and Katko, T.S. 2016. Indigenous practices of water management for sustainable services: case of Borana and Konso, Ethiopia. *SAGE Open* 6(4), doi:10.1177/2158244016682292.

BPS. 2019. Indonesian Environmental Statistics 2019. Central Bureau of Statistics, 1-224 (*in Indonesian*).

BPS. 2021. Indonesian Coffee Statistics 2021. Central Bureau of Statistics, 1-101(*in Indonesian*).

BPS. 2022. Bulletin of Export Foreign Trade Statistics by Commodity and Country Groups, October 2022, 1-274 (*in Indonesian*).

Burton, R.J. 2014. The influence of farmer demographic characteristics on environmental behaviour: a review. *Journal of Environmental Management* 135:19-26.

Debie, E. 2021. Smallholder farmers' decisions to the combined use of soil conservation practices in Tiwa watershed, Northwest highlands of Ethiopia. *Heliyon* 7: e05958, doi:10.1016/j.heliyon.2021.e05958.

Effendy, Hanani, N., Setiawan, B. and Muhaimin, A.W. 2013. Effect characteristics of farmers on the level of technology adoption Side-Grafting in cocoa farming at Sigi Regency-Indonesia. *Journal of Agricultural Science* (*Toronto*) 5(12):72-77.

Etriya, E., Scholten, V.E., Wubben, E.F. and Omta, S.O. 2019. The impact of networks on the innovative and financial performance of more entrepreneurial versus less entrepreneurial farmers in West Java, Indonesia. *NJAS-Wageningen Journal of Life Sciences* 89:100308.

Ferreira, T., Shuler, J., Guimarães, R. and Farah, A. (2019). Chapter 1: Introduction to coffee plant and genetics. In: *Coffee Production, Quality and Chemistry*. pp. 1-25, doi:10.1039/9781782622437-00001.

García, S.O., Santillan, V.S, Vivier, V.B., Anglés-Hernández, M., Pérez, M.E. and Prado, B. 2022. Soil governance and sustainable agriculture in Mexico. *Soil Security* 7:100059, doi:10.1016/j.soisec.2022.100059.

Hall, R., Scoones, I. and Tsikata, D. 2017. Plantations, outgrowers and commercial farming in Africa: agricultural commercialisation and implications for agrarian change. *Journal of Peasant Studies* 44(3):515-537, doi:10.1080/03066150.2016.1263187.

Hayakawa, K. and Mukunoki, H. 2021. The impact of COVID-19 on international trade: evidence from the first shock. *Journal of the Japanese and International Economies* 60:101135, doi:10.1016/j.jjie.2021.101135.

Huang, M.H. and Rust, R.T. 2018. Artificial Intelligence in Service. *Journal of Service Research* 21(2):155-172, doi:10.1177/1094670517752459.

Huang, X., Ye, Y., Zhao, X., Guo, X. and Ding, H. 2022. Identification and stability analysis of critical ecological

land: case study of a hilly county in southern China. *Ecological Indicator* 141(1101):109091, doi:10.1016/j.ecolind.2022.109091.

Johnson, R.D. and Gueutal, H.G. 2017. SHRM Foundation's Effective Practice Guidelines Series the Use of EHR and HRIS in Organizations Transforming HR Through Technology. www.shrm.org/foundation.

Lee, H., Lee, J. and Shim, K. 2016. Entrepreneurial characteristics: a systematic literature review. *20th Pacific Asia Conference on Information Systems, PACIS 2016. Pacific Asia Conference on Information Systems.*

Lin, B.Xi, and Zhang, Y.Y. 2020. Impact of the COVID-19 pandemic on agricultural exports. *Journal of Integrative Agriculture* 19(12):2937-2945, doi:10.1016/S2095-3119(20)63430-X.

Mahyuda, M., Amanah, S. and Tjitropranoto, P. 2018. The adoption rate of good agricultural practices of Gayo arabica coffee cultivation by farmers in Central Aceh Regency. *Jurnal Penyuluhan* 14(2):308-323 (*in Indonesian*).

Melvani, K., Myers, L. B., Stacey, N., Bristow, M., Crase, B. and Moles, J. 2022. Farmers' values for land, trees and biodiversity underlie agricultural sustainability. *Land Use Policy* 117:105688, doi:10.1016/j.landusepol.2021.105688.

Minello, I.F., Scherer, L.A. and da Costa Alves, L. 2014. Entrepreneurial competencies and business failure. *International Journal of Entrepreneurship* 18:1-16.

Nandini, R. 2018. Benefits analysis of agroforestry farming patterned candlenuts, cacao, coffee and banana in Sesaot Community Forest, West Lombok. *Jurnal Peneltian Kehutanan Faloak* 1(2):1-12, doi:10.20886/jpkf.2018.2.1.1-12 (*in Indonesian*).

Prokopy, L.S., Floress, K., Arbuckle, J.G., Church, S.P., Eanes, F.R., Gao, Y., Gramig, B.M. and Ranjan, P. 2019. Adoption of agricultural conservation practices in the United States: Evidence from 35 years of quantitative literature. *Journal of Soil and Water Conservation* 74(5):520-34, doi:10.2489/jswc.74.5.520.

Rasak, O.B. and Amusat, A.S. 2012. Perceived efficacy of radio agricultural commodities trend programme among farmers in Oyo State, Nigeria. *Journal of Media and Communication Studies* 4(3):46-51, doi:10.5897/JMCS11.097.

Saha, S., Monroe, A. and Day, M.R. 2016. Growth, yield, plant quality and nutrition of basil (*Ocimum basilicum* L.) under soilless agricultural systems. *Annals of Agricultural Sciences* 61(2):181-186, doi:10.1016/j.aoas.2016.1 0.001.

Tufaila, M., Aliyaman, Ginting, S. and Alam, S. 2014. Evaluation of land fitness for crop of coffee, cocoa, and cashew in District North Moramo, South Konawe. *Agroteknos* 4(3):167-173 (*in Indonesian*).

van Wyk, A S. and Prinsloo, G. 2019. A review of the ethnobotanical uses, pharmacology, toxicology, management, and cultivation of selected South African protected multi-purpose tree species. *South African Journal of Botany* 124:258-269, doi:10.1016/j.sajb.2019.0 5.012.