Heliyon 8 (2022) e12012

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Partnership 4.0: smallholder farmer partnership solutions

Sofyan Sjaf [a,d], Ahmad Aulia Arsyad [c,*], Afan Ray Mahardika [b], Rajib Gandi [a], La Elson [b], Lukman Hakim [a], Zessy Ardinal Barlan [a,b], Rizki Budi Utami [b], Badar Muhammad [b], Sri Anom Amongjati [b], Sampean [b], Danang Aria Nugroho [d]

[a] Department of Communication and Community Development Sciences, FEMA IPB University, Indonesia
[b] Center for Agricultural and Rural Development Studies, IPB University, Indonesia
[c] College of Vocational Studies, IPB University, Indonesia
[d] The Institute for Research and Community Service, IPB University, Indonesia

ARTICLE INFO

Keywords:
Partnership 4.0
Village development
Agriculture
Small farmers

ABSTRACT

The current pseudo-partnership pattern causes the farmers' income to be low from the results of their farming activities, so a partnership pattern is needed that is able to create a mutual partnership. The research which was conducted in Cikarawang Village, Bogor Regency, West Java Province – Indonesia aims; (1) recognize the existing condition of farmers and the use of agricultural land; (2) knowing the distribution of agricultural commodities; (3) identify existing partnership patterns; and (4) provide solutions for partnership patterns that benefit farmers. By using mixed-methods combined with the Drone Participatory Mapping (DPM) approach to produce *Data Desa Presisi* (DDP), this study succeeded in identifying three statuses of farmers, namely: cultivators, owners and cultivators of their own land, and owners who work on their own land at the same time working on other people's land, with an average access to land management of 3,437.32 m^2. The small access of each farmer in land management is further exacerbated by the variety of agricultural commodities that are cultivated by farmers. There are at least 19 types of agricultural commodities that are cultivated, but do not meet the economic scale that is able to improve the welfare of farmers. This condition opens up opportunities for the partnership pattern between farmers and middlemen to continue to survive which is actually detrimental to farmers. Partnership 4.0 innovation is present to replace the old partnership pattern by focusing on the basis of technology and information that is fully accessible to farmers to jointly control agricultural activities (upstream-downstream). Partnership 4.0 places farmers and offtakers on an equal footing, so that smallholders can benefit and help achieve the welfare of smallholders.

1. Introduction

According to the Results of the Inter-Censal Agricultural Survey (2018), the percentage of land-holding farmers in Indonesia is 69.40%. As many as 30.6% of cultivators only. Of the 69.40% (26,904,610) land owner farmers, 59.06% (15,890,427) are smallholders (< 0.5 Ha) (BPS, 2018). This data shows that land ownership by farmers in Indonesia is still very minimal, especially in the Java region. The area of agricultural land is getting narrower due to the conversion of agricultural land to non-agriculture due to economic growth and population growth. Thus, it is certain that as long as economic development continues, agricultural land conversion cannot be avoided and from year to year it is getting bigger (Bambang Irawan and Ening Ariningsih, 2015; Nut et al., 2021). The impact of high land conversion is also able to encourage an imbalance of land functions (Feng et al., 2020; Hishe et al., 2021). Therefore, a strategy for managing agricultural land resources is needed which is increasingly limited in the form of farmers' consolidation and organization. Research by (Liu et al., 2017) highlight how certain small-scale farmers play an important role in attracting other farmers to engage in sustainable practices that help preserve cultural, social and environmental systems, while also presenting food commodity agriculture tourism as their identity. As stated by (Hayami and Kikuci, 1982) that it takes "social technology" or social engineering in the form of institutions, patterns of relationships and social relations that are built between farmers and non-farmers.

Responding to these conditions, the government has made various efforts to overcome the problem of access and control of agricultural land by the people. Through agrarian reform, the government accelerates land

* Corresponding author.
E-mail address: ahmadaulia@apps.ipb.ac.id (A.A. Arsyad).

https://doi.org/10.1016/j.heliyon.2022.e12012
Received 7 March 2022; Received in revised form 7 June 2022; Accepted 23 November 2022

registration and overcomes agrarian inequality and ongoing conflicts (Luthfi, 2018). So far, there are three known patterns of agrarian systems in progress: (1) individualistic agrarian systems adopted by India, Bangladesh and South Korea; (2) crossing agrarian system adopted by Guyana, Tanzania and Egypt; and (3) the communal agrarian system adopted by China and Cuba. Of the three agrarian systems, research by (Ghai and Lee, 1979) recommends a strategic approach in the implementation of the agrarian system that incorporates an incentive model. As for this Incentive model as an effort to distribute welfare for farmers, especially smallholders/landless farmers through efforts to encourage added values which are managed in an organized manner among farmers and other parties (industry, research institutions/universities and the state).

The description above emphasizes that the issue of limited access and control of agricultural land by farmers is not only interpreted as distributing land resources, but also organizing farmers with multi-stakeholders to create added value that has been out of the hands of farmers, so that farmers get a better understanding of what are the advantages and disadvantages of farmers in managing their agriculture (Samoggia et al., 2019; Sjaf, 2019). The question is what are the concrete steps to make this happen?

Technological advances in the era of the industrial revolution 4.0, need to be considered in the context of advancing agriculture that is more just. Technology should be directed not to enrich the group of investors (big industry) but to small farmers. To realize sustainable development, agricultural development is needed, endogenous motifs, site-specific approaches, and innovative pathways are urgently needed in the world of agriculture, and must be built in the near future (Jiao and Min, 2017). This agricultural innovation must be carried out within an organizational framework, where a group of people must be gathered collectively, to carry out joint creation and share knowledge in the involvement of actors and stakeholders with the required capacity, so that as a team will be better able to handle the complexity of the innovation process (Lybaert et al., 2021; Rahman et al., 2021).

The momentum of the Covid-19 pandemic that has hit all countries has opened up opportunities for the presence of technology to improve agricultural systems. Especially related to the agricultural food supply chain. However, the pandemic did not significantly affect the structure of the agri-food supply chain (Okitasari et al., 2021). This fact can be seen from the position of farmers who are still in the lower layers of the distribution chain and even in the social structure of the community. This low position is convincingly due to the low level of farmer welfare.

The low level of farmer welfare is caused by the distribution chain that is not profitable for farmers. The problem with the distribution chain can be seen from the gap in farmers' profit gains. This condition has an impact on poor farmers who do not have a choice of livelihood strategies and are subject to various economic, social and distribution chain constraints (Cai et al., 2019). The gap and weak bargaining position of farmers affect the supply chain system, especially related to improper handling of agricultural products and the involvement of intermediaries that mislead farmers (Bhatia and Janardhana, 2020). As a result, the prices of agricultural products are lower and post-harvest losses occur due to the availability of inappropriate tools, limited market access and lack of knowledge about government schemes and policies. This condition makes the agricultural sector more challenging and complex (Bhatia, Kiran, 2018; Bhatia and Janardhana, 2020).

Based on the problems above, the agricultural partnership pattern emerged as an effort to reduce the farmers' gap. The role of partnership in the formation of the distribution chain is to shorten the marketing chain, so that the number of marketing agencies involved in the marketing chain is reduced, especially the number of brokers who generate low margins (Aeni, 2017). Bjärstig's research states that collaborative partnerships in natural resource management can lead to improving aspects of sustainability, especially socially. The goal of partnership is always expected to be beneficial between partners, but the practice of implementing partnerships is still not ideal (Bjärstig, 2017). For this reason, one of the problems with partnerships is the lack of professionalization of human resources at the level of production and processing in the supply chain. This is the main cause of other problems as revealed by (Beber et al., 2021). Thus forming a supply chain ecosystem that is still not inclusive in agricultural partnerships in Indonesia (ADB, 2018).

The problems faced by farmers are not only limited access and land tenure, but also pseudo partnerships that are detrimental to farmers (Kaupa and Shindume, 2022). This partnership pattern is characterized by unequal cooperation between two parties in the distribution of profits, services, and capital. To overcome so that this partnership pattern does not continue, the shortcomings and losses of farmers must be measured to improve the bargaining position of farmers. Considering the important role of farmers in the agricultural sustainability system and food availability, Partnership 4.0 as a digital platform can address the problems faced by farmers as mentioned above. Partnership 4.0 presents a mutually beneficial partnership (mutualism partnership) between farmers and various other parties which is the key to success in building relationships and partnerships (Sjaf, 2019).

Therefore, the Partnership 4.0 platform is used to facilitate and bring together various parties (government, private sector, farmers, and the public) in establishing partnerships. The principle of partnership between the government and the private sector in agriculture prioritizes the active participation of each party in the transfer of knowledge and improvement of agricultural skills to local communities, as well as contributing greatly to the achievement of socio-economic goals by creating jobs and employment opportunities in the region (Kaupa and Shindume, 2022).

The Partnership 4.0 platform is also able to answer problems regarding the privatization of government extension services. This is because partnership 4.0 is oriented to partnerships that are able to organize, empower, and direct farmers, so that they can demand appropriate and better extension services from the private and government sectors. The service is expected to be able to answer the need for transparency and increase trust between partners (Dilipkumar and Ingle, 2021). For all of this, partnership 4.0 is interpreted as a collective action aimed at meeting the needs of farmers through a mutually beneficial, transparent and empowering partnership pattern.

In addition to the previous description, it is important to pay attention to the use of big data as the basis for formulating agricultural policies to build partnership patterns in agriculture. Big data as an innovation cannot be separated from the advancement of digital technology that is growing. The results of the research of Kharel et al. (2022) have even noticed the need to encourage partnerships in data innovation in agricultural management, through connected systems and agricultural technology sharing. Partnership innovation by integrating agricultural data to improve farm management decisions in the field, increase efficiency, and improve environmental yields.

Based on empirical facts and previous research, action research on agricultural partnerships which we call partnership 4.0 is research that identifies the condition of existing farmers and their land tenure from the big data that we have collected. This study also wants to know the distribution of commodity types based on land tenure owned by farmers and existing partnership patterns and the problems presented. This research involves universities, farmers, village youth, village governments and industrial partners based on technology 4.0, inclusive and participatory.

2. Materials and methods

The study was conducted from October to December 2021, located in Cikarawang Village, Dramaga District, Bogor Regency, West Java Province, Indonesia (Figure 1). The considerations for choosing a research location in Cikarawang Village are as follows: (1) it is a village around the IPB campus (the only agricultural campus in Indonesia); (2) to be the location of the Partnership 4.0 program between farmers, universities, and offtakers; and (3) agricultural village with an area of 95.79 ha (37.82%) of the total village area (253,27 ha).

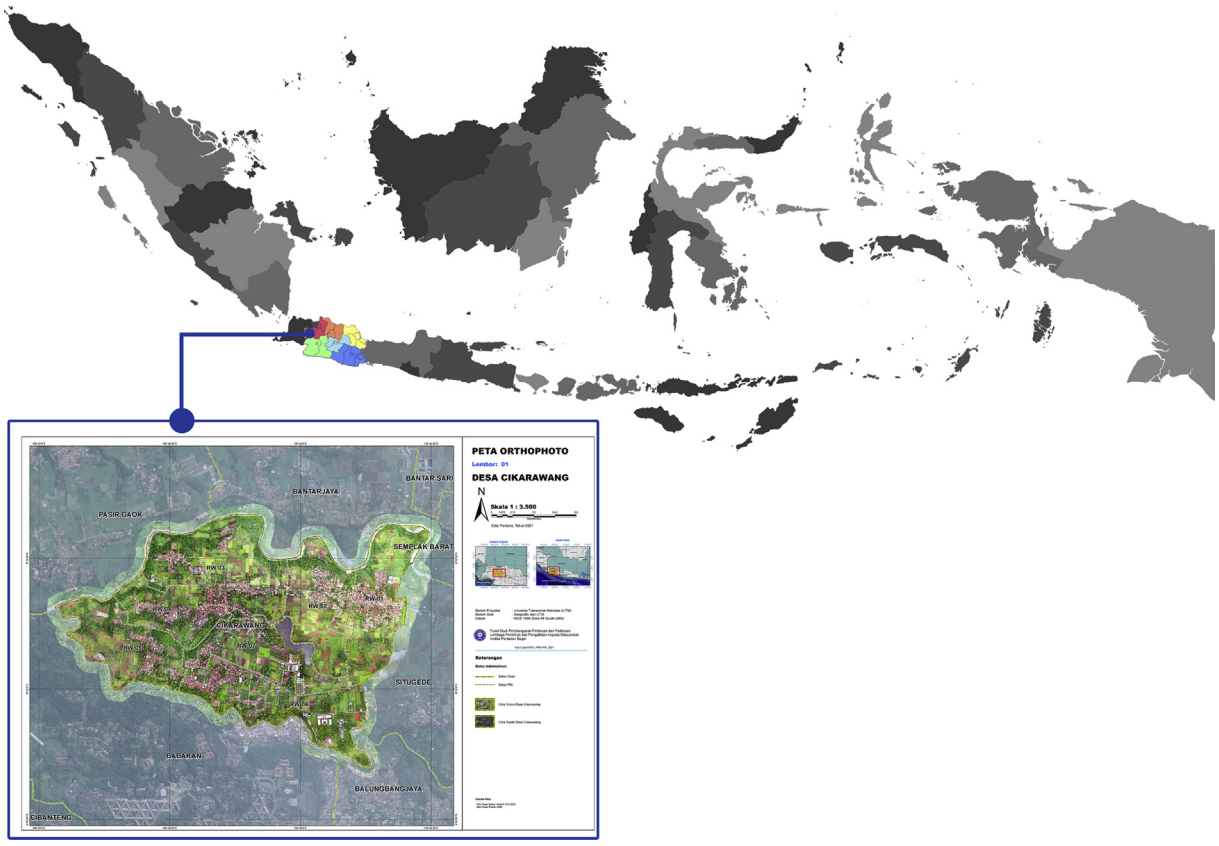

Figure 1. Research site map.

Furthermore, to answer the research questions posed, the researcher used mixed-methods which combined quantitative and qualitative methods. Referring to (Creswell and Clark, 2017)that mixed-method can provide opportunities for each method to cover each other's shortcomings. Quantitative methods are considered weak in understanding the context or setting of community conditions, while qualitative methods tend to be dominated by researchers' interpretations, giving rise to a bias of researcher subjectivity and difficulties in generalizing findings due to the limited number of participants. For this reason, this study uses a mixed-method combined with a Drone Participatory Mapping (DPM) approach to produce DDPs that are useful for this research (Creswell and Clark, 2017; Sjaf et al., 2020). This combination is deliberately done so that researchers have comprehensive knowledge related to the research location (Table 1).

Table 1 shows the research methods used can answer more than one research objective. This is possible because this research does not only show the existence of farmers (owners and cultivators) through numerical data only, but also through spatial data. By showing these two types of data, offtakers have certainty about the identity of farmers and the area of land that is cultivated as an important information base in building partnership patterns that are prosperous for farmers.

Involvement of informants (farmers, farmer group leaders, village officials, and young farmers from each RW) is a researcher's effort to obtain the information needed accurately so that the information needed related to the existing conditions of farmers in carrying out agricultural activities and partnership patterns in the research location can be obtained comprehensively.

Table 1. Research objectives, approaches, instruments and data sources.

Objective	Method	Instrument	Data source
1. Know the existing conditions of farmers and the management/ utilization of agricultural land.	DPM generating DDP	Merdesa Census App	Village government officials, heads of RW/ hamlets, farmer figures, young farmers who joined Merdesa Farm (a community in the field of agriculture, consisting of farmers and young farmers) and residents of Cikarawang Village
	2. Quantitative through land census approach	• Drone • Partnership 4.0 App	All farmers (owners and tenants)
3. Knowing the distribution of commodity types based on land management/use.	Quantitative through land census approach	• Drone • Partnership 4.0 App	Village government officials, RW/hamlet heads, farmer leaders, and young farmers who join Merdesa Farm
4. Identify existing partnership patterns and problems.	Qualitative through Focus Group Discussion (FGD)	• Venn Diagram • Problem Tree • Season Calendar • Supply Chain	Village government officials, RW/hamlet heads, farmer leaders, young farmers who join Merdesa farm and experts (soil science, agronomy, institutions, community empowerment and agricultural technology)
5. Providing solutions for partnership patterns that benefit farmers.		Participatory discussions with experts	

3. Results

This section will describe three things: (1) the typology of Cikarawang Village to obtain an overview of the research location;

(2) the current condition of farmers based on the use of agricultural land; and (3) the partnership pattern that is still ongoing in Cikarawang Village. The three descriptions were used as discussion material to explain the importance of Partnership 4.0 as a smallholder partnership solution.

3.1. Typology of Cikarawang Village

Cikarawang Village is a village located in the western part of Bogor Regency, West Java Province. This village has a land area of 253.27 ha which is divided into 7 Rukun Warga (RW) areas. RW 03 is the largest area, which is 20.87% (52.85 ha) of the Cikarawang Village area. On the other hand, RW 04 is the RW which has the smallest area (17.13% or 43.39 ha). The population of Cikarawang Village is 8,510 people with a population density of 3,359.92 people/km2, where RW 03 is the area with the largest population (1,753 people or 20.60%). However, the highest population density is in RW 04 (5,830.60 people/km^2) and the lowest is in RW 06 with 1,710.07 people/km^2 (Figure 2).

The male population (4,276 people or 50.27%) in Cikarawang Village is more than the female population (4,232 people or 49.73%). Based on the population pyramid of Cikarawang Village, it can be seen that the number of productive age is higher than the number of non-productive age (Figure 3). From the population pyramid data, information on the dependent burden ratio is 43/100, meaning that 100 people of productive age bear 43 non-productive ages.

Furthermore, from the total area of Cikarawang Village, the most common type of land use is upland/field, which is 118.41 ha (46.75%). Then followed by mixed plantations covering an area of 53.07 ha (20.95%) and settlements covering an area of 49.04 ha (19.36%). The rest, other land uses are allocated for infrastructure covering an area of 8.67 ha or 3.42%; public facilities covering an area of 4.30 ha or 1.70%; and others: offices, paddy fields, and others (Figure 4).

Several types of agricultural commodities are cultivated on dry land/fields, including: corn, taro, sweet potato, cassava, mixed (taro, sweet potato, cassava), banana, and others. As for the use of mixed plantation land, several agricultural commodities are cultivated by farmers, including: coconut, rambutan, mangosteen, jackfruit, and others. Based on this information, Cikarawang Village can be referred to as a village with the typology of fields. One type of commodity that is widely grown in Cikarawang Village is sweet potato (Figure 5 (a, b)).

3.2. Farmers' existing conditions and land tenure

Using the Partnership 4.0 application, this study succeeded in identifying the identity of the status of farmers in the use of agricultural land in Cikarawang Village. There are 59 land owner farmers, 22 land cultivators and 98 land owner farmers who also work on other people's land. The total area of agricultural land in Cikarawang Village that is utilized is 95.79 ha. Furthermore, of the seven RW/hamlets in Cikarawang Village, RW 03 is the area that has the largest land area (19.58% or 19.99 ha), followed by RW 01 (18.26% or 18.65 ha), RW 02 (16 .24% or 16.59 ha) and RW 05 (16.24% or 16.59 ha). Meanwhile, the RW which has the smallest land area is in the RW 04 area of 7.51 ha or 7.35%. The area of land used and the number of farmers based on status can be seen in Table 2.

Table 2 shows as many as 179 farmers with the status of Cultivators, Land Owner Farmers and Land Owner Farmers at the same time working on other people's land. There are more farmers who own land who cultivate land owned by others (54.75%) than farmers with the status of land owner farmers (32.96%) and tenants/cultivators (12.29%). From the overall status of farmers, RW 01 is the area that has the largest number of farmers (24.02%), followed by RW 03 (18.44%) and RW 06 (13.97%). Furthermore, the average access to land use for each farmer in Cikarawang Village is 3.437,32 square meters (m^2). Management/utilization of agricultural land and land ownership status of parcels can be seen in Figure 6.

Figure 6 above shows that smallholder farmers who simultaneously work on other people's land are mostly found in RW 01 (12.85%) followed by RW 03 (12.29%) and RW 05 (7.72%). Furthermore, the largest landowners were in RW 05 (6.15%) and RW 07 (6.15%). Meanwhile, most of the land cultivators were found in RW 01 (5.59%). From this land use data, it shows that land consolidation from farmers is an urgent agenda to be carried out as soon as possible so that farmers prosper.

In addition, this study also succeeded in showing 19 types of commodities planted by farmers in a land area of 95.79 ha. The 19 commodities are jicama, chili, corn, crystal guava, oranges, long beans, peanuts, soybeans, galangal, melons, rice paddy, bananas, livestock grass, vegetables, cassava, taro, eggplant, yams and multi-commodities (1 plot of land is planted with 2–4 agricultural commodities).

Of the nineteen agricultural commodities planted by farmers on agricultural land, there are four types of commodities, including: yam

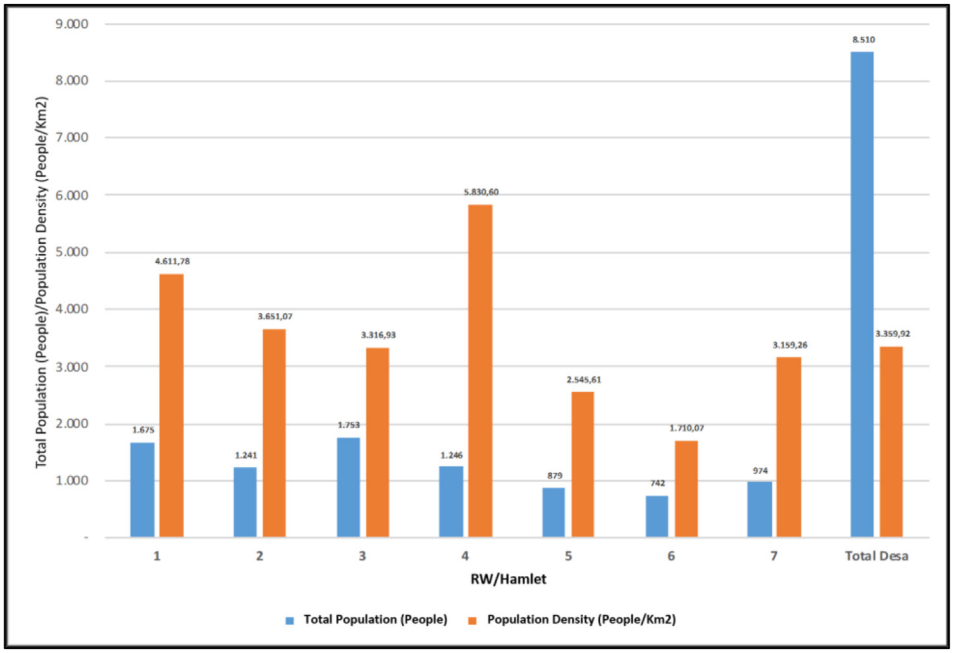

Figure 2. Number and density of population based on RW/hamlet in Cikarawang Village.

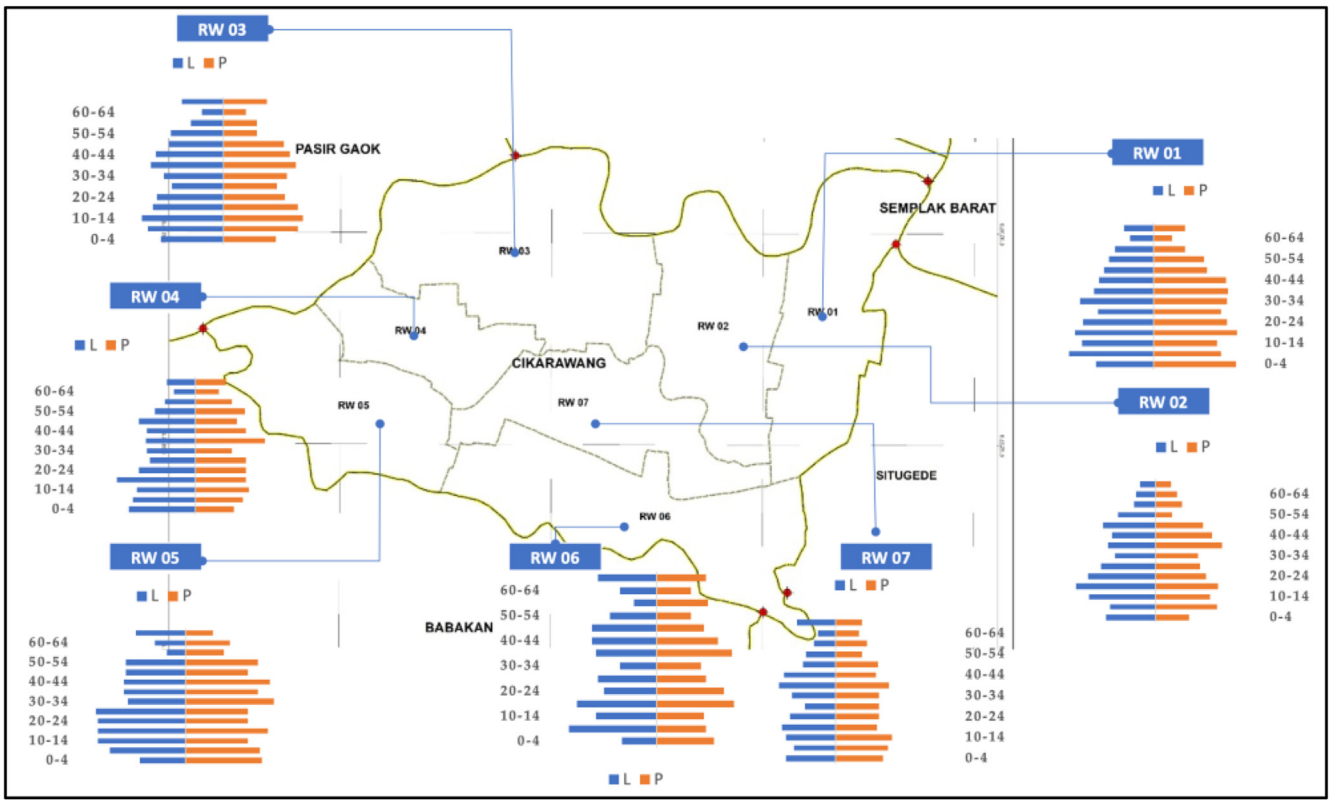

Figure 3. RW/Hamlet based Village population pyramid in Cikarawang Village.

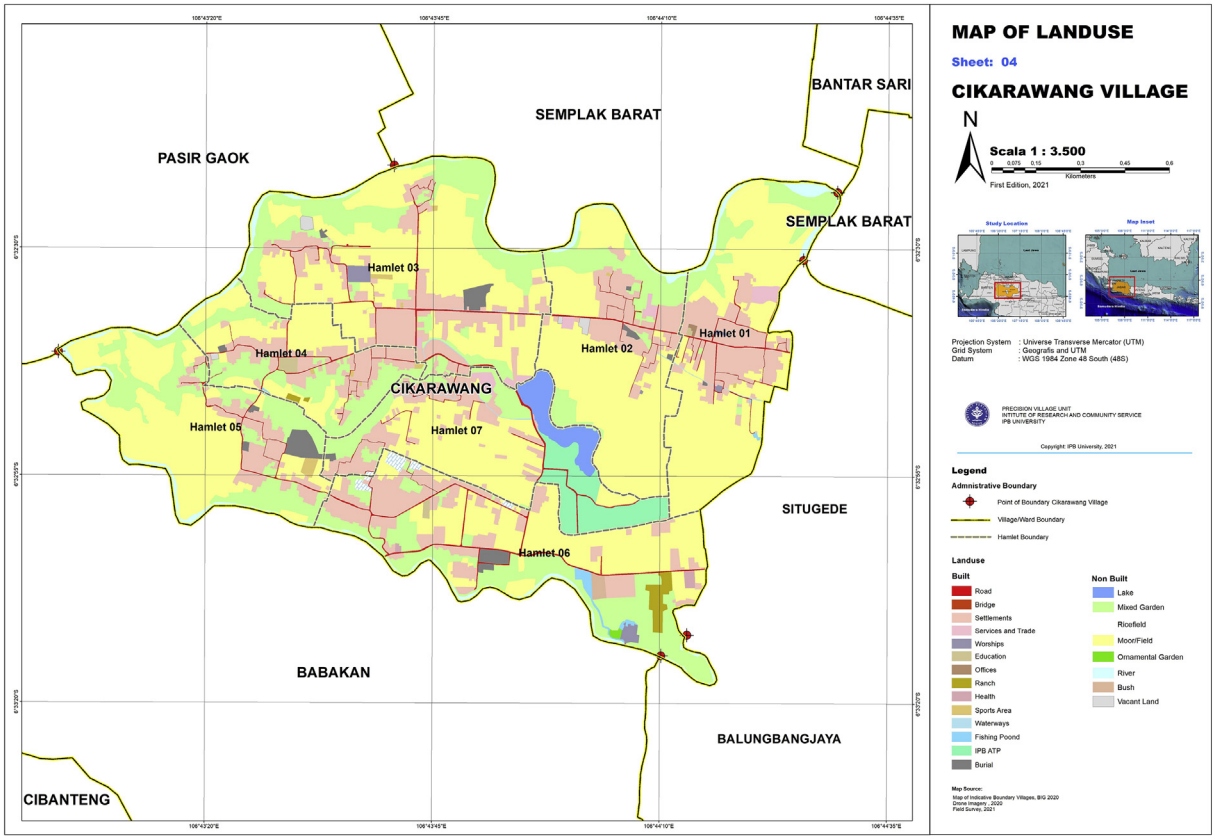

Figure 4. Land use in Cikarawang Village.

(a) (b)

Figure 5. Sweet potato commodity: (a) Viewed by using drone image; (b) Seen directly up close.

Table 2. The area of agricultural land used and the number of farmers based on status.

RW/ hamlet	Agricultural land area (Ha)	Farmer status (person)			Total
		Cultivator	Land owner farmer	Land owners and working on other land	
1	18.65	10	10	23	43
2	16.59	5	2	12	19
3	19.99	2	9	22	33
4	7.51	1	11	7	19
5	16.58	2	9	14	25
6	11.14	1	7	11	19
7	11.66	1	11	9	21
Total	**95.79**	**22**	**59**	**98**	**179**

(29.0%), cassava (28.72%), multi-commodity (14.23%) and crystal guava (7.73%). Furthermore, RW 01 and RW 03 are the largest areas planted with agricultural commodities. On the other hand, RW 04 is the area with the least number of agricultural commodities planted, which is 7.51% of the total land area (102.13 ha). The distribution of nineteen agricultural commodities cultivated in Cikarawang Village can be seen in Figure 7.

Figure 7 shows the distribution of agricultural commodities cultivated by farmers in Cikarawang Village. From an area of 95.79 ha of agricultural land, it is divided into 443 plots of land that are managed or utilized by farmers. Farmers who own land who are also cultivating land belonging to other people mostly manage or utilize plots of agricultural land (81.72% of the total plots of agricultural land or 362 plots of land). This farmer status uses a lot of agricultural land by planting cassava commodities (25.51% or 113 plots of land) and yams (22.35% or 113 plots).

Meanwhile, land owner farmers utilize agricultural land as much as 13.32% of the total plots of agricultural land (59 plots of land). The agricultural lands were planted by farmers with cassava and yams as commodities, which amounted to 4.29% (19 plots of land) each of the total plots of agricultural land. Meanwhile, cultivators used agricultural land as much as 4.97% of the total plots of agricultural land planted with yams (1.58% or 7 plots of land) and cassava (1.35% or 6 plots of land). The types of commodities that are cultivated based on the status of farmers in Cikarawang Village can be seen in Figure 8.

3.3. Farmer partnership pattern

The results of our research show that so far, farmers have not been the subject of development in the agricultural sector. Farmers tend to be positioned as objects that are limited to 'spectators' of a development show. This statement may be considered an exaggeration, but it is the truth. Why? First, so far, farmers have not been clearly recognized for their rights of access and even ownership of land. We asked the village government about data on the distribution of agricultural land and who are the farmers who depend on agricultural plots for their livelihood? The answer we got:

> *"…we (village government) do not have data on farmers and the area of land cultivated. So far, we only know the data of farmers and their land area from people's words…"* (IJ, Head of the Community Welfare Section of Cikarawang Village)

Then how is it possible for development in the agricultural sector which has been carried out without being supported by clear data? So it can be ascertained that what happened was that the agricultural programs that entered Cikarawang Village did not have a significant impact on improving the welfare of farmers. Second, many farmers (small and landless cultivators) are excluded from farmer groups in Cikarawang Village. Many of them are not involved in farmer groups in the village.

This further gives confidence that so far farmer groups have not been developed in a participatory manner or tend to be 'elite driven' with project interests only. Third, many small farmers (cultivators) are not aware of the exploitation that takes place against them in partnership patterns (especially partnering with middlemen). This partnership pattern causes many farmers to be in debt with middlemen. Farmers' debts to middlemen are used as a binder for farmers to sell their crops at a price determined unilaterally by the middleman. These three things indicate that farmers have not been positioned as subjects of development in the agricultural sector.

Not only the description above, the results of the analysis using the Venn diagram (Figure 9) show that the position of farmers with government and private stakeholders has also not received attention. The findings of this study indicate that there are four categories of stakeholder relations with farmers in Cikarawang Village:

1. Stakeholders who are less important to farmers and have no influence. According to farmers, stakeholders who fall into this category are stakeholders who are around them, but do not have any influence so that farmers feel that the existence of stakeholders is not important. The stakeholders who fall into this category are extension workers. In this case, the extension worker was deemed not to have provided the guidance needed by the farmer to solve the farmer's problem;
2. Stakeholders who are less important, but are considered influential for farmer activities. Stakeholders who fall into this category are the Kebun Merdesa Community. This community provides demonstration plots that are used for farmer learning. The presence of this community is considered influential because it is able to facilitate farmers to obtain information related to agricultural activities;
3. Stakeholders who are considered important, but have no effect on farmer activities. Farmers realize that these stakeholders are important, but because of the difficulty of accessing these stakeholders, farmers feel that their presence is not very influential in farmer activities. The stakeholders included in this category are: Universities, Village Governments, Village Owned Enterprises (BUMDes), and farmer groups; and
4. Stakeholders who are considered important and influential for farmer activities. The stakeholders are middlemen and farmers who are not members of farmer groups (colleagues). For farmers, middlemen are very influential in farmers' activities because they are the marketing

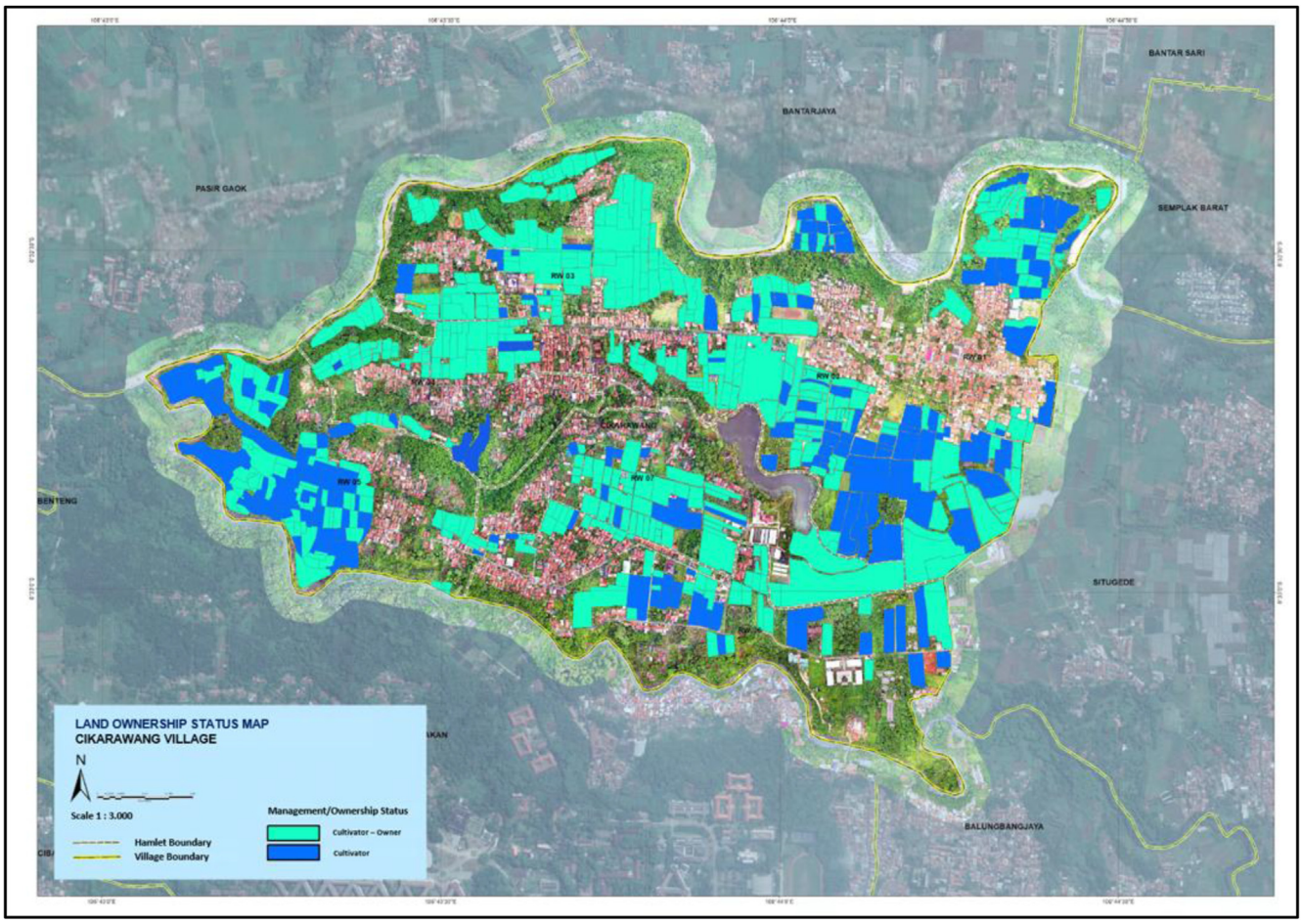

Figure 6. Map of agricultural land management/use and land ownership status in Cikarawang Village.

places for agricultural products and the parties who determine the selling price of farmers' products. Likewise, colleagues have an influence on farmers because it is a place where farmers exchange seeds and information on agricultural cultivation.

The description of the four categories of stakeholder relations above, shows the phenomenon that the position of farmers in rural areas is still very weak. The results of this study indicate two factors that cause the position of farmers to be weak: minimal access to information about cultivation and market knowledge of the commodities produced; and the exploitation of agricultural land which is still done individually. Therefore, efforts are needed to bring farmers closer to the sources of information needed and to consolidate both land and commodities. The two efforts are intended to empower farmers.

Generally, farmers in Cikarawang Village are farmers who cultivate yams and cassava commodities. However, almost all farmers have side jobs to fulfill their daily needs, such as being farm laborers, odd jobs and others. This side job is the most likely livelihood strategy for farmers to survive despite the difficulty of finding other job opportunities. We often see this phenomenon in rural Indonesia after the Covid-19 pandemic. Therefore, agriculture as an important sector in the main income of farmers (especially smallholders) becomes strategic. This strategic value is because it can help small farmers to improve their welfare through good and neat organization. In this context, it is necessary to understand the pattern of cultivation of commodities produced by farmers.

Furthermore, agricultural commodities in Cikarawang Village are various types of yams (white, red, and purple). Cultivation of yams is done 2 times a year, in the dry season and the rainy season. In the dry season, starting with building mound and looking for seeds in April, then continuing with the planting period in May and loosening the soil in June. However, caterpillar attacks often occur in planting in the dry season. For this reason, fertilizers and pesticides are applied during that month.

The harvest period is done after approximately 6 months from the planting period. After harvesting in the dry season, the activity of building mounds and looking for seeds is carried out again in October, which generally has entered the rainy season. Then the planting period is carried out again in November, and the soil loosening period is carried out after one month of planting. At the beginning of the year, fertilizers and pesticides were applied again. The main problem faced by farmers in Cikarawang Village is flooding in the rainy season which causes the sweet potatoes to rot and yields are not maximally obtained by farmers.

Marketing of farmers' crops in Cikarawang Village is very dependent on middlemen. This study found that there has been a partnership between farmers and middlemen. The partnership pattern applied is that farmers provide labor and land, and middlemen provide capital to purchase seeds and fertilizers. All agricultural products are sold to middlemen and payments to farmers are made by middlemen after deducting the cost of seeds and fertilizers, as well as farmers' debts. This is as expressed by the informants in this study:

> *"…middlemen can provide loans to purchase seeds and fertilizers. But sometimes middlemen provide their own seeds and fertilizers, so the farmers immediately receive everything for their land. As for the return of farmers' debts, they are paid from the harvest in the form of commodities that have been set unilaterally by middlemen…"* (SJ, Cikarawang Farmer)

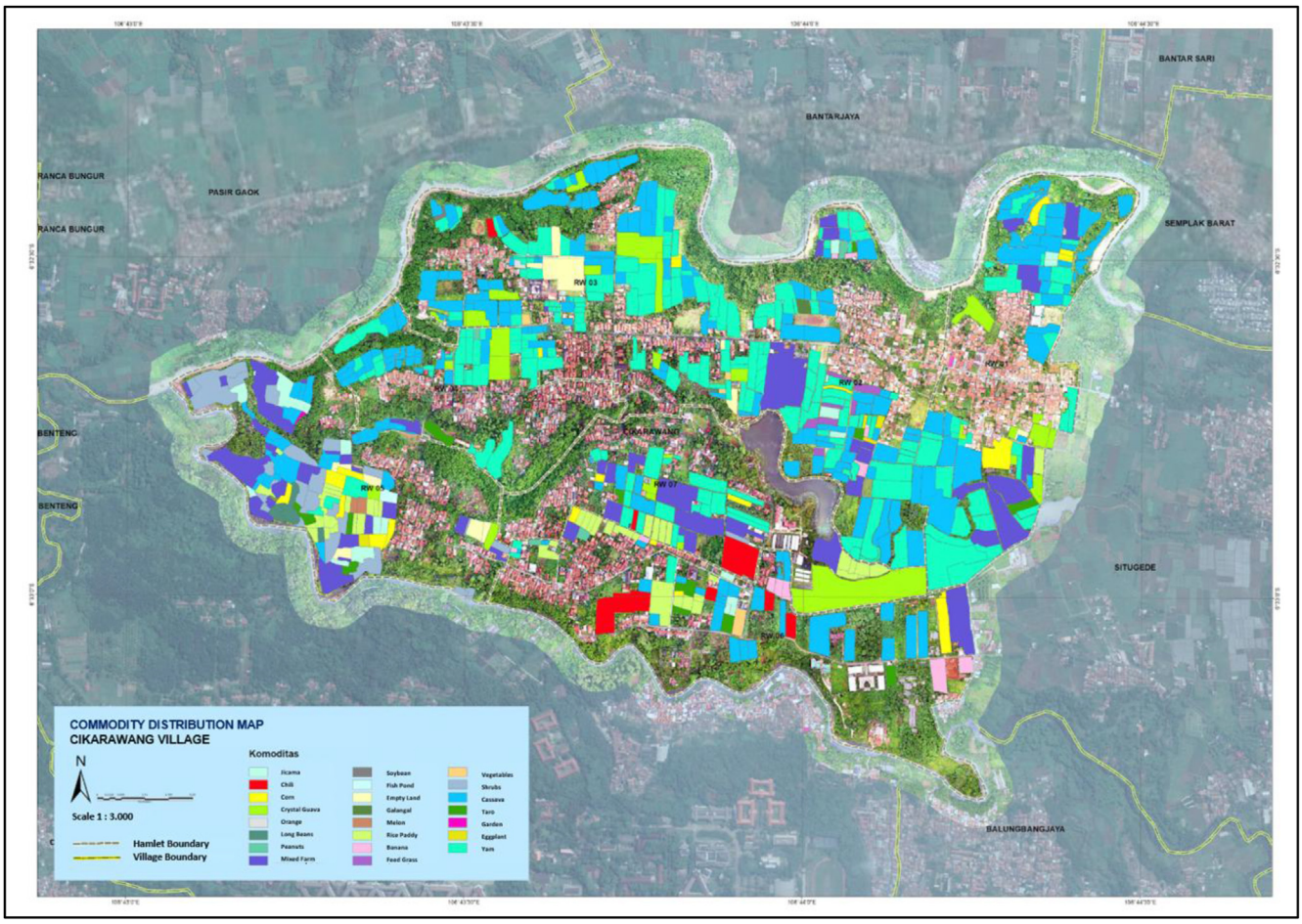

Figure 7. Map of distribution of agricultural commodities in Cikarawang Village.

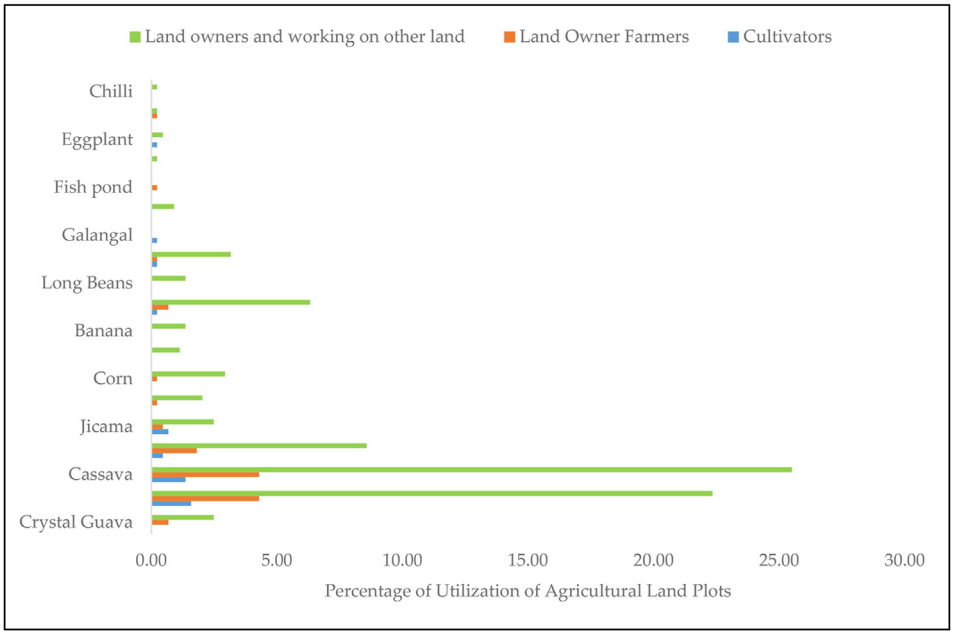

Figure 8. Types of cultivated commodities based on farmer status in Cikarawang village.

The partnership pattern above is a pseudo-partnership pattern that is not equal and makes farmers subordinated. This fact can be proven from the unequal distribution of profits between farmers and middlemen in the distribution chain. The results of this study indicate that the profit margin obtained by the middleman is very large and vice versa for the farmer, it is a loss. The profit margin is obtained from 4 stages of harvest

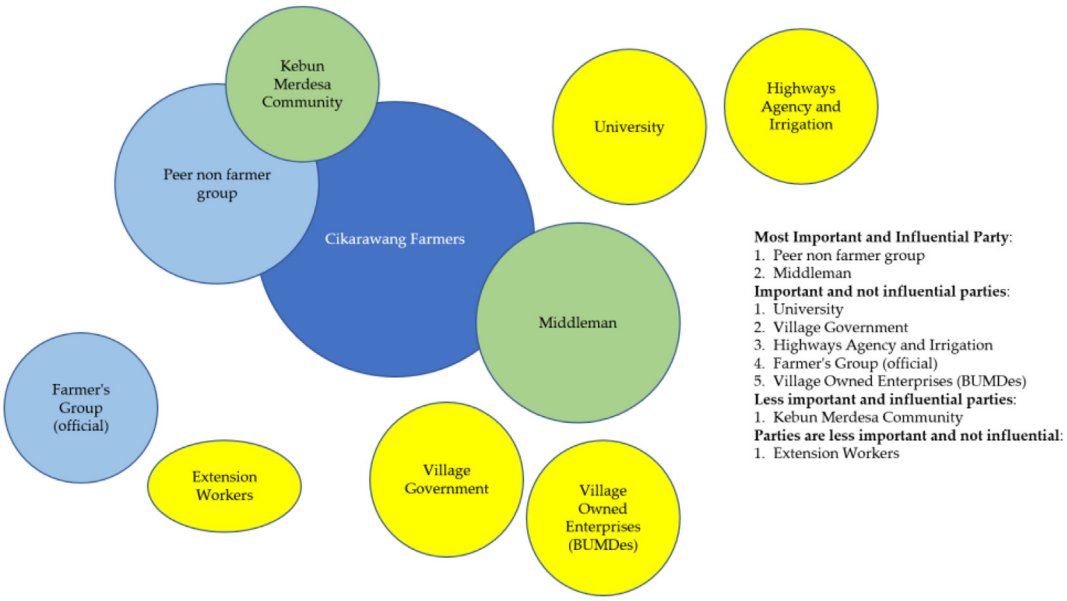

Figure 9. Venn diagram showing farmer relationship pattern.

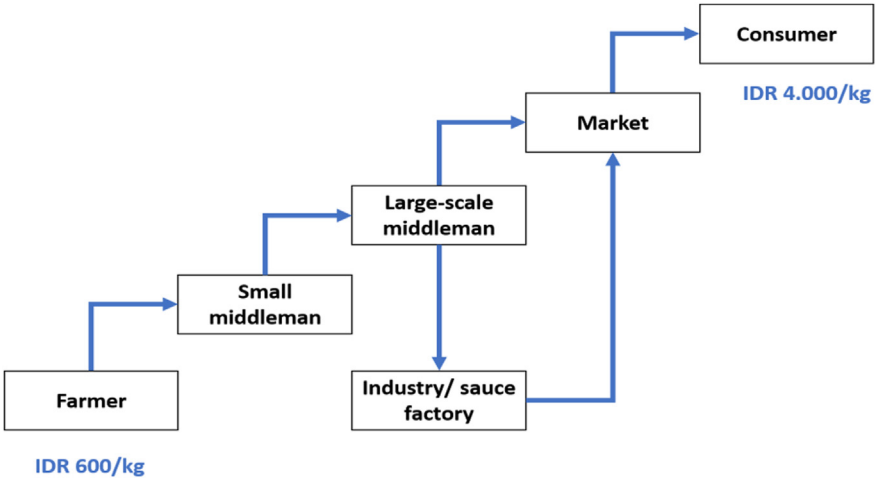

Figure 10. Distribution chain of yam commodity trade in Cikarawang Village.

trading transactions from farmers to consumers (markets) in the yam commodity distribution chain (Figure 10).

Figure 10 shows that the phenomenon of a fairly large margin (producer-consumer) from the distribution chain of yam commodity trade in Cikarawang Village is because the relationship between farmers and small middlemen is built on bonds of indebtedness. This relationship resulted in the weak bargaining position of farmers to determine the price of their crops. Farmers are powerless to accept harvest prices from small middlemen. For the case of yam commodity, the price is IDR 600/Kg, while the selling price in the market is IDR. 4,000/Kg. This means that the market price is 6 times the selling price of farmers' crops. The question is whether farmers benefit from these prices? From the search results in this study, it shows that farmers experience losses. The money that farmers get from the harvest is IDR 1,500,000 for 2.5 tons of sweet potatoes produced from an area of 2,800 square meters. The yields obtained are not commensurate with the production costs incurred by the farmers, which is IDR 3,700,000 which is allocated for irrigation, planting, maintenance, fertilization and pruning. The discrepancy between production costs and the results obtained is caused by two factors: (1) unilateral pricing by middlemen; and (2) the low yields of farmers due to caterpillar pests and the unsuitability of land for yam commodities.

Then why do farmers continue their agricultural activities through a partnership pattern that makes them lose? The reason is simple, because farmers have no other choice. This means that farmers have no other choice, other than continuing the partnership pattern on the basis of debt of gratitude. Therefore, Partnership 4.0 needs to be present to be a partnership option that improves the welfare of farmers.

The results of this study indicate that the weak position of farmers in the agricultural development process makes it difficult for farmers' welfare to be realized. Sampean et al. (2019); Sjaf et al. (2020, 2021) stated that the failure of development (agriculture) which resulted in not achieving an increase in farmer welfare was due to the narrow spaces for community participation in the development process starting from how the data was built, the program planning process, implementation and monitoring of program evaluations that do not involve the community (farmers) as subjects. In this case, farmers are positioned as mere objects.

Li's, (2007) research strengthens the results of this study that development practices that often take place including agricultural development programs tend to be technocratic and procedural which are far from

substantial values. The substantial values in question are how the development process is carried out in a participatory manner, placing the community as the subject and placing the suitability of the social, economic, cultural and ecological context as the foundation of the development program. Technocratic and procedural agricultural development practices are more sustainable when datafication practices are getting stronger and linking them to discursive knowledge practices that serve as the basis for policies that in fact weaken local decision-making (farmers' communities) (Rudolph et al., 2019). This is what causes the farming community to be increasingly excluded from development programs and tends to lead to injustice for farmers due to their compulsion to follow a pseudo-partnership structure to continue to fulfill their daily needs (Sulistiyani, 2004).

4. Discussion

Cikarawang village has a relatively large agricultural land, which is 37.78% of the total village land area. With a land area like this, agriculture should be able to become a driving force for the economy in Cikarawang Village. However, the results of this study indicate that farmers are in the middle to lower level of welfare. Welfare conditions like this are because farmers are still in an unprofitable distribution chain. The position of farmers tends to be weak, so the profits from agricultural activities are not that great. Moreover, with the narrow area of land cultivated by each farmer and the absence of a strong farmer organization, the farmers do not grow and develop.

The variety of agricultural commodities cultivated by farmers in Cikarawang Village is one of the causes. There are 19 types of agricultural commodities that are cultivated by farmers (see Figure 7) intensively with limited production coverage in the research villages. In this condition, it is certain that the production results from farmers do not meet the massive production scale to meet industrial needs. Small production leaves farmers with no choice but to re-establish partnerships in the form of selling agricultural products to middlemen at low prices.

This partnership pattern is common among farmers in Indonesia. Then why is the condition of farmers like this still happening? Whereas the world has entered the era of information disclosure, advances in science and technology, and more and more choices are available. Under these conditions, farmers' livelihoods should be better.

4.1. Data and technology-based partnership innovation

So far, farmers have only been the object of development without increasing their capacity. Other critical stressors for farmers are agricultural policies, the general economic situation and farm-specific financial situation, as well as excessive bureaucracy and workload (Scheurich et al., 2021). This phenomenon is also very thick found in the research location. Of course, this phenomenon results in the increasing difficulty of farmers' access to technology and information to improve their farming skills. So far, to be able to encourage farmers to adopt agricultural technology properly is by having motivation, opportunity and ability (Wei et al., 2021). Therefore, it is necessary to have innovative partnerships that are in favor of farmers so that farmers can be more empowered, motivated, open to opportunities, and capable of improving their welfare. One form of partnership innovation that can be done is the Partnership 4.0 innovation. But it should be understood that system changes aimed at more sustainable agriculture take longer to evaluate, as they require new and innovative procedures and practices to create more resilient and well-adapted systems (Oliveira et al., 2019).

Partnership 4.0 is a partnership that provides technology and information that can be accessed by farmers to jointly control agricultural activities (production-marketing) carried out by those who partner (farmers-offtakers). Not only that, farmers can access knowledge related to good cultivation practices as well as market access for cultivated commodities. The existence of data collection on the potential of farmers and land, can be used as a means of developing farmer organization in a better partnerships. Partnership 4.0 emphasizes the relationship between farmers and offtakers based on technology applications. The application of this technology serves to build transparency between farmers and partners in terms of the availability of agricultural production and harvesting facilities. The digital platform helps farmers and their partners get information about agricultural conditions and their needs based on farmer community networks (Agyekumhene et al., 2020; Kaupa and Shindume, 2022; Kharel et al., 2022).

Partnership 4.0 encourages farmers to determine and accept commodity prices that are appropriate or not in accordance with market prices. This is important because farmers already have the ability to do good cultivation, off takers can also receive commodities that meet market criteria, and can arrange assistance of agricultural crops. In addition, Partnership 4.0 opens opportunities for greater farmer organization within village units and between villages, so that communication and coordination of planting agricultural commodities that are profitable for farmers can be established, such as yams and other commodities. Partnership 4.0 avoids competition between farmers and instead builds cooperation between farmers and offtakers. On the other hand, offtakers can also maintain the sustainability of commodity supply because of the organization carried out by farmers.

Partnership 4.0 departs from the reality experienced by farmers in Cikarawang Village which may be experienced by other farmers in Indonesia. With the advancement of digital technology and the increasingly dynamic characteristics of society, we are increasingly confident and easy to carry out the process of accumulating knowledge and power to encourage social change more quickly, although knowledge and power elsewhere as a problem can also arise. This discourse, which according Foucault (2013) continues, is how to produce knowledge, along with the accompanying social practices, as subjectivity formed by the power relations behind knowledge and social practice, which are interrelated among all these aspects.

Partnership 4.0 is important as an effort to encourage communities to simultaneously transform, meet social needs (more effectively than existing solutions), create new capabilities and better relationships, by utilizing assets and resources owned by rural communities (Portales, 2019). The new solution offered from the Partnership 4.0 is in the form of a village institutional arrangement that accommodates without leaving a single social layer in the village. This is the importance of inclusive innovation to be able to be present in helping villages, so that they are able to promote people's welfare in a just manner (Sjaf et al., 2020). Innovation is not just something new, but broader than that, it is something that can encourage renewal in society or in certain localities (Berger and Gewin, 1983). Innovation in agriculture not only emphasizes technical innovation, however, it may be much more important to understand institutional innovation (Oliveira et al., 2019). Partnership 4.0 is not just a technology application, but also a process of assistance and agricultural development that places farmers as the main subject, so that the partnership is able to empower farmers. Multi-stakeholder partnership governance is a good approach for developing a shared vision among stakeholders (Schils et al., 2019). In a partnership system like this, what becomes very important is the participatory process. The involvement of farmers in developing this partnership innovation is to increase the ability of farmers to understand and use technology based on digital platforms that help them to monitor and communicate agricultural conditions in existing value chain schemes (Agyekumhene et al., 2020).

Currently, villages are faced with major problems in fostering farmers, including the discrepancy of data held by stakeholders with actual conditions. Data collection is not comprehensive and rarely updated, resulting in the program being implemented not being able to address the main problems in rural areas. In this context, *Data Desa Presisi* (DDP) is presented to solve the problem of incompatibility and accuracy of the data (Sjaf et al., 2022). DDP consists of two data: spatial data and social data. Spatial data collection using drones that produce images with an accuracy of up to 5 cm from the surface. This spatial data is supported by social data that uses interview techniques to all villagers to produce

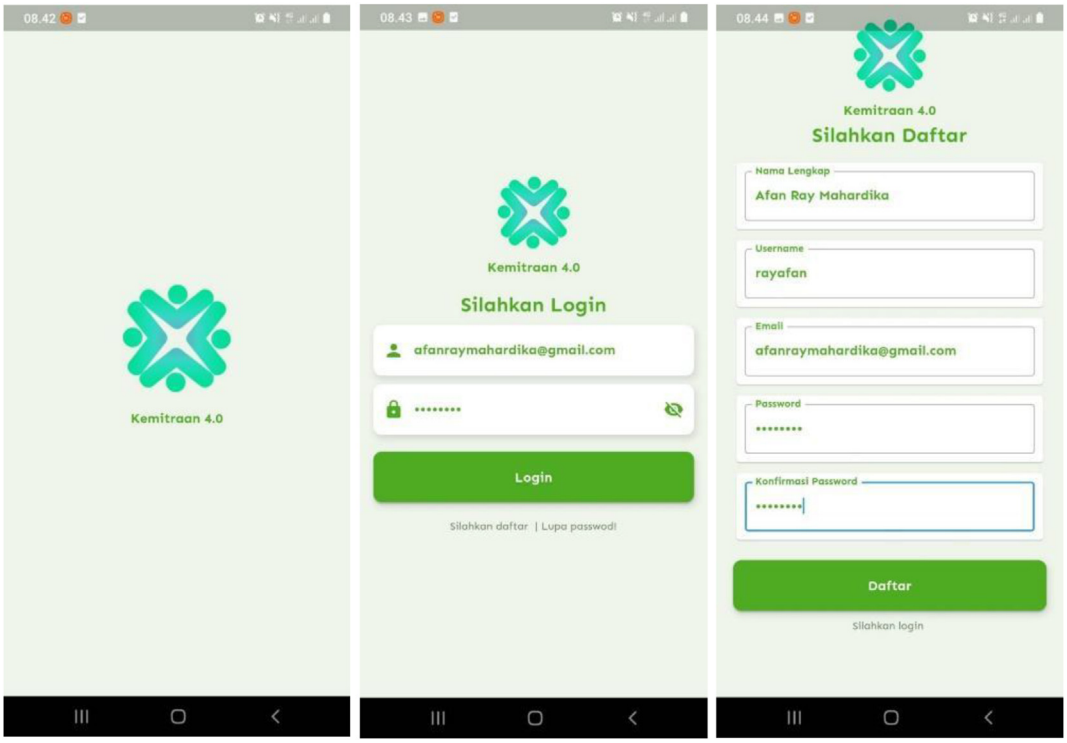

Figure 11. Partnership 4.0 application login page display.

more valid data. All data is inputted through the Partnership 4.0 application (Figure 11) which can be accessed in real-time and can be easily updated.

The Partnership 4.0 business model begins with making preparations to support the availability of data, namely using a participatory spatial mapping method, including: preparation and implementation of a census using a mobile phone instrument equipped with a Marking Object feature

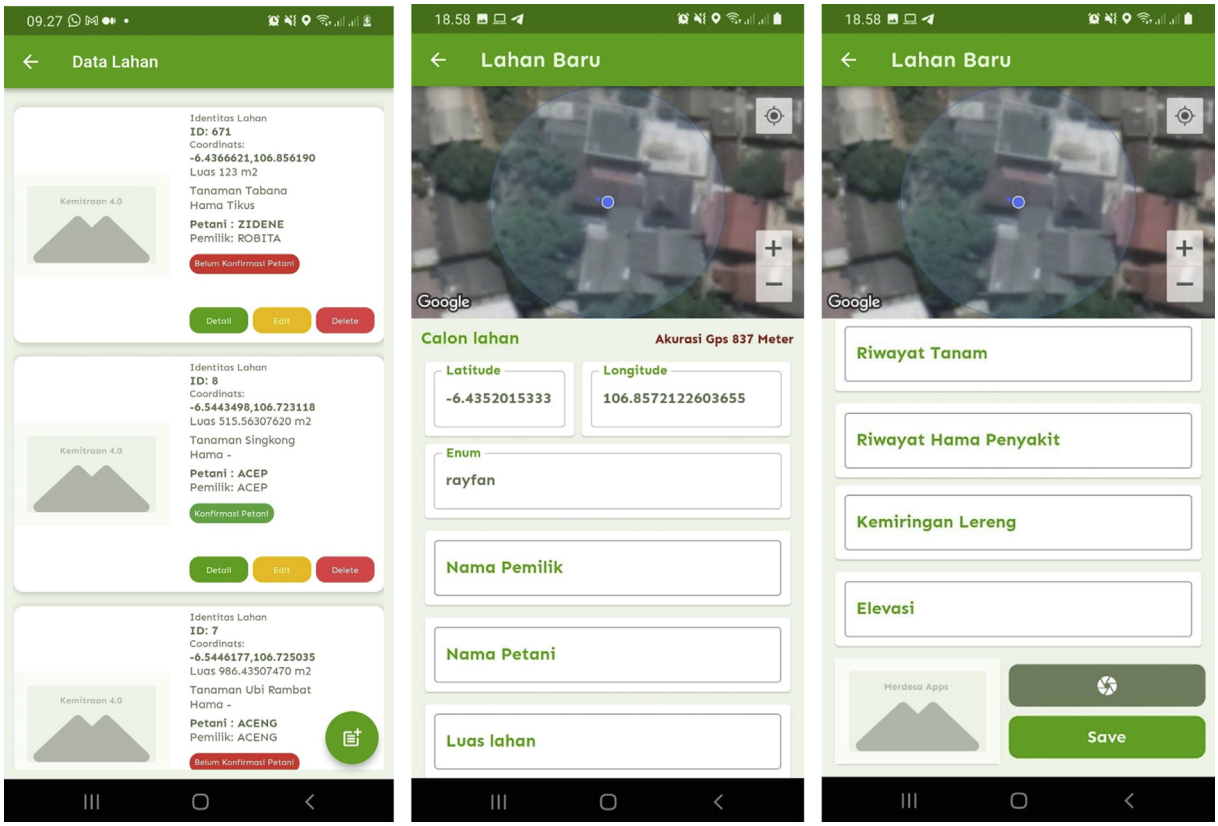

Figure 12. Display of identified land data from PLPF features in Partnership 4.0 application.

to identify information on Prospective Land Prospective Farmers (PLPF), and perform data processing and analysis (Sjaf et al., 2022). In addition to using the participatory spatial mapping method, the social approach method is also used to identify the socio-economic conditions of prospective farmers who will join the partnership. The initial target is to produce land availability data based on spatial data (Fieldsend et al., 2021).

Using the Partnership 4.0 application, data on the amount of agricultural land in Cikarawang Village covering an area of 95.79 ha (37.82%). In addition, the Partnership 4.0 application helps provide data on the status of farmers: cultivators (22 people), land owner cultivators (59 people) and land owner cultivators who also working on other lands (98 people) in Cikarawang Village. All information on farmers and the land they own and use can be used as PLPF data for the development of partnership programs that improve the welfare of farmers (Figures 12 and 13). Thus, the availability of data like this becomes a strategic matter for offtakers and universities in mapping the needs and existing conditions of development subjects.

During this action research, the research team succeeded in building a partnership process between parties (farmers, Kebun Merdesa Community and Offtakers) starting with PLPF data collection. Land collection in the planning process begins with land suitability mapping and land recommendations in accordance with the established Standard Operating Procedures (SOP). The role of the Kebun Merdesa Community (KMC) as a hub as well as a Learning Center (LC) is very important for organizing farmers and land. KMC ensures anyone who is willing to partner. So that land and commodities that are fragmented, can be organized and consolidated into a wider area and focus on 2–3 superior commodities that are needed by offtakers. Because offtakers always consider aspects of quality, quantity, and production continuity (Agyekumhene et al., 2020).

Furthermore, the role of offtaker and LC in PLPF data collection using this application is monitoring farmer activities. Monitoring activities starting from pre-harvest (land preparation and processing, seeding, planting, maintenance, and plant control) to predict the yields obtained by partner farmers and post-harvest handling processes by the offtaker market and other markets. Production results that are marketed to the

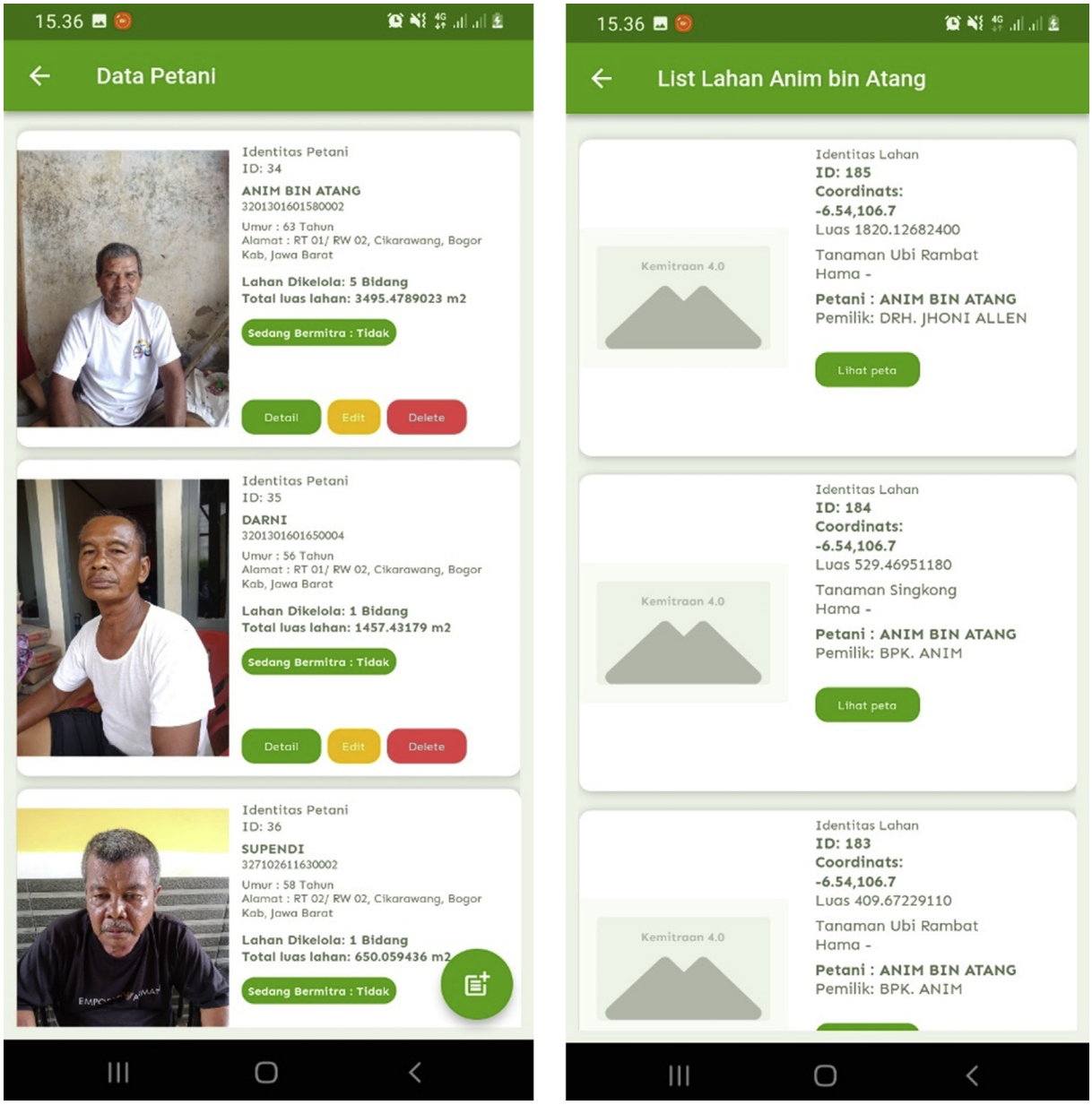

Figure 13. Display of farmer data based on the PLPF census in the Partnership 4.0 application.

offtaker market are expected to increase the income of partner farmers for the better.

Data on land conditions and land area are used to determine initial land cultivation and also the number of seeds that can be planted. The data is then adjusted to the needs of seeds that must be provided by the offtaker for each farmer. The number of seeds planted is multiplied by the potential production per yam plant and produces a production prediction. Planting times are also recorded through the monitoring page (Figure 14) to find out the estimated harvest time so that they can manage the sustainability of the production stock for the offtaker. SOPs are determined by the company and monitored through the Partnership 4.0 application. Farmers' obedience to cultivation is the key to production that is in accordance with good harvest quality and meets company standards.

The advantages obtained by farmers from partnerships carried out using the Partnership 4.0 application are market certainty and also transparency of capital and income from cultivating agricultural commodities (Fieldsend et al., 2021; Swain et al., 2022). Market certainty is obtained from sales that have collaborated with the offtaker as the buyer. Then the price transparency is obtained by farmers from data on commodity selling price fluctuations which are reported every day through the application. Business capital and income are also recorded and calculated through the application. Each cultivation activity is recorded by farmers and supervisors from the company and then the capital used by each party is calculated. The Partnership 4.0 application provides a yield prediction feature that farmers can use (Figure 15).

The way to use it is to enter the required information including land area, number of plots, and spacing. The results of the information that has been entered will produce a population number that can be used to predict crop yields. The yields obtained from cultivation activities are weighed, then the total income is generated from the product of the number of harvest scales with the selling price at the time of sale. While the income estimation feature includes information on the amount of capital from companies and farmers as well as the total income that will be obtained from sales (Figure 15).

By utilizing the Partnership 4.0 application, each party involved in the partnership can monitor each other's agricultural business processes. Based on research by Dilipkumar & Ingle (2021), the process of outreach and community empowerment as well as public services requires increased transparency and trust between partners. The Partnership 4.0 application has the potential to answer the need for transparency and increase trust between the parties involved. Increased transparency and trust between parties by utilizing technology is believed to be able to increase the efficiency and effectiveness of production results as the results of the study of Kharel et al. (2022).

4.2. Partnership 4.0 and the digital industrial revolution: smallholder partnership solutions

The increasingly massive digital era has shown the rapid growth of the business and social sectors, including in rural areas. Nowadays, everything is easy to share, including knowledge and power itself (Ritzer, 2011). The internet has become an important aspect of life because of its characteristics that facilitate access to information and socialization (Dolunay et al., 2017). The presence of the internet and the massive use of social media has accelerated the process of decentralizing power and knowledge. In this framework, the digital revolution in agriculture is very possible so that the redistribution of profits can be more equitable, especially for farmers (Lele and Goswami, 2017). In short, agricultural innovation with a technological approach should also be able to build a better order. In that context, it is important to encourage an efficient partnership pattern using digital platform, which means it is also transparent because it can be accessed by every party, and in the end a mutually beneficial partnership pattern (Agyekumhene et al., 2020; Fieldsend et al., 2021). The strategic step that must be taken in developing partnership 4.0 in the era of disruption is to encourage digital

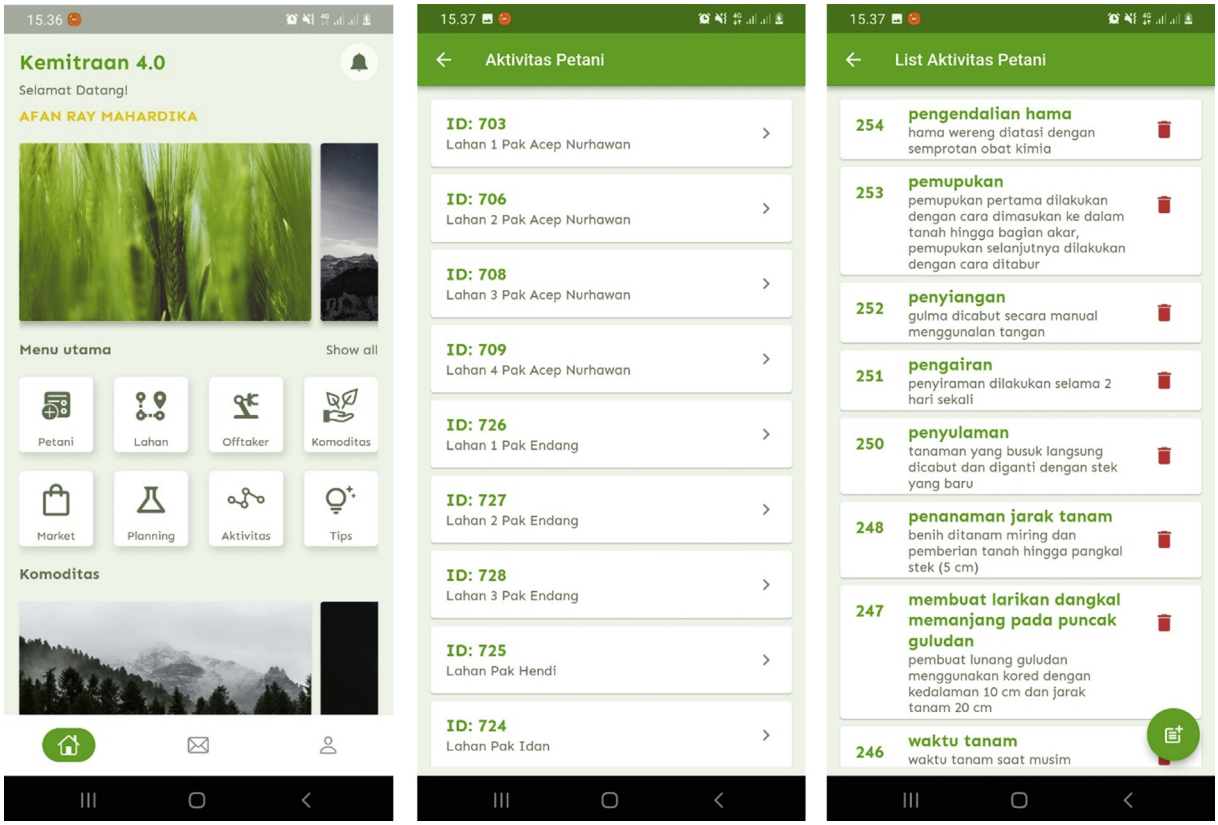

Figure 14. Display of monitoring data on farmer's cultivation activities based on their land in the Partnership 4.0 application.

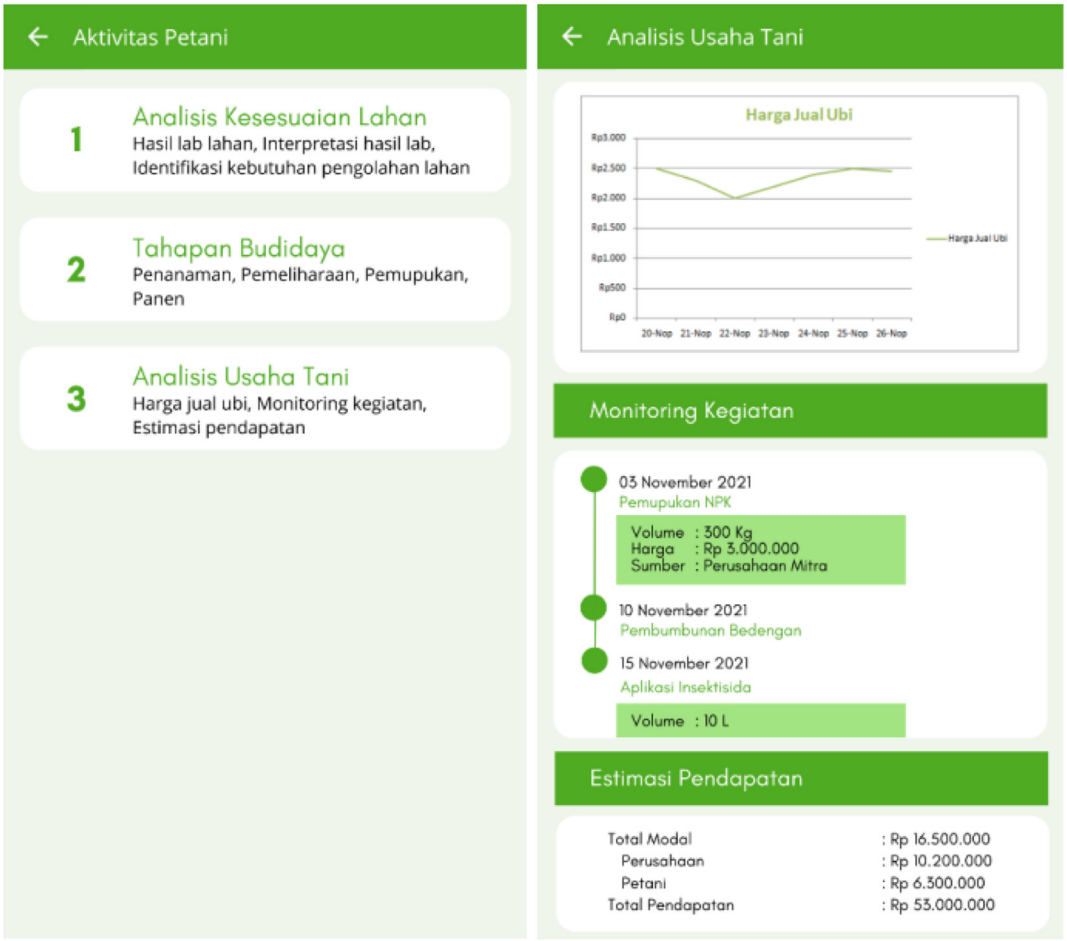

Figure 15. Farming business prediction display design in the Partnership 4.0 application.

literacy for farmers (Lele and Goswami, 2017). Digital literacy teaches farmers to be literate in using digital platforms and encourages farmers to monitor commodity prices. Farmers can also monitor the development of commodity cultivation systems within the partnership (Fharaz et al., 2022; Lele and Goswami, 2017; Suebsombut et al., 2020).

Digital literacy opens farmers' access to e-commerce systems characterized by online buying and selling. Farmers' participation in digital financial markets can also be measured by their involvement in digital payments, digital wealth management and digital credit in rural areas (Su et al., 2021). This potential can be used in the development of the 4.0 partnership system in Cikarawang Village. The development of the digital economy in the era of disruption will be able to encourage the welfare of farmers in rural areas. In this study, digital literacy was used for organizing farmers and developing networks between farming communities in Cikarawang Village.

Organizing farmers through partnership 4.0 can maximize economic potential that has not been touched by digital technology. For example, if the business activities of the farmers are still carried out separately and are not organized. This organizing activity encourages an increase in cost benefits (Ru-Zhue et al., 2022; Su et al., 2021). The partnership application 4.0 is an important promotional tool to strengthen business brands. The concept of digitization is considered to be increasing and bringing new changing trends in emerging markets including rural industries. Despite increasing digitization, the development of rural communities remains reflected in the ability of diverse local communities to mobilize and manage the resources available to them to meet unique local needs (Mccarthy and Brennan, 2009). Thus, the new digital revolution for rural industrialization is the right path to success (Lekhanya, 2018).

Furthermore, the sustainability of rural industrialization can occur, if the industrialization carried out is to increase the added value of the existing resources in the village without being separated from the culture of the community (Sajogyo and Tambunan, 1983). However, rural industrialization that has been built so far is more likely to cause damage to the village nature and increase economic inequality (Micu et al., 2022). This happens because of the development bias of non-agricultural industrialization that develops unproductively for rural households, offering incomes equal to or even more than traditional agriculture (Briones, 2017).

During this Covid-19 pandemic, the 4.0 partnership system increasingly supports forms of farmer organization to strengthen farmer cohesiveness in developing their business. The use of digital partnership applications forms a partnership network, market certainty, and opens up space for access to agricultural assistance programs from various parties (Micu et al., 2022; Zantsi et al., 2022). Therefore, the Covid-19 pandemic can accelerate rural digitalization that not only considers economic aspects, but also various other issues, such as: health, environmental sustainability, culture, on the application of digital technology. Currently, concern for sustainability aspects in villages has increased from several dimensions (Milán-García et al., 2019). Unfortunately, the village has not actually been managed to achieve the fulfillment of quality basic human rights in a fair and equal manner, for the welfare of the villagers and the realization of inclusive and quality economic growth (Sjaf et al., 2021). The potential of human, environmental and economic resources, including various problems in rural areas, must be a starting point as a sustainable development strategy (Antic et al., 2017). Villages must have strategies to improve their development based on accurate data information, local community capabilities and rational future-oriented

development planning through innovations that encourage increased production and equitable distribution of welfare (Arham et al., 2019; Balaban et al., 2019; Brennan et al., 2007)).

5. Conclusions

Rapid advances in technology and science require our ability to adapt and find partnership solutions that favor smallholders. The study concludes the importance of identifying agricultural land based on land use and ownership. Land use is useful for viewing land use in general (including determining village typology). Land ownership is also useful for knowing the identity and condition of farmers. This research has succeeded in showing that the typology of the research village is a field that is planted with various types of agricultural crops (such as: corn, taro, sweet potato, cassava and others). The status of farmers is divided into three statuses, namely cultivators, owners and cultivators of their own land, and owners who work on their own land at the same time working on other people's land with an average access to management/utilization of agricultural land for each farmer with an area of 3,437.32 M2.

Due to this condition, serious problems were found regarding commodity fragmentation in smallholder lands (19 types of commodities). The cause of this fragmentation is the unequal pattern of partnerships between farmers and middlemen. Distribution of profits is enjoyed unilaterally by middlemen in the distribution chain, and not vice versa for farmers. This partnership pattern will never improve the welfare of farmers, so a new partnership pattern is needed that provides benefits to small farmers as the case study adopted in this research.

The new partnership concept referred to in this article is a partnership pattern that is adaptive to change and able to improve the welfare of farmers or with the term Partnership 4.0. Partnership 4.0 is a partnership that is built based on technology and information that is fully accessed by farmers to jointly control agricultural activities (upstream-downstream). This partnership is carried out by those who agree to partner (farmers – offtakers). Partnership 4.0 encourages farmers to determine and accept commodity prices that are appropriate or not in accordance with market prices. This partnership pattern opens up opportunities for greater farmer organization within village units and between villages so that communication and coordination of planting agricultural commodities can be developed that are profitable for farmers. Not only that, Partnership 4.0 avoids competition between farmers and instead builds cooperation between farmers and offtakers with the principle of mutual benefit and welfare. Finally, partnership 4.0 is not just presenting applications (platforms) used by those who partner. However, this application is used to ensure everything, from precise data collection related to PLPF, monitoring farmer activities (planting, fertilizing, and caring for plants), estimating profits from planted commodities, to control between two parties, farmers and offtakers.

6. Patents

The *Data Desa Presisi* (DDP) with the Drone Participatory Mapping (DPM) approach used in this study has Intellectual Property Rights No. EC00202040860 on October 15, 2020.

Declarations

Author contribution statement

1) Conceived and designed the experiment: Sofyan Sjaf, Ahmad Aulia Arsyad, Afan Ray Mahardika, La Elson, Lukman Hakim.

2) Performed the experiment: Sofyan Sjaf, Ahmad Aulia Arsyad, Afan Ray Mahardika, Rajib Gandi, La Elson, Lukman Hakim, Zessy Ardinal Barlan, Rizki Budi Utami, Sri Anom Amongjati.

3) Analyzed and interpreted the data: Sofyan Sjaf, Ahmad Aulia Arsyad, Rajib Gandi, La Elson, Lukman Hakim, Zessy Ardinal Barlan, Sri Anom Amongjati, Sampean.

4) Contributed reagents, materials, analysis tools or data: Afan Ray Mahardika, Rizki Budi Utami, Badar Muhammad, Danang Aria Nugroho.

5) Wrote the paper: Sofyan Sjaf, Ahmad Aulia Arsyad, Afan Ray Mahardika, Rajib Gandi, La Elson, Lukman Hakim, Zessy Ardinal Barlan, Sri Anom Amongjati, Sampean.

Funding statement

Sofyan Sjaf was supported by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi [2901/E3/PKS.08/KL/2021].

Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare the following conflict of interests: Partnership 4.0 application has received patent (Reg. Number 000316179), by the Ministry of Law and Human Rights of the Republic of Indonesia.

Additional information

No additional information is available for this paper.

Acknowledgments

Thank you to the Directorate General of Higher Education, Ministry of Education and Culture, Research and Technology, PT Askara Daulat Desa, STP IPB University, and the Research Team who provided support so that this research was carried out.

References

ADB, 2018. Indonesia: Inclusive Business in Indonesia— Improving Supply Chain Efficiency through Inclusive Business.
Aeni, E.F., 2017. Peranan Kemitraan dalam Rantai Nilai Ubi Jalar di PT Galih Estetika Indonesia. Kabupaten Kuningan, Jawa Barat.
Agyekumhene, C., de Vries, J., van Paassen, A., Schut, M., MacNaghten, P., 2020. Making smallholder value chain partnerships inclusive: exploring digital farm monitoring through farmer friendly smartphone platforms. Sustainability 12 (11).
Antic, M., Santic, D., Kasanin-Grubin, M., Malic, A., 2017. Sustainable Rural Development in Serbia-Relationship between population dynamicss and environment. J. Environ. Protect. Ecol. 18 (1), 323–331.
Arham, I., Sjaf, S., Darusman, D., 2019. Strategi pembangunan pertanian berkelanjutan di Pedesaan berbasis citra drone. J. Ilmu Lingkung. 17 (2), 245–255.
Balaban, M., Župljanin, S., Nešović, D., 2019. Regional sustainability of local and rural development. Ekonomika Poljoprivrede 66 (4), 1173–1186.
Beber, C.L., Langer, G., Meyer, J., 2021. Strategic actions for a sustainable internationalization of agri-food supply chains: the case of the dairy industries from Brazil and Germany. Sustainability 13 (19).
Berger, H.F.L., Gewin, P., 1983. Coomunication Strategies. The Interstate Orienters and Publisher, Inc.
Bhatia, M., Janardhana, G.M., 2020. Agriculture supply chain management - an operational perspective. Brazilian J. Operat. Product. Manag. 17 (4).
Bhatia Kiran, V., 2018. Participatory communication developing alternative epistemes for emancipation. Asian J. Appl. Commun. 7 (1), 1–10.
Bjärstig, T., 2017. Does collaboration lead to sustainability? A study of public-private partnerships in the Swedish mountains. Sustainability 9 (10).
BPS, 2018. The Result of Inter-census Agriculture 2018. BPS-Statistics Indonesia.
Brennan, M.A., Barnett, R.v., Lesmeister, M.K., 2007. Enhancing local capacity and youth involvement in the community development process. Community Dev. 38 (4), 13–27.
Briones, R.M., 2017. Transformation and Diversification of the Rural Economy in Asia. The IFAD, Research Series Philippine Institute for Development Studies.
Cai, J., Wang, T., Xia, X., Chen, Y., Lv, H., Li, N., 2019. Analysis on the choice of livelihood strategy for peasant households renting out farmland: evidence fromwestern poverty-stricken areas in China. Sustainability 11 (5).
Creswell, J.W., Clark, V.L.P., 2017. Designing and Conducting Mixed Methods Research. Sage publications.

Dilipkumar, R.G., Ingle, S.G., 2021. Public-private partnerships in agriculture. Agriculture and Food: E-Newsletter 3 (10), 359–361. https://www.researchgate.net/publication/355166574.
Dolunay, A., Kasap, F., Keçeci, G., 2017. Freedom of mass communication in the digital age in the case of the internet: "Freedom house" and the USA example. Sustainability 9 (10).
Feng, L., Zhang, M., Li, Y., Jiang, Y., 2020. Satisfaction principle or efficiency principle? Decision-making behavior of peasant households in China's rural land market. Land Use Pol. 99.
Fharaz, V.H., Kusnadi, N., Rachmina, D., 2022. Pengaruh literasi digital terhadap literasi E-marketing pada petani. J. Agribisnis Indonesia 10 (1), 169–179.
Fieldsend, A.F., Cronin, E., Varga, E., Biró, S., Rogge, E., 2021. 'Sharing the space' in the agricultural knowledge and innovation system: multi-actor innovation partnerships with farmers and foresters in Europe. J. Agric. Educ. Ext. 27 (4), 423–442.
Foucault, M., 2013. Archaeology of Knowledge. Routledge.
Ghai, D., Lee, E., 1979. Agrarian Systems and Rural Development. Macmillan.
Hayami, Y., Kikuci, M., 1982. Asian Village Economy at the Crossroads: an Economic Approach to Institutional Change. The Johns Hopkins University Press.
Hishe, H., Giday, K., van Orshoven, J., Muys, B., Taheri, F., Azadi, H., Feng, L., Zamani, O., Mirzaei, M., Witlox, F., 2021. Analysis of land use land cover dynamics and driving factors in desa'a forest in northern Ethiopia. Land Use Pol. 101.
Irawan, Bambang, Ariningsih, Ening, 2015. Dinamika kebijakan dan ketersediaan lahan pertanian. In: Irawan, Bambang, Ariningsih, Ening, Pasandaran, Effendi (Eds.), Panel Petani Nasional: Mobilisasi Sumber Daya Dan Pengutatan Kelembagaan Pertanian. Badan Penelitian dan Pengembangan Pertanian and IAARD Press, pp. 9–26.
Jiao, W., Min, Q., 2017. Reviewing the progress in the identification, conservation and management of China-nationally important agricultural heritage systems (China-NIAHS). Sustainability 9 (10).
Kaupa, S., Shindume, S., 2022. Effectiveness of the Public-Private Partnership Initiatives in Agriculture in Namibia Management View Project. www.ijicc.net.
Kharel, T.P., Ashworth, A.J., Owens, P.R., 2022. Linking and sharing technology: partnerships for data innovations for management of agricultural big data. Data 7 (2).
Lekhanya, L.M., 2018. The digitalisation of rural entrepreneurship. In: Entrepreneurship - Trends and Challenges. InTech.
Lele, U., Goswami, S., 2017. The fourth industrial revolution, agricultural and rural innovation, and implications for public policy and investments: a case of India. Agric. Econ. 48, 87–100.
Liu, S.Y., Yen, C.Y., Tsai, K.N., Lo, W.S., 2017. A conceptual framework for agri-food Tourism as an eco-innovation strategy in small farms. Sustainability 9 (10).
Luthfi, A.N., 2018. Reforma kelembagaan dalam kebijakan reforma agraria era Joko Widodo-Jusuf Kalla. BHUMI: J. Agraria Dan Pertan. 4 (2), 140–163.
Lybaert, C., Debruyne, L., Kyndt, E., Marchand, F., 2021. Competencies for agricultural advisors in innovation support. Sustainability 14 (1), 182.
Mccarthy, M., Brennan, M., 2009. Food risk communication : some of the problems and issues faced by communicators on the Island of Ireland (IOI). Food Pol. 34 (6), 549–556.
Micu, M.M., Dumitru, E.A., Vintu, C.R., Tudor, V.C., Fintineru, G., 2022. Models underlying the success development of family farms in Romania. Sustainability 14 (4).
Milán-García, J., Uribe-Toril, J., Ruiz-Real, J.L., de Pablo Valenciano, J., 2019. Sustainable local development: an overview of the state of knowledge. Resources 8 (1), 1–18.
Nut, N., Mihara, M., Jeong, J., Ngo, B., Sigua, G., Prasad, P.V.V., Reyes, M.R., 2021. Land use and land cover changes and its impact on soil erosion in stung sangkae catchment of Cambodia. Sustainability 13 (16).
Okitasari, H., Kasih, P.H., Mauliddina, Y., Safrudin, Y.N., 2021. Food agriculture supply chains during a pandemic. J. Logist. Supply Chain 1 (2), 45–56. https://ejournal.upi.edu/index.php/JLSC.
Oliveira, M. de F., da Silva, F.G., Ferreira, S., Teixeira, M., Damásio, H., Ferreira, A.D., Gonçalves, J.M., 2019. Innovations in sustainable agriculture: case study of lis valley irrigation District, Portugal. Sustainability 11 (2).
Portales, L., 2019. Social innovation and social entrepreneurship. In: Social Innovation and Social Entrepreneurship. Springer International Publishing.
Rahman, D., Moussouri, T., Alexopoulos, G., 2021. The social ecology of food: where agroecology and heritage meet. Sustainability 13 (24), 13981.
Ritzer, G., 2011. Sociological Theory. McGraw-Hill.
Ru-Zhue, J., Aujirapongpan, S., Songkajorn, Y., Jiraphanumes, K., 2022. The effect of technological organization on cost innovation and value creation. Emerg. Sci. J. 6 (2), 322–336.
Rudolph, N., Millei, Z., Alasuutari, M., 2019. Data practices and inequality in South African early childhood development policy: technocratic management versus social transformation. S. Afr. J. Chem. Eng. 9 (1), 1–11.
Sajogyo, Tambunan, 1983. Industrialisasi Pedesaan. Pusat Studi Pembangunan Lembaga Penelitian. Institut Pertanian Bogor.
Samoggia, A., Perazzolo, C., Kocsis, P., del Prete, M., 2019. Community supported agriculture farmers' perceptions of management benefits and drawbacks. Sustainability 11 (12), 3262.
Sampean Wahyuni, E.S., Sjaf, S., 2019. The paradox of recognition principles in village Law in ammatoa kajang indigenous community. Sodality: J. Sosiologi Pedes. 7 (2), 195–211.
Scheurich, A., Penicka, A., Hörtenhuber, S., Lindenthal, T., Quendler, E., Zollitsch, W., 2021. Elements of social sustainability among austrian hay milk farmers: between satisfaction and stress. Sustainability 13 (23).
Schils, R., Philipsen, B., Hoekstra, N., Holshof, G., Zom, R., Hoving, I., van Reenen, K., Stienezen, M., Klootwijk, C., van der Werf, J., Sebek, L., van Eekeren, N., van Dixhoorn, I., van den Pol-van Dasselaar, A., 2019. Amazing grazing: a public and private partnership to stimulate grazing practices in intensive dairy systems. Sustainability 11 (20).
Sjaf, S., 2019. Involusi Republik Merdesa. IPB Press.
Sjaf, S., Elson, L., Hakim, L., Godya, I.M., 2020. Data Desa Presisi. IPB Press.
Sjaf, S., Kaswanto, K., Hidayat, N.K., Barlan, Z.A., Elson, L., Sampean, S., Gunadi, H.F.F., 2021. Measuring achievement of sustainable development goals in rural area: a case study of sukamantri village in bogor District, West Java, Indonesia. Sodality: J. Sosiologi Pedes. 9 (2).
Sjaf, S., Sampean, Arsyad, A.A., Elson, L., Mahardika, A.R., Hakim, L., Amongjati, S.A., Gandi, R., Barlan, Z.A., Aditya, I.M.G., Maulana, S.A.B., Rangkuti, M.R., 2022. Data Desa Presisi: a new method of rural data collection. MethodsX 9.
Su, L., Peng, Y., Kong, R., Chen, Q., 2021. Impact of e-commerce adoption on farmers' participation in the digital financial market: evidence from rural China. J. Theor. Appl. Electr. Comm. Res. 16 (5), 1434–1457.
Suebsombut, P., Chernbumroong, S., Sureephong, P., Jaroenwanit, P., Phuensane, P., Sekhari, A., 2020. Comparison of Smart Agriculture Literacy of Farmers in Thailand. In: 2020 Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering (ECTI DAMT & NCON), 242–245.
Sulistiyani, A.T., 2004. Kemitraan Dan Model-Model Pemberdayaan. Gava Media.
Swain, H.S., Chandrakumar, M., Swain, S., Muruganthi, D., Vanitha, G., 2022. Assessing a digital agri tech start-up landscape and identifying potential opportunities for partnerships and funding. ~ 29. Pharma Innov. J. 7, 29–38. www.thepharmajournal.com.
Wei, T., Liu, Y., Wang, K., Zhang, Q., 2021. Can crop insurance encourage farmers to adopt environmentally friendly agricultural technology—the evidence from shandong Province in China. Sustainability 13 (24), 13843.
Zantsi, S., Hlakanyane, L., Nkunjana, T., 2022. Towards a united South African agriculture: a review of social networking between black smallholder and white commercial farming communities through farmer organisations. Int. J. Afr. Renaiss. Stud. Multi. Inter. Transdisc. 17 (1), 146–170.