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Are the Physical and Social Capitals Still Critical Factors in Enhancing the Sluggish Productivity of Coffee Agroforestry?: The Evidence of Endogenous Growth Role at Batutegi Forest Management Unit

Samsul Bakri[1,2*], Adella Putri Apriliani[2], Hari Kaskoyo[1,2], Christine Wulandari[1,2]

[1]Department of Forestry, Faculty of Agriculture, The University of Lampung, Bandar Lampung, Indonesia 35145
[2]Master of Environmental Science Study Program, The Graduate School, The University of Lampung, Bandar Lampung, Indonesia 35145

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Abstract

Increasing income is the main interest of farmers in establishing highly productive and sustainable coffee agroforestry. Since the program in Batutegi Lampung Province has been facing a limitation of physical capital (PC), to increase the income (INC), it is urgent to stimulate the capacity of social capital (SC). In this context, it is important to elucidate the role of extension participation (ROLE) to build better capacity of SC in amplifying the whole productivity. This study aims to analyze a) the direct effect of PC, SC, and ROLE on INC, and b) PC and SC on ROLE, as well as c) the indirect effect of ROLE (as a mediating variable) for PS and SC in increasing INC. Structural equation modeling (SEM) is applied at a 95% confidence level. The PC indicator is land ownership. The elements of norms, trust, and networks are indicators for SC. The three ROLE indicators are participation in extension on forest protection, agroforestry techniques, and post-harvest. Income sources from coffee beans and NTFPs are an indicator of INC. Data collection was carried out in AprilJune 2020 by conducting interviews with 98 HKm holders. The results suggest: a) the direct effect on ROLE by PC is sluggish (p-value = 0.112) but by SC is very significant (p-value = 0.000); b) the direct effect on INC by PC or SC is blunt (not significant), whereas by ROLE is significant with p-value = 0.740, 0.123, and 0.000, respectively; and c) the indirect effect on INC by PC remains sluggish although mediated by ROLE (p-value = 0.188) but significant by SC (p-value = 0.000). The implications, for instance, are that to ensure that HKm holders can leave protected forest areas voluntarily and survive outside forest areas when their concession rights expire, the FMU should prioritize enhancing their knowledge and skills to combat decreasing returns in agroforestry production rather than enlarging land allotment.

Keywords: *decreasing return, extension, knowledge enhancement, leave protected forest voluntarily, PLS-SEM*

**Correspondence author, email*: *samsul.dikjar@gmail.com; samsul.bakri@fp.unila.ac.id*

Introduction

Based on the data of Global Forest Watch (2023), the tree stand loss area in Indonesia continues to increase steadily from 0.39 to 2.17% of a total of 189 million ha from 2001 to 2016. However, 2016 became a turning point in this position i.e., down to 0.47% in 2022. This achievement is partly a contribution from forest area management policies, in particular the provision of social forestry schemes, which include village forests, customary forests, partnership forests, community plantation forests, and community forests (HKm) which have now reached an area of around 6,371,773.42 ha for 1,287,710 heads of families (MoEF, 2023a). The HKm is a program of the Government of Indonesia to empower people who cultivate around or inside state forests, especially in the production forests or even in the protection forests (Kaskoyo et al., 2014). The HKm program allocates a maximum of 15 ha of forest land per household for peasants to employ agroforestry cultivation during the 35-year concession period but is prohibited from cutting wood instead of collecting NTFPs. The legality of NFTP collection is also known in conservation partnership programs (Bakri et al., 2023a). As a form of empowerment scheme, HKm authorities provide guidance, training, and extension so that HKm holders can leave their land voluntarily to live and develop outside the forest area after the concession period ends (Wulandari et al., 2021; Bakri, et al., 2023a).

On the other hand, even though social forestry has had great success in its reforestation program, unfortunately, this scheme has not been able to completely reduce the poverty of HKm members. By using sample tests from research results from the Eastern Region (Leunufna et al., 2023; Ma et al., 2023), the Central Region (Muthmainnah et al., 2022; Yusuf et al., 2023), and the Western Region of Indonesia (Wulandari et al., 2021; Susilo & Nairobi, 2019), it turns out that the average income is USD1.87 (sd = 1.00) or the equivalent of USD0.47 (sd = 0.25) household^{-1} day^{-1} if it is assumed there are 4 people household^{-1}. This average is below the criteria used by the World Bank (2023), namely USD 3.65 capita^{-1} day^{-1}. The new criteria applied because

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Indonesia has been categorized as a low-middle-income country. Even though the Government of Indonesia, through the Ministry of Environment and Forestry, annually spends on average more than USD500 billion (MoEF, 2023b) among others, for fostering HKm and four other social forestry schemes, including investment in infrastructure, governance, extension 35in production facilities, training and extension on forest protection, cultivation techniques, post-harvest, and marketing.

A similar description can also be presented for Lampung Province, which was the first FMU to implement the HKm program since 2008 namely the Batutegi FMU in Tanggamus Regency. At that time the tree stand loss acreage was still 0.68% of an area of 3.35 million ha, then decreased to 0.51% and finally reached 0.22% for 2016 and 2022, respectively. Under the tree-improvement canopy, nowadays forest cover has also been increasing from 3.6% in 2008 (Syahputra et al., 2022) to 8.57% in 2022 (Bakri et al., 2023b). HKm achievements in Lampung Province are now 386 concessions involving 8,610 households (MoEF, 2023a). As in other parts of Indonesia, HKm concession holders in this province are also still trapped in poverty except for their achievement in forested area recovery. This judgment can at least be reflected by HKm concession holders drawn from three HKm programs in Lampung Province, namely at FMU Bukit Punggur Way Kanan Regency, amounting to USD0.99 (sd = 0.25) day^{-1} $capita^{-1}$ (Wulandari et al., 2021), at FMU Selagai Lingga Central Lampung Regency, it is USD1.5 (sd = 0.22) day^{-1} $capita^{-1}$ (Wulandari et al., 2022), and in FMU Batutegi Tanggamus Regency, it is USD1.5 (sd = 0.31) day^{-1} $capita^{-1}$(Susilo & Nairobi, 2019).

The sluggish response to increasing INC should not be attributed to the failure of the FMU authorities to carry out the empowerment tasks. Even if there is a real contribution, it does not seem to be a substantial problem. Such failures are relatively no severe matter and quick to amend rather than caused by endogenous variables in nature, especially due to the low capacity of the forest area itself, which is primarily a marginal area i.e., as the protected forest. It should be suspected that both physical and social resources are sluggish (Cervellati et al., 2023) and no longer effective in producing cash crops such as coffee beans. Therefore, the restoration of the intrinsic functions achieved through the social forestry program has not directly increased INC. This phenomenon is contrary to the simulation result conducted by Bakri et al. (2014) namely that if the forested area is increased by 1%, the average income of Lampung Province will increase by 5.7% (sd = 0.62). But how long the reafforestation measure takes time to produce an effect on INC increase is not explained.

The phenomenon of resources leveling off of physical or land capital (Cervellati et al., 2022) and social capital at a macro level in the Lampung region has been reported by Affandi (2009), Bakri (2012), and Bakri et al. (2014). This symptom is indicated by the scale of return in various agro-industrial sectors, which continues to decline, namely in the form of a sluggish response to inputs of energy and labor but very responsive to inputs of raw materials for agricultural products, including coffee beans (Affandi, 2009). This phenomenon is also a reflection of environmental stagnant (Cervellati et al., 2022). Bakri et al. (2014) also proved that reforestation in the upstream areas of this province can significantly reduce the level of erosion, landslides, and flood frequency then at the same time increase farmers' income, industrial sector growth, economic growth, and the human development index. At the same time, the impact of reforestation is also accompanied by an increase in social capital which is reflected, among other things, in decreasing crime intensity (Bakri, 2012, Bakri et al., 2014). This reforestation measures as a form of restoring the flow of environmental services (Maris & Homes, 2023) which then triggers productivity growth in the agricultural sector, followed by the downstream sectors, and ultimately has an impact on welfare.

On the on-farm scale, the symptoms of leveling off of physical resources in this province were also reported by Bakri et al. (2021a) that land resources at the Gedongwani FMU area in South Lampung Regency is also similar to Batutegi region in terms of soil properties or fertility (Dai et al., 1989). The simulation of increasing the area of land for each HKm member did not significantly (p-value = 0.927) increase the income of agroforestry-based forest HKm holders with the lower strata of food crops. Conversely, strengthening the performance of social capital can be very significant in increasing income for both the network element (p-value = 0.014) and the trust element (0.025). Similarly, Wulandari et al. (2021) from the results of their study at FMU Bukit Punggur, Way Kanan Regency, revealed that the addition of land holdings for the allocation of semi-intensive use of upland food crops using the agroforestry system could not increase the income of HKm members in this area (p-value = 0.836).

The phenomenon of diminishing returns in this area can be explained conceptually by using the theory of endogenous economic growth, which is a counter theory to neoclassical economics (Romer, 1990; Cervellati et al., 2022). Physical capital in the form of land resources, especially in protected forest areas, is actually of marginal land quality (Dai et al., 1989) to produce cash crops. The land productivity in this area may only be sustainable if it is maintained as a natural forest ecosystem. Because the natural forest has been changing into semi-intensive agriculture in the coffee agroforestry system, the erosion exceeds natural soil formation, soil fertility deterioration rises up, soil organic matter content depletes, accompanied by severe biodiversity loss, and ecological equilibrium recovery is under suppression. In sum, the ecosystem service can not afford agroforestry production as expressed by the sluggish response of decreasing return of farming income. To understand all those ramification problems, an adequate learning experience is required. In fact, according to Nurhaida et al. (2011) and Wulandari et al. (2021), many forest HKm holders in Lampung area are descendants of immigrants from Java who moved since 1905 under Dutch colonialism. They generally do not have any experience in agroforestry cultivation. Knowledge and skill improvements, therefore, are an obligate requirement to foster them so that they will be able to successfully increase income from coffee agroforestry cultivation under the constraint in such a fragile protected forest.

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Knowledge and skills are inherent in each HKm member, and according to endogenous growth theory (Romer, 1990; Lechthaler, 2022), are the third production factor (E) after human resources or labor (L) and capital (K) both the physical and social capital. Factor E is referred to as the third factor because classical and neoclassical economists oppose this theory, which only recognizes L and K as factors of economic production. Factor E is also called knowledge capital, which can be accumulated from day to day at work. The E factor inherent in humans naturally never decreases but is always additive until retirement. The accumulation of knowledge capital is generally also accelerated through the impact among individual workers when they interact with each other, such as in working groups. According to Han et al. (2022), factor E, therefore, is also a source of creativity that can compensate for reduced physical capital capacity and accelerate social capital accumulation, which in this study has not been effective in increasing yields or income. Besides, the E factor can also stimulate a production recovery system that may stagnate, as is possible to have occurred in recent HKm management.

It is commonly known that besides learning by doing and sharing, the accumulation of factor E in each individual can also be accelerated through formal education and training as well as through participation in extension activities (ROLE). In any production system in a rural environment such as in agroforestry, working in groups will provide an impact on knowledge (knowledge spillover), both obtained through daily work experience and through ROLE. That way the accumulation of E can take place much faster because it is encouraged by the ongoing sharing of knowledge. Simultaneously with this interaction, it can also strengthen social capital among its participants i.e., among HKm members. Puskarova (2022) emphasized that SC itself can make society work efficiently and, hence, promote knowledge sharing. This means that the accumulation of social capital (SC) will also take place intensively through the habit of sharing knowledge (Wah et al., 2007; & Harjanti et al., 2022).

According to Claridge (2019) and Pryanath and Jayathma (2021), currently the concept of social capital is widely used by researchers is a concept first proposed by Coleman (1988) who divided it into three elements, namely norms, trust, and networks. Norm as a basic element of the SC facilitates common rules that become a shared guide. The existence of effective norms will stimulate the emergence of trust between two persons or more. Trust is the inner mind of someone who dares to ignore risks. Strong trust can facilitate ongoing relationships between individuals, which means building a network. The intertwining of these three elements in a social system will suppress rent seekers, and opportunistic behavior, as well as free riders (Bakri, 2023). Strong social capital in the economic system certainly will reduce transaction costs (Pryanath & Jayathma, 2021), including the costs for negotiations, supervision, contract costs, mediation costs, and other costs that must be spent, but nothing produces any income at all. Reducing transaction costs, therefore, will reduce sunk costs, which in turn will increase the capital productivity of every economic activity (Puskarova, 2022) including the rural economy as in the agroforestry system (Bakri et al., 2021b).

The research questions, therefore, need to be revealed through this research: a) are the physical capital, especially land resources and social capital, still a productive asset for increasing the income of HKm members in the coffee agroforestry system?; b) are physical capital and social capital able to stimulates HKm members to participate in extension activities?; and c) can participation in extension be a leverage factor for physical capital and social capital to increase INC?

This research was intended to analyze: a) the direct effect of physical capital (PC), social capital (SC), and participation in extension (ROLE) on income enhancement (INC), and b) the direct effect of PC and SC on INC, as well as c) the indirect effect of ROLE performance as a mediating variable for PS and SC to enhance INC.

Methods

This research was conducted from April to June 2020 in the Batutegi Forest Management Unit (FMU) area, Lampung Province (Figure 1).

In line with the objectives of this study, a linear model postulate approach is employed, i.e., the structural equation modeling (SEM) algorithm at a 95% confidence level, to determine the direct effect of physical capital (PC) and social capital (SC) as well as the mediating effect of the extension activity variables (ROLE) on agroforestry coffee productivity. PC and SC variables were treated as exogenous variables, ROLE as intervening variables, and INC as endogenous variables. Two indicators for the PC variable were used as data proxies for land tenure inside (LND_1) and outside the forest (LND_2).

The SC variable was decomposed into elements of norms (NRM), trust (TRS), and network (NWK), each of which uses 2 indicators. The role of participation in extension activities (ROLE) about the subjects of forest protection (PRT_1), coffee agroforestry cultivation (PRT_2), and post-harvest (PRT_3) was applied as an indicator of the ROLE mediator variable. The indicators for HKm members' income are used as the earning source from coffee beans (AGF_1) and

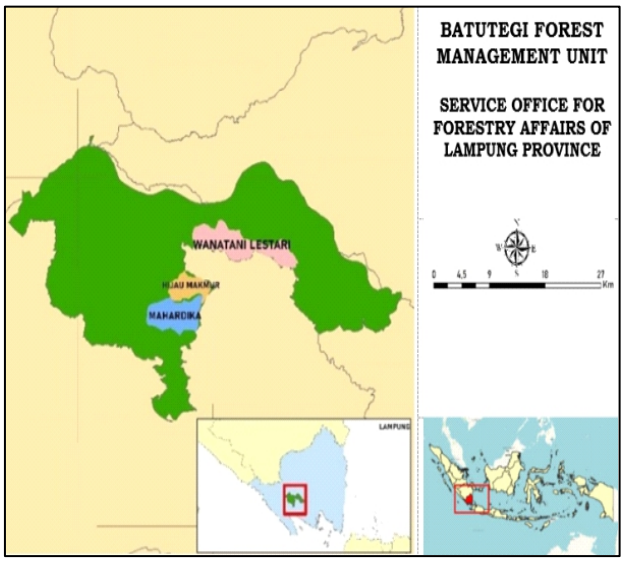

Figure 1 Research location.

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nontimber forest products or NTFP (AGF_2). The working hypotheses as an algorithm model are depicted in Figure 2.

Collecting data for all of these indicators was carried out through semi-structured interviews with 98 HKm holders who were taken using stratified random sampling. The instruments for capturing PC indicator data are presented in Table 1. In addition, Table 2, Table 3, and Table 4 are the SC indicator measuring instruments. Table 5 presents instruments for measuring indicators of ROLE. The instruments for measuring indicators of INC are presented in Table 6. In this case, it is assumed that the government policy of MoEF's Regulation Number 9/2021 (MoEF, 2021) will immediately be accompanied by a price stabilization policy in order to be resilence in the international coffee bean business. Table 1 and Table 6 are conversions for land holding and income indicators, respectively. All data are converted into an ordinal scale to make it convenient to interpret the SEM output. The evaluation of the measurement model was carried out using a composite reliability test (Cronbach's Alpha, Rho_A, and Rho_C) and test the validity of the instrument (using AVE criterion: Average variance extracted) following the advice of Hair et al. (2021) and Hair et al. (2019), respectively. Evaluation of the structural model is used by *t*-statistic (Hair et al., 2019) for each part of the 8 hypotheses tested.

Optimization of model parameters using Smart PLS-SEM for Student Version 4.0 was conducted in two steps. The first step is to obtain an algorithm model, which is also to select manifest or indicator variables that meet the criteria for use in the measurement model. The second is a bootstrapping step i.e., using 5,000 resamplings to obtain a robust SEM model.

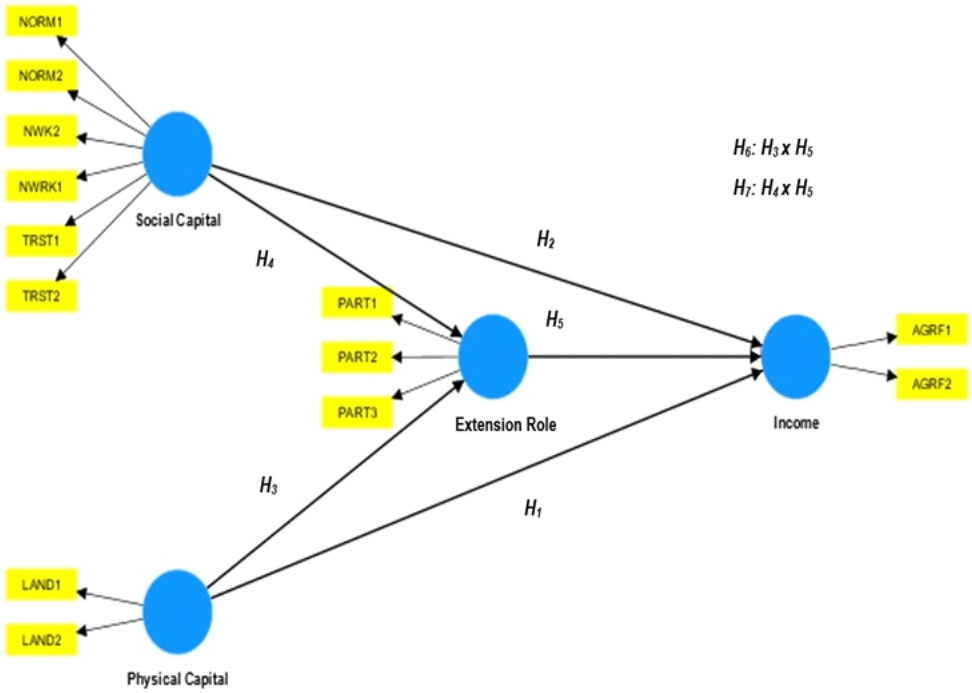

Figure 2 The working hypotheses.

Table 1 Scoring for land holding inside (LND_1) and outside (LND_2) forest area

Symbol	Landholding	Acreage (ha) [Score convertion]				
LND_1	Inside the state forest area	[1] <0.5	≤0.5 [2] <1.0	≤1.1 [3] <1.5	≤1.6 [4] <2.0	2.0≤ [5]
LND_2	Outside the state forest area	[1] <0.5	≤0.5 [2] <1.0	≤1.1 [3] <1.5	≤1.6 [4] <2.0	2.0≤ [5]

Table 2 Trust performance (TRS) measurement

Symbol	Trust measurement sentence	Please choose the score below:				
TRS_1	Your trust in your fellow HKm members	1	2	3	4	5
TRS_2	Your trust in FMU staff	1	2	3	4	5

Table 3 Network performance (NWK) measurement

Symbol	Network measurement sentence	Please choose the score below:				
NWK_1	I always keep in touch with fellow Hkm members on every important matters.	1	2	3	4	5
NWK_2	I always consult with Hkm officials on every important matter.	1	2	3	4	5

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Table 4 Norm performance (NRM)* measurement

Symbol	Sentence for the level norm measurement	Please choose the score below:				
$NORM_1$	I will help someone whose soul is threatened, even if his/her behavior is bad.	1	2	3	4	5
$NORM_2$	I am willing to sacrifice for someone who is truly in a tight spot, even though his/her behavior to me is bad	1	2	3	4	5

Note: * = after Vipriyanti (2007) and Bakri et al. (2021a)

Table 5 Role participation in extension activities (ROLE) measurement

Symbol	Sentence for a role in extension participation measurement	Please choose the score below:				
$PART_1$	Extension activities about forest protection is vital for farmers.	1	2	3	4	5
$PART_2$	Extension activities in coffee agroforestry cultivation is vital for the farmers.	1	2	3	4	5
$PART_3$	Extension activities about coffee post-harvesting is vital for farmers.	1	2	3	4	5

Table 6 Scoring the income (INC)

Symbol	Income source	Income in IDR million $year^{-1}$ [Score convertion]				
AGF_1	Coffee bean	[1] <6	≤6 [2] <7	≤7 [3] <8	≤8 [4] <9	[5] ≥9
AGF_2	Other NTFP	[1] <6	≤6 [2] <7	≤7 [3] <8	≤8 [4] <9	[5] ≥9

Results and Discussion

Measurement model evaluation The reliability and validity of the measured data are necessary conditions in any development of a quantitative model such as SEM. As a series of evaluations of this measurement model, it is necessary to examine the loading factor of each indicator used as a proxy for each latent variable applied in this study. For this purpose, Figure 3 depicts the output of the algorithm model obtained from PLS SEM output (Step 1).

As suggested by Hair (2021), the critical value for each indicator as a surrogate (proximate) of each latent variable is 0.700. However, for explanatory research purposes, this critical value is lower, namely 0.600 (Hair et al, 2019). Therefore, it is necessary to remove NRM_1 and NRM_2 from the structural modeling with output values of only 0.154 and 0.536, respectively (Figure 3). Thus for the SC latent variable, only the remaining four indicators are used as proxies. Meanwhile, all indicators for the latent variables PC, ROLE, and INC are retained in this modeling because they have a loading factor that exceeds their critical values (Figure 4). In more detail, the results of the reliability and validity tests of the measurement instruments are presented in Table 7.

By examining Table 7, it can be claimed that the measurement model for each indicator as the surrogate of four latent variables (PC, SC, ROLE, and INC) is reliable and valid. This claim for reliability is proven by the results of the composite reliability test which has exceeded the critical value for both Cronbach's Alpha, Rho_A, and Rho_C criteria. Likewise, the claim on the validity of the measurement results is proven by the value of the AVE (average variance extracted) test result. Based on the results of this measurement model test, any data collected from this study is feasible when applied to structural modeling inputs.

Evaluation of structural model: Hypotheses testing Before this evaluation is carried out, it is necessary to examine the results of the independence test on the multicollinearity of the data used as indicators for the four latent variables. This test needs to be carried out because SEM uses the postulates of a linear model which requires that multicollinearity does not occur among the data used as predictors. In other words, the indicator data must be independent of one another, which means that none of them affects the other. This requirement of being free from multicollinearity has also been fulfilled as shown by the following VIF test results (Table 8). Then bootstrapping is carried out to obtain a robust model (Step 2). This bootstrapping was carried out using a resampling of 5,000 units. The final SEM model is depicted in Figure 4. The results of the evaluation of the model structure in the context of hypothesis testing are presented in Table 9.

The results of the H_1 test prove that an increase in physical capital (PC) cannot be directly significant (p-value = 0.740) in increasing coffee agroforestry income (INC). This finding reflects the phenomenon of leveling off in land productivity, more allocation either LND_1 or LND_2, can not increase farmers' income (INC). This phenomenon also occurs in some developing countries such as Bangladesh (Quddus & Kropp, 2020). An important implication of this finding is that land extension for the coffee agroforestry allocation in the study area should be avoided, and even those in protected forest areas should be halted immediately instead of enhancing knowledge and skill of HKm holder with begin in agroforestry techniques at such fragile area then accompanied by developing entrepreneurial skill at least for the small group among them (Bakri et al., 2021b).

This implication is also augmented by the H_6 result (discussed below), which connotes that farmers who have

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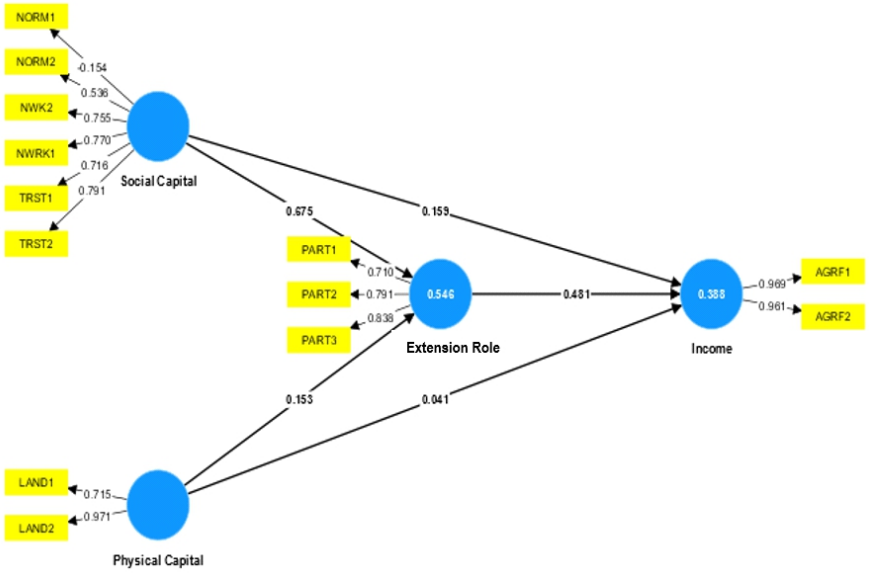

Figure 3 The output of the SEM algorithm (Step 1).

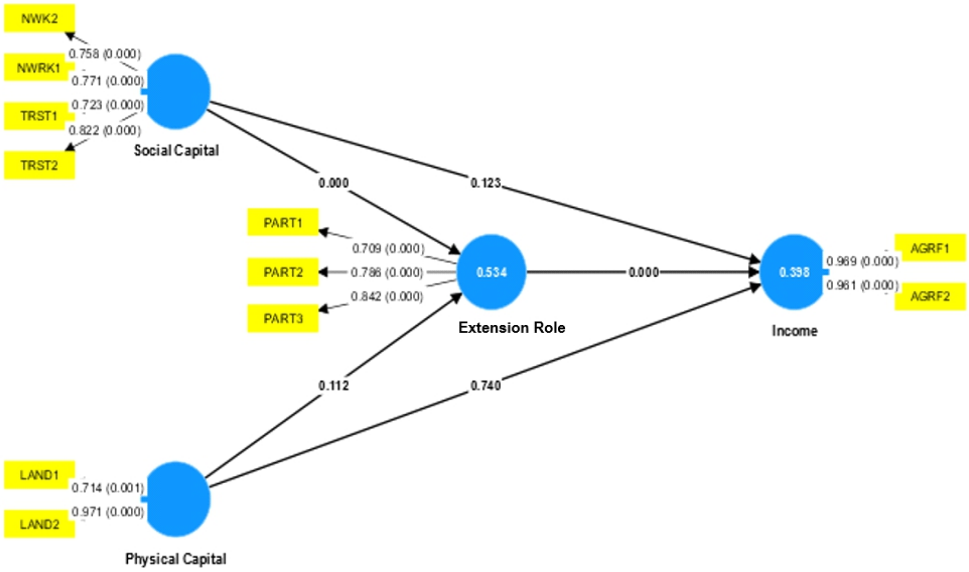

Figure 4 The final SEM model after bootstrapping uses 5,000 units of resampling.

Table 7 The composite reliability and average variance extracted

Latent variable	Cronbach's alpha	Rho_A	Rho_C	Average variance extracted (AVE)
	Critical value = 0.600[ρ]			Critical = 0.500[§]
Social capital (SC)	0.769	0.772	0.853	0.592
Physical capital (PC)	0.690	1.304	0.839	0.727
Extension role (ROLE)	0.685	0.717	0.823	0.610
Income (INC)	0.926	0.934	0.964	0.931

Note: [ρ] = after Hair et al. (2019); [§] = after Hair et al. (2021)

larger plots of land seem do not to have enough time to pursue knowledge and improve their skills through participation in extension activities, so they have no opportunity to pursue new knowledge or technology (Maris & Holmes, 2023) in daily cultivation. As a result, PC can not be amplified through the extension role (ROLE) which in turn cannot increase income (INC) as well. In terms of resource productivity theory, these findings are a loud alarm that there has been a phenomenon of decreasing returns to scale (Bakri, 2012; Bakri et al., 2014; Bakri et al., 2021a) in this study area. It

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implies that the addition of production factors (more land allocation) is no longer able to increase its productivity. If the land allotment is continued, it means that there will be a waste of resources, not only physical resources but also human, time, and financial resources as well.

These findings suggest FMU authorities must continue to increase the knowledge and skills of HKm concession holders through strengthening extension performance as a sufficient condition that needs to accompany stability policies selling price for coffee beans so that farmers' real income (INC) can be increased sustainably. These findings are also important as feedback for amending the policy on granting concession land in state forest areas. That the maximum area is 15 ha per household seems necessary to also take into account the physiographic conditions and land resource capabilities as well as the local climate type. Likewise, the maximum proportion of area to the total land area that can be allocated to HKm as a whole in each FMU is very important to be considered. These various local constraints cannot be ignored considering that the working capacity of HKm holders also faces conditions of decreasing returns to scale concerning knowledge and skills in working in protected forest areas that are biophysically fragile in areas such as this research location.

Aside from being a waste of resources, if the FMU authorities continue to expand land tenure (through the issuance of new HKm permits) it is also contrary to the HKm vision, which is to free protected forest land from occupation through the self-empowerment of each community so that natural succession will begin when the HKm concession ends (Wulandari et al., 2021). It would be wise to save all of these resources to be directed at increasing SC to improve community skills through enrolling in extension activities, to improve their skills in forest protection, agroforestry cultivation techniques, and post-harvest processing. Besides, land resource areas in the form of protected forests must function as fostering areas for human ecological zones (Maniraho et al., 2023) concentrated at lower elevation positions on the landscape, either in the form of erosion protection, recharging groundwater, as well as flood control. The return of the functions of all controls from this protected forest will further enhance the main function of the Batutegi dam for irrigation (Artika et al., 2022) which can drive the agricultural, industrial, and service sectors, which in turn can increase people's income and very useful tax revenues for subsidies for HKm holders who have to leave protected forest areas (Bakri, 2012; Bakri et al., 2014) when the HKm concession period ends. Furthermore, it is hoped that HKm holders who have succeeded in leaving the protected forest area voluntarily can survive working or doing business outside the forest area to live their lives with their descendants and not return to being forest encroachers anymore.

The results of the H_3 test also support the results of the H_1 test that physical capital ownership (LND) cannot encourage community interest in participation in extension activities (ROLE). This finding also reflects that the larger land tenure (LND) also takes up a lot of time and resources for HKm holders, who exhaustively exploit their land resources that have exceeded their production capacity or experiencing diminishing state (Quddus & Kropp, 2020). As mentioned before, farmers like this do not have many opportunities to increase participation in extension (ROLE), which means they cannot pursue their knowledge, capital, and skills so their INC can not increase significantly with an increase in the area of LND. This imagination is also strengthened by information about the quality of the land that dominates the study area.

Table 8 Inner VIF test

Indicator	Inner VIF
	Critical value = 5.000§
LND_1	1.383
LND_2	1.383
TRS_1	1.547
TRS_2	1.861
NWK_1	1.629
NWK_2	1.506
PRT_1	1.245
PRT_2	1.491
PRT_3	1.376
AGF_1	3.893
AGF_2	3.893

Note: § after Hair et al. (2019)

Table 9 The results of the structural model hypotheses test

Part hypotheses	Original sample (O)	Sample mean (M)	Standard deviation (sd)	t-statistic (|O/sd|)	*p*-value	Decision
[a] Direct Effect						
H_1: PC→INC	0.034	0.038	0.104	0.331	0.740	Rejected
H_2: SC→INC	0.192	0.189	0.124	1.545	0.123	Rejected
H_3: PC→ROLE	0.144	0.153	0.091	1.589	0.112	Rejected
H_4: SC→ROLE	0.670	0.675	0.072	9.240	0.000	Accepted
H_5: ROLE→INC	0.464	0.467	0.115	4.019	0.000	Accepted
[b] Indirect Effect						
H_6:PC→ROLE→INC	0.067	0.074	0.051	1.316	0.188	Rejected
H_7:SC→ROLE→INC	0.311	0.313	0.080	3.870	0.000	Accepted

Note: = affects

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As has been described in detail by Dai et al (1989) the study area is mainly formed of marginal land that has been undergoing an advanced weathering of soil types with very low fertility besides commonly laying on steep topography in the landscape. Under heavy annual rainfall, i.e. around 3,000 mm year^{-1} (Bakri et al., 2018), land degradation due to increased erosion rates on these marginal lands takes place fast, especially when the vegetation cover is depleted because it has been converted to semi-intensive agricultural cultivation such as this coffee agroforestry. Even since the first transmigration in 1905 under Dutch Colonization this area had been cultivated by people moving from Java Island (Nurhaida et al., 2011; Wulandari et al., 2021). This is why the local authorities should use up the SC to increase HKm participation in extension (ROLE), especially for those who already have a large enough land holding. Increasing the performance of ROLE, is expected to augment their knowledge and skills in preventing forest land from further degradation. In turn, this will increase INC as proved by Bakri et al. (2021a) at Gedongwani FMU. The increment INC is a necessary prerequisite for the self-empowering process to take place voluntarily that will stimulate HKm members to leave their land, no later than the next 20 years when their concessionary time will be due.

The result of the H_4 test is very convincing that SC can significantly increase the performance of participation in extension participation (ROLE). If the SC performance increases by one unit, it will significantly increase the interest of HKm members to participate in the extension by 0.670 units (p-value = 0.000). This means that the strength of SC can encourage the HKm members' curiosity in pursuing knowledge (Dewantoro & Ellitan, 2022) through participation in extension activities (ROLE). It differs from PC, the use and maintenance of SC does not require a lot of physical exertion but is merely based on the convenience of trust to make relations by networking among the HKm members. Networking, in turn, can strengthen trust by facilitating various kinds of transactions without requiring many forms of guarantees, which means saving on various transaction costs and then increasing the productivity of every economic activity (Pryanath and Jayathma, 2021) as also in the coffee agroforestry system. In line with the acceptance of H_5, based on the study conducted at Gedongwani FMU in South Lampung, Bakri et al. (2021a) reported that SC significantly enhanced increase the income of agroforestry farming families who produce food crops under timber stands.

While H_2 is rejected, the result of the H_5 test is conclusively accepted, when ROLE increases by one unit, it will be accompanied by INC around 0.464 units (p-value = 0.000). These two findings (rejecting H_2 and accepting H_5) provide evidence that the power of SC in the study area is effective as a production factor when SC is used to implement ROLE performance improvement. If not, then SC will be like a group of unproductive individuals, not as an order that can regulate relations between individuals to carry out collective action (Zhou et al., 2023; Qurniati et al., 2017) which is very much needed in the rural economic system as the agroforestry system. These findings provide a signal that local authorities need to continue to facilitate the promotion of ROLE activities in the areas of forest protection, agroforestry cultivation techniques, and post-harvest skills improvement. This finding also confirms that HKm concession holders need fostering through facilitation or extension to enhance productivity, solve some other problems, and more importantly improve welfare as reported by Wulandari and Kurniasih (2019) and Kaskoyo et al. (2017). In connection with this phenomenon, it is necessary to examine further the ability of the ROLE (mediating variable) which should be a leverage factor for PC and SC in increasing the productivity and INC of HKm holders in this study area.

The main motivation in testing the ROLE variable is to evaluate whether this latent variable can still be used as a mediator in PC and SC leverage efforts when they are experiencing a level-off in increasing INC. In contrast to the phenomenon in Java Island, for example as reported by Stewart et al. (2021), namely the motives for increasing the INC of small forest actors are generally controlled by prices based on the quality of the products, both wood and NTFP. In this research area, the ROLE effect still really controls the motive for increasing INC, especially through strengthening SC that has accumulated among the villagers. The differences in types of incentives seem to be largely influenced by the level of access and exposure to various types of information, which in Java is much higher so that small forest actors without relying much on the performance of their extension services are generally able to handle agroforestry techniques, which means they can focus more on price as an incentive. Whereas HKm holders in the study area of Batutegi FMU are still much more dependent on the extension performance (Bakri et al., 2021b), particularly for leveraging their SC for the sake of increasing INC. This argument is also reflected by the strong values of $NWRK_1$ and $NWRK_2$ as indicators of SC (Figure 3).

In this way, the indirect effect of ROLE can be accounted for in mediating PC and SC. In this context, the rejection on H_6 connotes that the ROLE variable has not been able to become a leverage factor for PC to boost productivity or income (INC). This finding is in line with the results of research by Bakri et al. (2021a) in the Gedongwani FMU area which has an old volcanic plain topography with rainfall of around 2,500 mm per year with an agroforestry crop pattern of lower strata in the form of a food crop. Likewise to what was reported by Wulandari et al. (2021) at the Way Kanan FMU. The phenomenon of leveling off in land resources further strengthens that physical capital, especially land resources (LND) has experienced a decreasing return to scale, which means that the increase in acreage does not affect land productivity as expressed by INC (p-value = 0.188). This means that even though SC cannot directly increase community productivity, it can still be excited through the ROLE mediator variable. Even though participation in extension activities (ROLE) proved unable to boost PC to increase land productivity (H_7) as reflected by their INC, fortunately, the ROLE is still very strong in leveraging SC. As evidenced by the results of the H_7 test, every increase of SC one unit results in an increase in INC of around 0.331 (p-value = 0.000).

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Conclusion

The results suggest: a) the direct effect of social capital (SC) cannot increase income (INC) but can encourage participation to increase knowledge (ROLE) which in the end can increase INC significantly, b) on the other hand, the direct effect of physical capital (PC) cannot increase ROLE or INC, and c) the indirect effect of ROLE mediation on PC is still slow but very significant for SC in increasing income. The implication of these findings: to ensure that HKm land concession holders can leave protected forest areas voluntarily when their concession rights have expired, FMU authorities must continue to increase the knowledge and skills of HKm concession holders through strengthening extension performance as a sufficient condition that needs to accompany stability policies selling price of coffee beans so that farmers' real income (INC) can be increased sustainably. These findings are also important as feedback for amending the policy on granting concession land in protected forest areas. That the maximum area is 15 ha per household seems necessary to take into account the physiographic conditions and land resource capabilities as well as the local climate type. Likewise, the maximum proportion of area to the total land area that can be allocated to HKm as a whole in each FMU is very important to be considered. These various local constraints cannot be ignored considering that the working capacity of HKm holders also faces conditions of decreasing returns to scale about knowledge and skills in working in protected forest areas that are biophysically fragile in areas such as this research.

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References

Affandi, M. I. (2009). Peran agroindustri dalam perekonomian wilayah Provinsi Lampung: Analisis keterkaitan antarsektor dan aglomerasi industri [dissertation]. Bogor: IPB University.

Artika, E., Yuwono, S. B., Banuwa, I. S., Setiawan, A., Bakri, S., & Wahono, E. P. (2022). The effect of land cover forest on fluctuations in the availability of water in the Batutegi Dam, Lampung, Indonesia. *IOP Conference Series: Earth and Environmental Science*, *1027*, 012006. https://doi.org/10.1088/1755-1315/1027/1/012006

Bakri, S. (2012). Fungsi intrinsik hutan dan faktor endogenic pertumbuhan ekonomi sebagai determinan pembangunan wilayah di Provinsi Lampung [dissertation]. Bogor: IPB University.

Bakri, S. (2023). *Kelembagaan lingkungan.* Tangerang Selatan: Open University Press.

Bakri, S., Darusman, D., Juwanda, B., & Bahruni. (2014). Pengembangan wilayah di bawah kendala sumberdaya. *Jurnal Sosio Ekonomika*, *18* (2), 161–170.

Bakri, S., Wulandari, C., Kurniasari, N., Safe'i, R., Ramdani, D., Anshory. (2023a). Effects of characteristics and perceptions of collectors of non-timber forest products to be members of the partnership program: A case study at Bukit Barisan Selatan National Park, Indonesia. *Jurnal Manajemen Hutan Tropika*, 9(2), 109–118. https://doi.org/107226/jtfm.29.2.109

Bakri, S., Sitorus, V., Kurniawan, B., Kuniawaty, E., Dewi, B. S., & Kaskoyo, H. (2023b). How much is the cost to reduce the incidence rate of infectious diseases through reforestation? (Case study on pulmonary tuberculosis under global warming scenario). *Polish Journal of Environmental Studies*, *32*(2), 1519–1529. https://doi.org/10.15244/pjoes/157212

Bakri, S., Qurniaty, Safe'i, R., & Hilmanto, R. (2021a). Social capital in its relation to the income of agroforestry community: Studi at Karang Rejo Village, Jati Agung District of South Lampung Regency. *Jurnal Hutan Tropis*, *9*(1), 191–203.

Bakri, S., Karomani, K., & Ashaf, A. F. (2021b). The role of extension participation on risk-taking behavior of local elites and the coffee agroforestry farmer's income: A case study at social forest community on Batutegi Forest Management Unit, Lampung Province. *IOP Conference Series: Earth and Environmental Science, 739*, 012006. https://doi.org/10.1088/1755-1315/739/1/012006

Bakri, S., Setiawan, A., & Nurhaida, I. (2018). Coffee bean physical quality: The effect of climate change adaptation behavior of shifting up cultivation area to a higher elevation. *Biodiversitas*, *19*(2), 413420. https://doi.org/10.13057/biodiv/d190208

Claridge, T. (2019). Current definition of social capital. *Academic Definition in 2019.* Retrieved from https://www.socialcapital.research.com/current-definition-of-social-capital/

Cervellati, M., Meyerheim, G., & Sunde, U. (2023). The empirics of economic growth over time and across nations: A unified growth perspective. *Journal of Economic Growth*, *28*, 173–224. https://doi.org/10.1007/s10887-022-09216-2

Coleman, J. S. (1988). Social capital in the creation of human capital. *The American Journal of Sociology*, *94*(12), 951–20.

Dai, J., Darul, S. W. P., Hidayat, A., Sumulyadi, H. Y., Hendra, S., Yayat, A. H., Herman, A., Hermawsan, A., Burman, P., & Balsem, T. (1989). *Expalnatory booklet of the land unit and soil map of Kotaagung Sheet, Sumatera.* Bogor: Centre for Soil Research, Agency for Agricultural Research and Development, Department of Agriculture.

Dewantoro, A. D., & Ellitan, L. (2022). The role of social capital and knowledge creation in improving

organizational performance. *International Journal of Trend in Research and Development*, *5*(4), 5358.

Global Forest Watch. (2023). *Tree cover 20012022.* Retrieved from https://www.globalforestwatch.org/map.

Hair, J. F., Tomas, G. M. H., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). *Partial least squares structural equation modeling* (*PLS-SEM*) *using R.*: *Workbook.* Springer. https://doi.org/10.1007/978-3-030-80519-7

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 224. https://doi.org/10.1108/EBR-11-2018-0203

Han, S., Graceoh, E., & Kang, P. (2022). Social capital leveraging knowledge-sharing ties and learning performance in higher education: Evidence from social network analysis in an engineering classroom. *AERA, American Education Research Association*, *8*(1), 1–15. https://doi.org/10.1177/23328584221086665

Harjanti, D. & Halim, A. D. (2022). The role of social capital in building knowledge sharing and innovative work behavior in holding company. *Jurnal Bisnis dan Akuntansi*, *2*(4), 271–282. https://doi.org/10.34208/jba.v24i2.1577

Kaskoyo, H., Mohammed, A. J., & Inoue, M. (2014). Present state of community forestry (Hutan kemasyarakatan/HKm) program in a protection forest and its challenges: Case study in Lampung Province, Indonesia. *Journal of Forest and Environmental Science*, *30*(1), 15–29. https://doi.org/10.7747/JFS.2014.30.1.15

Kaskoyo, H., Mohammed, A., & Inoue, M. (2017). Impact of community forest program in protection forest on livelihood outcomes: A case study of Lampung Province, Indonesia. *Journal of Sustainable Forestry*, *36*(3), 250–263. https://doi.org/10.1080/10549811.2017.1296774

Lechthaler, W., & Tesfaselassie, M. (2022). Endogenous growth, skill obsolescence and output hysteresis in a new Keynesian model with unemployment. *Journal of Money, Credit and Banking*, *55*(8), 2187–2213. https://doi.org/10.1111/jmcb.12979

Leunufna, H. M, Wattimena, C. M. A., & Sahureka, M. (2023). Pola tanam agroforestry Dusung di Negeri Leahari Kecamatan Leitimur Selatanan Kota Ambon. *AE Innovation Journal*, *1*(2), 139–149.

Ma, T. N. R., Kaho, L. M. R., & Mau, A. E. (2023). Kontribusi program hutan kemasyarakatan terhadap pendapatan masyarakat (Studi kasus kelompok HKm Jita Sambi, Desa Tendambonggi, Kecamatan Ende, Kabupaten Ende). *Jurnal Wana Lestari*, *5*(1), 146–154.

Maniraho, L., Frietsch, M., Sieber, S., & Löhr, K. (2023). A framework for drivers fostering social-ecological restoration within forest landscape based on people's participation: A systematic literature review. *Discover Sustainability*, *4*(26), 1–13. https://doi.org/10.1007/s43621-023-00141-x

Maris, R., & Holmes, M. (2023). Perspective economic growth theory and natural resource constraints: A stocktake and critical assessment. *The Australian Economic Review*, *56*(2), 255–268. https://doi.org/10.1111/1467-8462.12505

[MoEF] Ministry of Environment and Forestry. (2021). Peraturan Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia Nomor 9 Tahun 2021 tentang Pengelolaan Perhutanan Sosial. Retrieved from https://peraturan.bpk.go.id/Details/235324/permen-lhk-no-9-tahun-2021

[MoEF] Ministry of Environment and Forestry. (2023a). Dari perhutanan sosial. *Siaran Pers* Nomor: SP.441/HUMAS/PPIP/HMS.3/12/2023. Retrieved from https://ppid.menlhk.go.id/berita/siaran-pers/7566/dari-perhutanan-sosial-untuk-hutan-lestari-dan-masyarakat-sejahtera

[MoEF] Ministry of Environment and Forestry. (2023b). *Laporan keuangan audited 2021.* Jakarta: Kementerian Lingkungan Hidup dan Kehutanan. Retrieved from https://www.menlhk.go.id/work-plan/?category=laporan-keuangan

Muthmainnah, H., Sribianti, I., Abdullah, A. Z., & Ramadhan, M. N. (2022). Kontribusi hutan kemasyarakatan (HKM) terhadap pendapatan kelompok tani hutan (KTH) di Desa Gunung Silanu Kabupaten Jeneponto. *Jurnal Kehutanan Papuasia*, *8*(1), 79–86. https://doi.org/10.46703/jurnalpapuasia.Vol8.Iss1.292.

Nurhaida, I., Setiawan, A., Bakri, S., Wiranta, G. A. B., & Syah, P. (2011). Development of fable comics as communication media and environmental education supplements to support the Way Kambas National Park biodiversity conservation campaign. *Bumi Lestari Journal of Environment*, *11*(2), 2527–6158.

Pryanath, H. M. S., & Jayathma, H. W. T. (2021). The effect of social capital on transaction cost and livelihood success of sanasa beneficiaries: A case of Badulla District in Sri Lanka. *Samodhana Journal*, *10*(1), 5276.

Puskarova, P. (2022). Trust or bust: Growth effects of knowledge, human and social capital revisited. *Economic Systems*, *46*, 101036. https://doi.org/10.1016/j.ecosys.2022.101036

Quddus, A., & Kropp, J. D. (2020). Constraints to agricultural production and marketing in the lagging regions of Bangladesh. *Sustainability*, *12*(10), 3956. https://doi.org/10.3390/su12103956

Qurniati, R., Febryano, I. G., & Zulfiani, D. (2017). How trust

influence social capital to support collective action in agroforestry development? *Biodiversitas*, *18*(3), 1201–1206. https://doi.org/10.13057/biodiv/d180344

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economics*, *98*, S71–S102.

Syahputra, A. M., Bakri, S., & Qurniati, R. (2022). Pengaruh tutupan hutan dan lahan terhadap sektor pertanian dalam perekonomian pendapatan daerah: Studi di Provinsi Lampung. *Ulin*: *Jurnal Hutan Tropis*, *6*(1), https://doi.org/10.32522/ujht.v6i1.6088

Susilo, Y. S., & Nairobi, N. (2019). Dampak perhutanan sosial pada pendapatan masyarakat. *ISEI Economic Review*, *3*(1), 1627.

Stewart, H. L., Race, D. H., Rohadi, D., & Schmidt, D. M. (2021). Growth and profitability of smallholder sengon and teak plantations in the Pati District, Indonesia. *Forest Policy and Economics*, *130*, 102539. https://doi.org/ 10.1016/j.forpol.2021.102539

Vipriyanti, N. U. (2007). Studi sosial ekonomi tentang keterkaitan antara modal sosial dan pembangunan ekonomi wilayah: Studi kasus di empat kabupaten di Provinsi Bali [dissertation]. Bogor: IPB University.

Wah, C. Y., Menkhoff, T., Benjamin Loh, B., & Evers, H. (2007). Social capital and knowledge sharing in knowledge-based organizations: An empirical study, *International Journal of Knowledge Management*, 3(1), 29–48.

World Bank. (2023). *Pathways towards economic security Indonesia poverty assessment.* Washington DC: The World Bank.

Wulandari, C., & Kurniasih, H. (2019). Community preferences for social forestry facilitation programming in Lampung, Indonesia. *Forest and Society*, *3*(1), 114–132. https://doi.org/10.24259/fs.v3i1.6026

Wulandari, C., Bakri, S., Riniarti, M., & Putra, H. J. (2022). The level of encroachers's acceptance on community forest development plan: Study at Selagai Linggai Forest Management Unity Regency Central Lampung-Indonesia. *Jurnal Hutan Tropis*, *10*(2), 114–123.

Wulandari, C., Bakri, S. Riniarti, M., & Supriadi. (2021). Fostering the sustainability of community forestry program: Case study in Lampung-Sumatra. *Forestry Ideas*, *27*(1), 210–232.

Yusuf, M., Septiadi, D., Nursan, M., & Fadli. (2023). Analisis ekonomi dan tingkat kesejahtraan rumah tangga petani peserta program hutan kemasyarakatan (HKm) di Kecamatan Sambalia, Kabupaten Lombok Timur NTB. *Jurnal Ganec Swara*, *17*(2), 401–411.

Zhou, L., de Vries, W. T., Panman, A., Gao, F., & Fang, C. (2023). Evaluating collective action for effective land policy reform in developing country contexts: The construction and validation of dimensions and indicators. *Land*, *12*(7), 1401. https://doi.org/10.3390/ land1207 1401