Improving Economic Welfare through Capital Development: Case Study of Smallholder Dairy Farmers in Pujon District

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Article

Improving Economic Welfare through Capital Development: Case Study of Smallholder Dairy Farmers in Pujon District

Nanang Dwi Wahyono [1,*] , Niswatin Hasanah [2] , Rita Parmawati [3,4] and Wing-Keung Wong [5,6,7]

1   Department of Agribusiness Management, State Polytechnic of Jember, Jember 68121, Indonesia
2   Department of Animal Science, State Polytechnic of Jember, Jember 68121, Indonesia; niswatin_hasanah@polije.ac.id
3   Postgraduate School, Brawijaya University, Malang 65145, Indonesia; rita_parmawati@ub.ac.id
4   Department of Socio-Economics, Faculty of Agriculture, Brawijaya University, Malang 65145, Indonesia
5   Department of Finance, Fintech & Blockchain Research Center, Big Data Research Center, Asia University, Taichung City 41354, Taiwan; wong@asia.edu.tw
6   Department of Medical Research, China Medical University Hospital, Taichung City 40447, Taiwan
7   Department of Economics and Finance, The Hang Seng University of Hong Kong, Hong Kong, China
*   Correspondence: nanang_d_wahyono@polije.ac.id

Abstract: Developing the economic welfare of smallholder dairy farmers is an important strategy for achieving the Sustainable Development Goals (SDGs) in regions such as Pujon District, a major dairy producer in the Malang Regency. Enhancing the economic stability of these farmers contributes to community welfare and promotes aspects of the SDGs such as "Good Health and Well-Being" and "No Poverty". This study delves into the relationships among five types of capital—human, social, natural, physical, and financial—and their influence on the welfare of dairy farmers in Pujon District. A questionnaire was distributed to 110 respondents in January and February 2022 for the purpose of this research. After the data were collected, Smart-PLS was used to analyze the structural-equation model (SEM). According to the findings, these five types of capital have a significant and positive impact on the welfare of farmers. As a result, these five capitals provide a tangible framework for enhancing and measuring farmer welfare in Pujon District, thus providing a strategic path for optimizing community resources to boost economic welfare and contribute to the Sustainable Development Goals. The study findings provide valuable insights into the strategies that can be adopted to promote sustainable agriculture and enhance the well-being of farmers in Pujon District.

Keywords: economic welfare; capital; smallholder dairy farmers; Sustainable Development Goals (SDGs); Pujon District; Indonesia

1. Introduction

Indonesia has a population of over 270 million people, making it the fourth most populous country in the world [1]. Agriculture contributes approximately 14% to the country's GDP and employs almost 35% of its workforce [2]. Livestock is an important component of the agricultural sector, providing employment and income to millions of people. In addition to dairy farming, Indonesia's livestock industry also includes poultry, beef, and goat farming [3]. The Indonesian agricultural industry faces a number of challenges, including low productivity, inadequate infrastructure, and limited access to markets, despite its vast potential [4]. Due to this, sustainable and innovative approaches are required to ensure that the country's agricultural sector can meet the needs of its growing population and contribute to national economic development.

The livestock sector impacts household economies in highland areas [5]. In Indonesia, livestock is one part of a small-scale integrated farming system that plays a significant role in meeting the economic needs of households [6,7]. Pujon District, Malang Regency, Indonesia, is the center of the dairy-farming business, and its household economies depend

on livestock [8]. The region has ideal geographic conditions for dairy-cow milk production, and dairy-cattle-based economic activity is a way of life in rural areas that has been passed down from generation to generation [9]. The Friesian Holstein (FH) breed is the most widely bred among dairy cattle, and the FH crossbred cattle can be optimally produced in the highlands, which have low temperatures [10]. The milk from dairy cattle includes numerous critical elements that people can use as sources of energy, vitamins, minerals, and protein [11], which has increased the demand for cow's milk in Asia over the last 30 years [12,13].

According to Panjaitan (2023), although the domestic cow-milk output has increased by only 2% per year, milk consumption has climbed by 5% per year, and domestic fresh-milk production in Indonesia only meets about 18% of the demand [14]. As a result, Indonesia still needs to import skim milk, buttermilk powder, and other forms of dairy products. Budiraharjo et al. (2021) stated that the GDP per capita, total milk exports, and domestic milk production are all factors that could increase the milk import in Indonesia, whereas the IDR exchange rate could decrease them [15].

The potential regional conditions are favorable for the development of the dairy-farming industry in Pujon District, and they must be harnessed to overcome significant problems, such as the low selling price of dairy milk from smallholder farmers [16,17] and a potential threat to milk producers because of a policy of exemption from import duty for imported dairy products based on [18]. These problems have considerable potential to reduce the economic welfare of farmers in the Pujon District.

The economic welfare of smallholder dairy farmers is a part of community welfare; thus, it encourages the Sustainable Development Goals (SDGs) of "Good Health and Well-Being" [19] and "No Poverty" [20] in Pujon District. The opportunity to realize the Sustainable Development Goals can be obtained from existing capital in the community [21]. In this case, there is a need for an appropriate management and development strategy for each existing capital, so an approach through the concept of the Sustainable Livelihood Framework (SLF) is appropriate [22,23].

The Sustainable Livelihood Framework (SLF) is an analytical framework that researchers use to understand the various factors that can influence subsistence choices and examine how these factors interact. It covers the skills, materials, social assets, and approaches individuals and communities use to survive, and provides an accurate picture and a comprehensive portrait of the reality of community livelihoods [24]. The capitals in the SLF include human, social, natural, physical, and financial components. These five capitals are livelihood elements that are interrelated and have a direct effect on households [25], and each component of these capital has a significant potential to generate various benefits and increase opportunities for a better livelihood [26].

This study aimed to examine the links among the human, social, natural, physical, and financial capitals, as well as their impacts on the welfare of the dairy producers in Pujon District. The study sought to identify ways to enhance the welfare of smallholder dairy farmers and promote sustainable development in the region. By analyzing the different types of capital and how they interact, the study aims to provide insights that can inform policy decisions and promote sustainable growth in the dairy-farming industry.

2. Materials and Methods

2.1. Research Location

We conducted this research in Pujon District, Malang Regency, Indonesia (Figure 1). This subdistrict has an area of 130.75 km^2 (4.39% of the Malang Regency area), with a hilly and highland topography, and it is dominated by horticultural- and livestock-farming activities. The total population has reached 62,402, of which 51% are male and 49% are female. Pujon District has an advantage in the dairy-farming sector, with a dairy-cattle population in 2019 of 20,670 that were classified as productive dairy cattle, and on the average, each dairy farmer has 5 to 25 dairy cattle. With that number of dairy cattle,

122 tons of dairy milk can be produced each day with a traditional tool, and on top of that, all of the produced dairy milk is managed by the local Pujon cooperative.
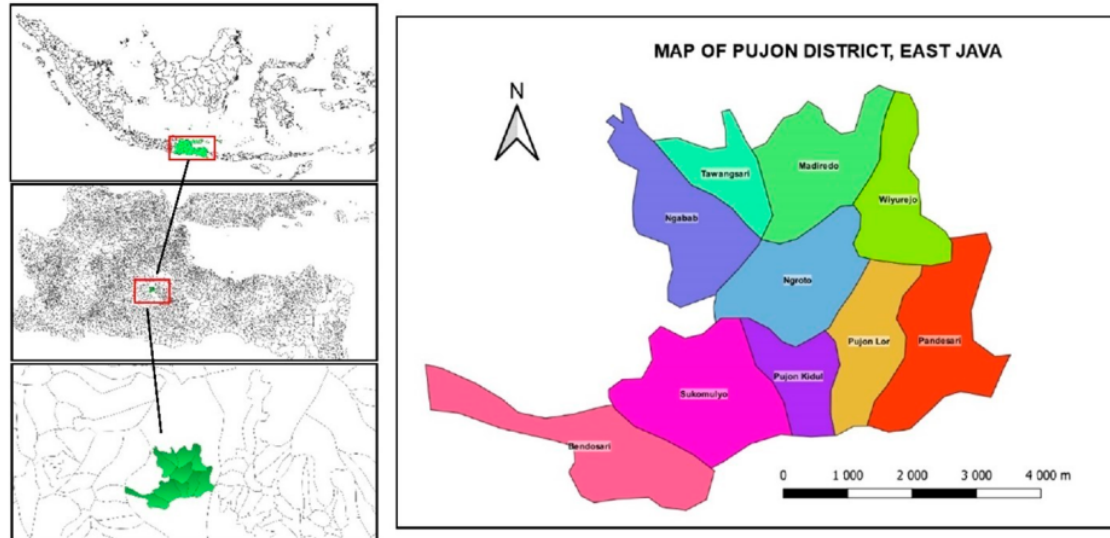

Figure 1. Map of Pujon District in East Java.

2.2. Research Design

In this research, we aimed to examine the links among the human, social, natural, physical, and financial capitals, as well as their impacts on the economic welfare of the dairy farmers in Pujon District. This study used SEM analysis to explain the relationship between the five capitals (human, social, natural, physical, and financial) and the farmers' economic welfare. The construct observed was economic welfare, and we assessed it using the following indicators: age, education, income, and number of family members [27,28]. For the descriptive statistical analysis, this study used structural-equation modeling (SEM) to organize and test the hypothetical relationships among the theoretical constructs and the relationships between the constructs [29].

2.3. Data Source

2.3.1. Sample of Population

In order to investigate the links among the different capitals and their impact on the welfare of dairy producers in Pujon District, we conducted a survey of smallholder farmers in the area. The research sample included 110 respondents, based on the Slovin formula calculation [30], which we chose because the number of farmers in Pujon District was ±8000 (based on Pujon local cooperative data in 2021). The Slovin formula is as follows:

$$n = \frac{N}{(1 + Ne^2)} \tag{1}$$

where N is the population, which is ±8000 milk farmers in Pujon District; n is the minimum sample quantity, which is 99; and e is the error, which is equal to 10%. By using the Slovin formula, we were able to determine an appropriate sample size that would allow us to obtain statistically significant results while keeping the survey manageable and cost-effective.

2.3.2. Questionnaire

To ensure comprehensive data collection, the distributed questionnaire covered a wide range of topics related to the five capitals of sustainability: human, social, natural, physical, and financial [31]. For each capital, the questionnaire included a series of specific attributes that the researchers later used as material for the analysis. To provide a clear overview of the questionnaire structure, we present the five capitals based on a previous study that improved on this research, and the corresponding attributes are listed in Table 1 [31]. By gathering data on each of these capital attributes, we aimed to gain a more complete understanding of the factors that impact the welfare of dairy farmers in Pujon District and identify potential areas for improvement.

Table 1. Capitals and attributes in questionnaire.

Capital		Attribute
Human	1.	Experience
	2.	Participation in training
	3.	Diseases that have been contracted in the last year
	4.	Family members who help with the farm
	5.	The presence of workers in running a dairy-farming business
Social	1.	Active in farmer associations
	2.	Participation in the dairy-cattle business
	3.	Willingness to help neighbors
	4.	Willingness to help group members
	5.	Willingness to help family
	6.	Willingness of neighbors to help
	7.	Willingness of group members to help
	8.	Willingness of family to help
	9.	The existence of cooperatives to help
	10.	Frequency of conflicts with government agencies
Natural	1.	Use of local green fodder
	2.	Green land ownership
	3.	Use of water sources
	4.	Availability of water sources
	5.	Dairy-cow milk production in the last year
	6.	Intensity of dairy-cow milk
	7.	Use of cow dung as fertilizer
	8.	Number of dairy cows owned
Financial	1.	Ownership of savings in a bank/cooperative
	2.	Debt ownership in banks/cooperatives/individuals
	3.	Form of savings
	4.	Family economic conditions
	5.	Presence of extra money
Physical	1.	Chopper ownership
	2.	Ownership of milk carrier
	3.	Ownership of cattle pens
	4.	Home ownership

2.4. Analysis

To further elaborate on the methodology used, SEM analysis allowed the researchers to create a comprehensive model that considered the interrelationships between the five different types of capital and their impact on the economic welfare of dairy-cattle farmers [31]. Smart-PLS was chosen as the analytical tool due to the relatively small sample size and the need for both inner and outer models [24]. Additionally, by examining indicators such as

age, education, number of family members, and individuals' income, the researchers were able to gain a more nuanced understanding of the factors influencing economic welfare in the context of Pujon District [27]. The overall hypothesis assumed that there would be a positive and significant relationship between the five different types of capital and the economic welfare of dairy farmers in the area.

3. Results and Discussion

The demographic data collected in this research—age, education, number of family members, and monthly income—played a crucial role in our analysis. These demographic factors provide invaluable context, as they often intersect with and influence economic welfare. For example, age and income levels can shed light on the economic stability and spending capacity of these farming households [32–37]. Likewise, education level may affect farming techniques and productivity [38–40], whereas the number of family members can impact labor availability and income distribution [41,42]. Thus, a thorough understanding of these demographic data are essential to fully grasp the multifaceted dynamics of farmer welfare in the Pujon District. We present these demographic data in Figure 2, offering a comprehensive snapshot of the community's demographic landscape and its potential implications for our study.

The study collected data on the demographic characteristics of the respondents. According to the age distribution (Figure 2a), most respondents were aged between 25 and 54 years old, with 27.3% of respondents falling into the 45–54-year-old age group. The productive age range for breeders in Pujon District was found to be between 25 and 45 years old, indicating that the labor force is dominated by this age group. Age has been found to have a positive effect on agricultural efficiency up to a certain point, based on prior research [32–34]. Additionally, older individuals may pay more attention to the condition of natural resources, including the conservation of raw materials, and age can also impact the welfare of breeders under certain conditions [35–37]. Even a weak association between age and well-being has been observed.

In terms of education level (Figure 2b), most respondents had only completed elementary school (54.6%), followed by junior high school (24.6%), senior high school (7.3%), and a bachelor's degree (12.7%). Education level is associated with employment efficiency in livestock and agriculture and the opportunity to transition to more sustainable agricultural practices [38,39]. Despite most respondents having only completed elementary school, there is potential for further education to increase work effectiveness and encourage sustainable practices, as noted in previous research [40].

The number of family members was also collected (Figure 2c), with most respondents having 3 family members (38 families), followed by 30 families with 4 family members and 20 families with 5 family members. The number of family members can have a detrimental impact on household food security. However, based on prior research, close family relationships between family members can allow farmers to increase efficiency in decision-making and seize existing development opportunities [41,42].

The study also collected data on the adult income level (monthly) of the respondents (Figure 2d). The income range was between IDR 1,100,000 and IDR 3,000,000 for most respondents (61%), whereas 19% of respondents had an income above IDR 4,000,000 and 20% had an income below IDR 1,100,000. All respondents had jobs related to dairy-cattle farming, such as smallholder farmers, dairy farmers, laborers, and cattle traders. Income affects the welfare of farmers [43] because it increases the economy of the agriculture sector, which in turn increases opportunities for welfare [44–46].
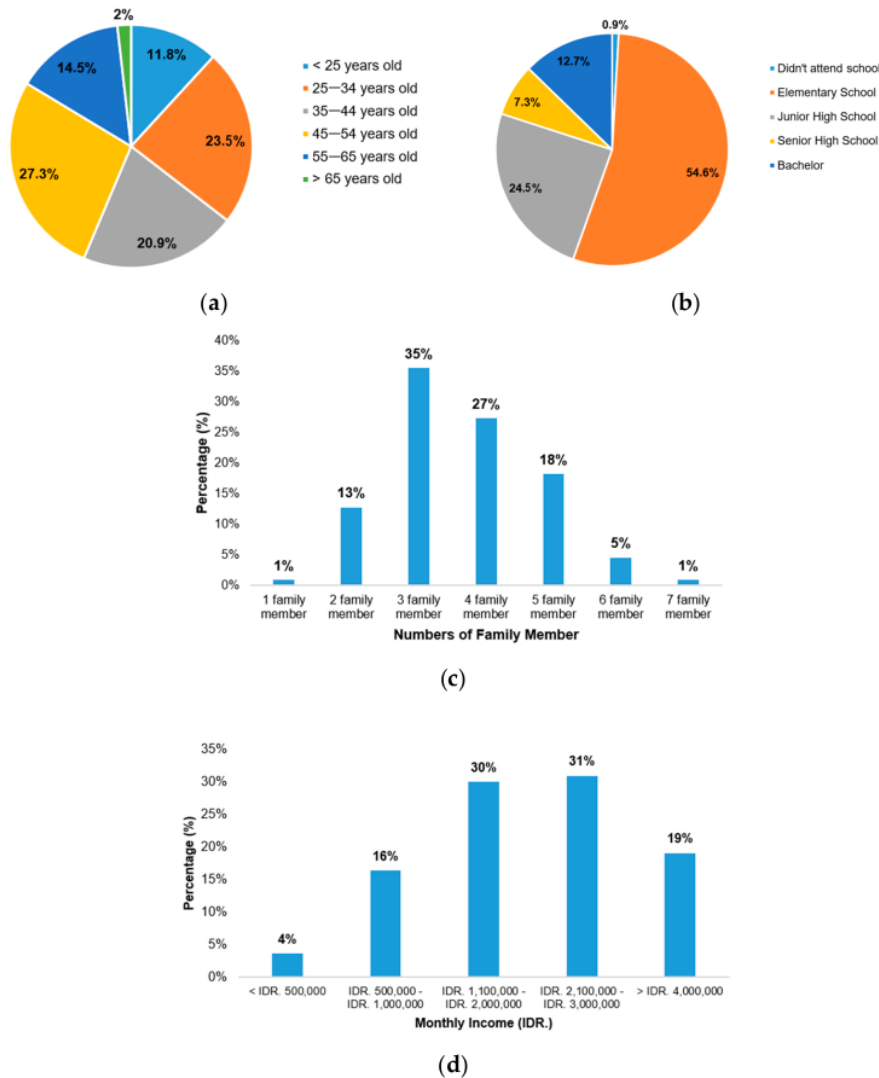
(a)

(b)

(c)

(d)

Figure 2. Respondents' (**a**) age; (**b**) education level; (**c**) number of family members; (**d**) individual adult incomes (monthly).

3.1. Structural-Equation-Modeling (SEM) Analysis

3.1.1. Outer-Model Evaluation

In the analysis, composite reliability, Cronbach's alpha, and average variance extracted (AVE) were used to evaluate the outer model of the structural-equation model (SEM). The AVE values for all constructs were greater than 0.5, indicating that they were valid and reliable (Table 2). Reliability measures, including Cronbach's alpha and composite reliability, also yielded results greater than 0.5, confirming the trustworthiness of all elements in the SEM analysis (Table 3) [47,48].

Table 2. Average variances extracted (AVEs).

Construct	AVE
Human	0.505
Social	0.666
Natural	0.602
Physical	0.573
Financial	0.669
Well-being	0.640

Table 3. Cronbach's alpha and composite reliability.

Construct	Cronbach's Alpha	Composite Reliability
Human	0.734	0.809
Social	0.707	0.828
Natural	0.707	0.723
Physical	0.704	0.821
Financial	0.724	0.804
Well-being	0.720	0.840

These evaluations of the measurement model ensure that the data collected were reliable and valid, and that the constructs used in the SEM analysis were appropriate for the research questions at hand. By establishing the validity and reliability of the measurement model, the subsequent SEM analysis could be relied upon to generate meaningful insights into the relationships between variables in the study [49].

3.1.2. Inner-Model Evaluation

The extent to which the exogenous variable explains the endogenous variable is expressed through the coefficient of determination, which is represented by the R-square and R-square-adjusted values, which can found in Table 4. The R-square value indicates the proportion of the variation in the endogenous variable that can be explained by the exogenous variable [50]. In this study, the R-square value of 0.525 indicates that the wellbeing of farmers was explained by the human, social, natural, physical, and financial capitals in a proportion of 52.5%, with the other variables accounting for the remaining variation. The R-square and R-square-adjusted values for the tested constructs are presented in Table 4. This information provides insight into the extent to which each construct contributes to the variance in well-being among farmers in Pujon District.

Table 4. Coefficient of determination.

Construct	R-Square	R-Square Adjusted
Well-being	0.525	0.500

The relationship between the five forms of capital and the economic welfare of farmers in Pujon District significantly contributes to improving their livelihoods. As depicted in Table 5, human, natural, physical, and financial capital all exerted a significant and positive influence on the economic welfare of farmers. These elements positively contributed to farmers' economic stability, implying that initiatives aimed at enhancing these aspects could potentially improve their welfare. However, it is noteworthy that social capital showed a contrasting trend, having a negative impact on farmers' economic welfare. This may be attributable to various factors, such as the structure of local social networks or community-cooperation dynamics. Understanding and addressing this unexpected relationship could be pivotal for devising more effective welfare-improvement strategies. The inner model demonstrated that all five capital dimensions—human, social, natural, physical, and financial—have a substantial influence on the economic welfare of farmers in Pujon

District (Figure 3). This underscores the importance of a comprehensive approach, one that takes into account all these factors, in measuring and enhancing farmers' economic welfare.

Table 5. Bootstrapping results.

|	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics	*p*-Values	Significance
Financial > Well-being	0.176	0.170	0.084	2.109	0.035	Significant effect
Human > Well-being	0.201	0.202	0.069	2.892	0.004	Significant effect
Natural > Well-being	0.237	0.227	0.105	2.256	0.024	Significant effect
Physical > Well-being	0.187	0.173	0.086	2.168	0.031	Significant effect
Social > Well-being	−0.205	−0.245	0.101	2.028	0.043	Significant effect
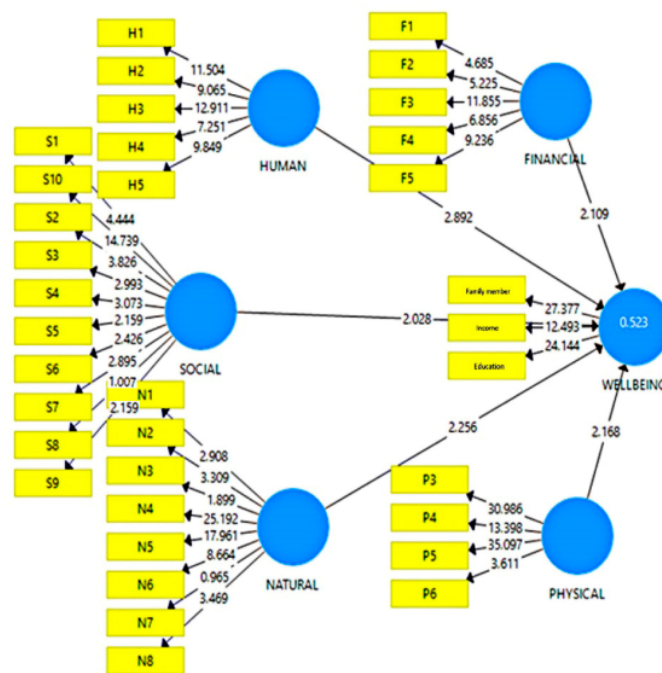
Figure 3. Inner-model evaluation.

In contrast, previous research has consistently documented the positive impact of social capital on farmers' economic welfare [51,52]. In Pujon District, strong cooperation and mutual support among farmers in both the livestock sector and daily life have led to lower levels of conflict between communities and local governments. Furthermore, the Pujon local cooperative aids farmers who encounter difficulties in developing or running their livestock businesses, bolstering social capital to enhance farmers' overall well-being and contributing to the sustainable development of the agriculture sector.

Based on prior research, good natural-resource management is crucial for human well-being, and the mental health of dairy farmers also significantly influences their approach to livestock welfare [37,38]. Therefore, the availability of both water and feed is critical for sustainable livestock development. Limiting the water supply to dairy cows could increase stress levels, affecting nutrient digestibility, reducing production, and weakening the livestock's immune systems [38,39]. Feed availability is another crucial factor in maintaining efficient milk production. However, several challenges exist concerning feed availability in

Indonesia due to unpredictable production factors, such as climate and weather uncertainty, low forage quality, high land conversion, and limited planting area [12].

Based on previous research, human qualities, including education, contribute significantly to better living standards [38]. Studies show that farmers' education levels substantially affect environmentally friendly agricultural practices [39]. Encouraging the community to pursue higher education is essential for future dairy-cattle business development. Additionally, the health aspect of human capital is vital to supporting the success of businesses. Farmers with poor health have lower resilience to cope with vulnerability changes [40].

Meanwhile, financial capital is significantly related to farmers' economic welfare [25]. Economic difficulties and concerns are associated with the welfare of farmers [28]. Financial capital refers to an individual's access to financial resources, affecting their capacity to respond to change. People with more financial resources have more options when responding to change, whereas those facing financial difficulties usually have fewer choices concerning their businesses [53].

Physical capital is also indispensable for running a dairy-cattle business based on previous research. Adequate equipment is required to maximize profits and minimize losses effectively. Biogas production from animal feces, particularly cow manure, offers many potential benefits, including the production of a renewable-energy source that is environmentally friendly because it uses waste from animals [54,55].

Pujon District has the potential to become a dairy-cow-based agro-ecotourism village, which could increase local income and promote the conservation of existing natural resources [56]. By merging tourism forms that are managed and owned by rural communities with forms that allow tourists to enhance their knowledge and learn about the local community's way of life, the sustainability of cultural, social, and environmental values can be achieved [57]. This multifaceted approach, integrating local traditions with sustainable tourism practices, can catalyze the economic development of Pujon District while preserving the rich natural and cultural heritage of the area.

4. Implications

4.1. Theoretical Implications

The results of this study contribute to the literature on sustainable agriculture and the well-being of farmers by establishing the interrelatedness of human, social, natural, physical, and financial capitals with the well-being of farmers [58,59]. The study confirms the applicability of the Socio-Economic Status (SES) framework in analyzing the complex interplay between the various capitals and their impacts on the well-being of farmers [58]. This study has demonstrated that there is a positive relationship between human, social, natural, physical, and financial capitals and the well-being of farmers, consistent with previous studies [16,20,58,59]. The findings suggest that increasing the capitals of farmers could lead to greater well-being. Therefore, the development of policies and programs for improving farmers' access to capital, particularly human and social capital, is crucial for promoting sustainable agriculture practices and enhancing the well-being of farmers.

Moreover, this study expands the literature on the relationship between human capital and the well-being of farmers in the context of sustainable agriculture. The study found that improving human capital by enhancing education level, skills, and knowledge can promote the well-being of farmers, as it provides opportunities for improved efficiency and encourages the adoption of sustainable practices. The study findings suggest that education and training programs that are designed to enhance human capital should be a priority for policymakers aiming to promote sustainable agriculture practices and enhance the well-being of farmers.

4.2. Managerial Implications

The study findings provide valuable insights into the strategies that can be adopted to promote sustainable agriculture and enhance the well-being of farmers in Pujon District.

The study findings suggest that the government should implement policies and programs that increase access to capital, particularly human and social capital, to promote sustainable agriculture practices and enhance the well-being of farmers [16,44,51]. Policies such as promoting farmer organizations, establishing cooperative networks, and increasing access to credit and markets can enhance social and financial capital [60]. Additionally, policies aimed at enhancing human capital, such as providing education and training programs, can improve farmers' knowledge and skills, thus promoting the adoption of sustainable agriculture practices and enhancing the well-being of farmers [61].

Moreover, the study findings suggest that improving natural and physical capital can lead to the enhanced well-being of farmers. Natural capital can be improved through the development of sustainable agriculture practices that promote biodiversity conservation, environmental protection, and resource management [62]. Physical capital can be enhanced through the provision of better infrastructure, such as irrigation systems, roads, and transportation [63]. Policies that prioritize the development of sustainable agriculture practices and enhance natural and physical capital can contribute to improving the wellbeing of farmers and promoting sustainable development.

In conclusion, this study provides valuable insights into the relationship between the capitals and well-being of farmers in the context of sustainable agriculture. The findings suggest that enhancing access to capital, particularly human, social, natural, physical, and financial capital, can promote sustainable agriculture practices and enhance the well-being of farmers. The study results have important implications for policymakers aiming to promote sustainable agriculture practices and enhance the well-being of farmers in Pujon District and similar contexts.

5. Conclusions

The study assessed the economic welfare of dairy farmers in Pujon District based on five types of capital, namely, human, natural, social, physical, and financial, to determine their impact on farmers' economic welfare and contribute to the realization of the Sustainable Development Goals. The hypothesis was that all five capitals significantly influence the economic welfare of dairy farmers. Structural-equation-modeling (SEM) analysis was employed to assess the relationships and influences of these five capitals.

The study found that the social capital of dairy farmers was strong, demonstrated by their cooperative attitude and support for each other in agriculture, animal husbandry, and everyday life, which reduces conflicts. The Pujon local cooperative provides education and training related to dairy-farming management, which helps farmers obtain maximum results. However, the study also identified some areas that require the government's intervention. Farmers need formal and informal educational opportunities to enhance their human capital, and the government must actively cooperate with local communities to plan a better-integrated water supply and management strategies to improve their natural capital. The community also needs better equipment through funding and a biogas-waste-management system to manage their physical capital. Furthermore, farmers need to be educated in financial management to measure the health of their businesses and to better manage their financial capital.

The study concludes that all five analyzed capitals have a positive influence on the economic welfare of the dairy farmers in Pujon District. Thus, government policies should focus on the development of all of these capitals, not just one. Academics should also provide recommendations for the development of these capital dimensions so that the collaboration between the community, academia, and government can be realized.

6. Limitations and Future Research

Despite the contributions of this study, several limitations should be acknowledged. Firstly, the study only focused on dairy-cattle farmers in Pujon District, which may limit the generalizability of the findings to other regions or contexts. Secondly, the study relied on self-reported data from farmers, which may have introduced bias and affected the validity

of the results. Additionally, there is no information available about Pujon farmer statistics, such as farming system, number of cows, farm equipment, land size, type of crops and forages, etc., which would have provided a richer context for the study.

To address the limitations mentioned above, future research can focus on the following aspects. Firstly, conducting similar studies in other regions and contexts can increase the generalizability of the findings and enhance the understanding of the relationship between the five capitals and the economic welfare of dairy farmers. Secondly, future studies can consider the demographic and socio-economic characteristics of the farmers to provide a more nuanced analysis of their economic welfare. Thirdly, utilizing both self-reported and objective data can improve the validity of the results. Fourthly, gathering more comprehensive data on Pujon farmer statistics, such as the farming system, number of cows, farm equipment, land size, type of cultivated crops and forages, etc., can provide more context for future studies. Finally, analyzing the variables from each capital in more depth can provide more insights into the influence and relevance of each variable, enabling the development of more effective and efficient government policies to promote the economic welfare of dairy farmers.

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