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The Sustainability of Contract Farming Model: A Case Study of an Agribusiness Company

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Abstract

The benefits of the agricultural partnership for companies are achieving supply continuity and quality. Meanwhile, partner farmers get price guarantees and marketing certainty. However, several aspects threaten sustainability. As a case study of PT SSS, this research used qualitative descriptive analysis. The results of the situational analysis show that the performance of PT SSS in 2021 is positive as reflected in the sales, profits, market share, and additional workforce, while the performance of partner farmers also is positive during the partnership with the company. There are two partnership patterns adopted by PT SSS, i.e. the plasma core and the trading partnership. In the plasma core partnership, the partner company is obliged to accommodate the partner farmers' harvests according to the agreed quantity and price and the company provides agricultural input credit. Trade partnerships are carried out if the supply of plasma core partnerships is not met. Problem analysis based on the fishbone method includes four dimensions, i.e. economic, social, environmental, and governmental. The policy implications needed are: 1) Strengthening the commitment to continue mutually beneficial partnerships, 2) Written partnership contracts containing rights and obligations, rewards, and punishments, 3) Establishment of farmer insurance, activation of farmer groups, and mentoring and counseling programs, 4) Adoption of more environmentally friendly technology and improvement of farm's and company's efficiency, 5) The adoption of innovation in marketing, products, and methods/processes/production techniques for PT SSS, 6) Government's commitment to reconsider land conversion, 7) Coordination with the government regarding the accessibility and affordability of subsidized fertilizers. Both the partner farmers and the company are committed to continuing contract farming, but there are technical aspects that need to be followed up and require the commitment of various stakeholders.

Keywords: partnership, supply, social, economic, environment
JEL classification: Q12, Q13, Q18

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1. Introduction

In various countries, the agricultural sector plays a role crucially in developing the national economy reflected by its high contribution to GDP (Chongela, 2015; Muradi & Boz, 2018; Suryahadi et al., 2012; Yu & Wu, 2018)the Mean Model was employed to estimate the contribution of agriculture sector to the Tanzanian economy. Moreover, the significant contribution of crops, livestock and fisheries subsectors to the Agriculture Gross Domestic Product (AgGDP. Specifically during the COVID-19 pandemic, as other economic sectors have contractions, the agricultural sector is growing positively. It

acts as the main pillar of the national economy (Cariappa et al., 2021). Although the product distribution is obstructed because of social limitation policy implementation, generally the value chain of agricultural products still runs smoothly. That condition is caused by the agricultural and food sectors are society's basic needs. Therefore, their value chain including agricultural inputs continuous to run smoothly. The agricultural sector in rural areas is proven in providing job fields when COVID-19 pandemic among Termination of Employment Relationship in urban areas (Muttaqin et al., 2020; Sinuraya & Muslim, 2020). However, the agricultural sector development strategy needs to reconstruct to enhance the sustainability of the agribusiness system on the economic, social, and environmental sides.

Contract farming is a sustainable agribusiness strategy that formation is motivated to fulfill supply and enhance agricultural products' quality (Prowse, 2012). Contract farming plays a role in agricultural development which can solve the problems of macroeconomics, there are business inequality, work inequality, and income inequality. The principle of Contract farming is synergy and dependence so that it can attract these various inequalities. Contract farming is an effort to empower farmers and reduce economic disparities between large agro-industrial companies and small farmers (Zakaria 2015). In this case, there are two involving actors, i.e. partner companies and partner farmers. On the partner farmer side, the contract farming system solves a classic problem in the agricultural sector, i.e. low accessibility of the farmer to capital, market, agricultural input, and technology information (Junaidi & Maghdafanti, 2020). One reason that formal monetary inclusivity level in small farmers is categorized as low is less collateral. The uncertainty and high-risk agribusiness cause not many credit accessibility of monetary institutions for farmers (Mhlanga & Dunga, 2020; Shafiai & Moi, 2015). Farmers need an inclusive financial system development to enhance the sustainability of agribusiness. In addition, farmers also have a problem with low market accessibility causing a low bargaining power of farmers. Collecting traders take the benefit of farmers' ignorance to achieve a low purchase price. Farmers often do not receive the price and commodity information well because of technology access limitations. Farmers often face a problem such as the scarcity condition of agricultural inputs, i.e. seeds, fertilizers, and pesticides (Courtois & Subervie, 2014; Shokoohi et al., 2019)farmers typically have a choice between selling their products to traders who travel between villages and markets and transporting their products to the nearest market themselves. Because of communities' remoteness and poor communications with marketplaces, farmers' uncertainty about market prices is usually high. Traders may take advantage of farmers' ignorance of the market price and extract a rent from them by offering very low prices for their products. In this article, we model bargaining interactions between farmers and traders meeting at the farmgate and we study how price information affects the bargain and the balance of power. We show the conditions for Market Information Services (MIS.

A contract farming system consists of a written agreement or verbal between partner farmers and partner companies about a contract farming system, i.e. agricultural product trade and agricultural inputs, i.e. capital/monetary, seeds, fertilizers, pesticides/herbicides, etc. The agreement between farmers and companies/ partners is wished to be able to create a reciprocally profitable agribusiness ecosystem. It means partner farmers benefit from the market easiness, selling price affordability, and agricultural inputs. Meanwhile, partner companies get supply continuity and good quality agricultural products. Contract farming also plays a role in rural area establishment (Freguin-Gresh et al., 2012; Meemken & Bellemare, 2020; Tudi et al. 2021). Generally, partner companies also transfer knowledge and technology to enhance agricultural product quality and productivity. It needs the farmers' capacity development to absorb the information which impacts positively the agribusiness' working performance (Otsuka et al., 2016).

In various countries, the contract farming

system is proven to enhance the farmers' welfare by profitability because it minimizes agricultural high risks by selling price guarantee, production input availability, and market (Barrett et al., 2012; Junaidi & Maghdafanti, 2020; Kundang, 2017; Mishra et al., 2018; Rokhani et al., 2020; Satiti et al., 2017; Subkhie et al., 2009; Tongchure, 2013)both at home and abroad, coupled with policy reforms have given rise to contract farming (CF. As the agribusiness system has a higher risk, it is different from other businesses because its productivity is determined by climate and weather conditions (Michalak, 2016). It has been a general problem that agricultural commodity price tends to fluctuate and characterize seasonally, i.e. when harvest season, the price tends to be lower, and in a bad season, the price tends to be higher. This condition causes unstable farmers' income (Abdi Seyyedkolaee et al., 2017). The existence of contract farming changes the conventional marketing pattern to be more efficient because it cuts the value chain of agricultural products. There are some agribusiness actors in the agricultural commodity distribution chain from farmers to end-consumers. As farmers receive low margins because of this condition, it decreases the agribusiness competitiveness level.

Contract farming is a vertical integration form of a value chain system that possible the partner companies to have higher monitoring of the production process, quantity, quality, and agricultural result characteristics (Prowse, 2012). That system solves some problems about farmers' freedom in conducting agribusiness and farmers' dependence on partner companies. Farmers tend to have debt from partner companies as occurred to potato farmers in India. In some cases, there are some conflicts between farmers and partner companies because of the contract violation. The contract farming system does not also enhance the bargaining power of farmers directly. Contract farming has the potential to cause some agrarian conflicts that impact small-scale farmers who have no control of their agricultural areas (Vicol, 2017). Social and environmental conflicts also become the main problem as occurred in palm oil contract farming in Jambi, Indonesia (Gatto et al., 2017). Environmental conflicts such as water pollution and siltation also become the main problem in East Kalimantan, Indonesia and it is negative impact to the sustainability of agriculture sector (Gani et al., 2021). Policymakers should formulate the policy which prioritize the environmental dimension to create the development sustainability (Cahyadin et al., 2021). Because some crucial dimensions become the negative indicators of agribusiness institutional existence, it needs to re-analyze the sustainability of the contract farming model.

PT SSS is an agribusiness company whose products are vegetable products such as recento tomatoes, cherry tomatoes, bell peppers, mini cucumbers, lettuces, and shishito as the main product. Those vegetable products are supplied to hotels, restaurants, and caterings in whole vegetables, fresh-cut vegetables, and mixed salad ready to eat (PT SSS, 2022). To fulfill customers' demands, PT SSS cooperates with farmers using contract farming pattern. The agribusiness system that prioritizes economic, social, and environmental dimensions is an effective strategy to achieve sustainability in agribusiness. However, PT SSS has a problem of stagnant profit level from 2013 to 2017. In addition, there are often conflicts between the company and partner farmers because of contract violations. Partner farmers experience an environmental impact, i.e. erosion in agricultural areas (Wiryawan, 2018). Those problems can be affected the sustainability of the company particularly including three important dimensions of sustainability, there are economic, social, and environmental. As this condition influences the sustain and working performance of contract farming, it needs to formulate policy recommendation for a precise contract farming model to achieve the sustainability of agribusiness. Generally, the intentions of this research are to 1) Analyze the situational of PT SSS and partner farmers, 2) Analyze the contract farming pattern between PT SSS and partner farmers in Megamendung, Bogor Regency, 3) Analyze the problems of contract farming pattern, 4) Formulate the policy implications to achieve the sustainability of contract farming.

2. Research Method

2.1 Framework Research

To identify the company performance applies situational analysis that covers sales growth, profit, market, labor/technology, and innovation. Some researchers used the working performance, i.e. sales growth and profit to measure the working performance of a company (Santos & Brito, 2012; Yang et al., 2019)employees, customers and suppliers, environmental practices, and the society to gauge the impact of these individual dimensions on the firm's financial performance. The Hexun rating system is used to gauge a firm's CSR performance on various stakeholder dimensions as it is one of the widely accepted CSR measurement criteria in China. The firm performance is measured by Tobin's Q, return on assets (ROA. Labor growth and market share are the determinants of a company's working performance. New technology adoption increases the working performance of a company, mainly relating to production efficiency (Ali & Leifu, 2016; Liang et al., 2010). Innovation, i.e. the innovation of product, process, market, and organization are crucial factors that affect significantly the success of a company (Rosli & Sidek, 2013; Tuan et al., 2016)including product, process, marketing, and organizational innovation within a firm, is considered as one of essential component for surviving and growing. These innovation activities create value and competitive advantages for successful organizations; therefore, understanding the organization's overall innovation is the first and foremost to understand the role of innovation on firm performance. The objective of this research is to explore two parts: the impacts of innovation on the different aspect of innovation performance, then their effects to firm performance (production, market, and financial performance. In addition to that indicator, the researcher also identified the willingness to continue the pattern of contract farming in the future and the satisfaction during contract farming.

Situational analysis by partner farmer side was analyzed according to perspective in economic aspects, i.e. the satisfaction to market guarantee, price, and capital, and in social aspects, i.e. innovation/new technology adoption and training. In addition, the researcher identified the satisfaction level of a farmer in partnership with a company and the willingness to continue the contract farming pattern in the future.

Theexternalfactorthataffectsthesustainability of contract farming is the government's support, i.e. regulation and direct support. After the situational analysis of PT SSS and partner farmers, the researcher analyzed the pattern of contract farming including the identification of problems becoming material to formulate the policy recommendation to form the pattern of sustainable contract farming.

Fishbone diagram is a method used to analyze the problems of contract farming. Fishbone diagram which is also known as Ishikawa diagram was proposed by Kaoru Ishikawa in 1960s to analyze the main problem in the Kawasaki shipyards. It can visualize and convey the important relationship between the disconnected elements in the process (Jayswal et al. 2011). This method is suitable to identify the elements in each problem of contract farming sustainability. Generally, the framework diagram in this research is shown in Figure 1.

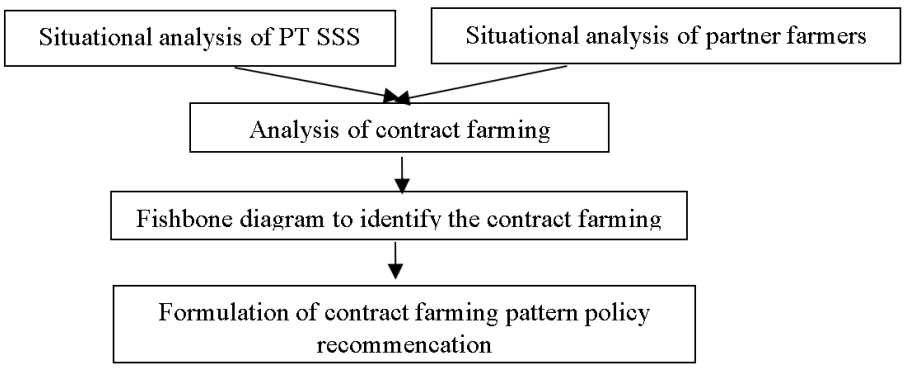

Figure 1. Framework Diagram

2.2 Scope

This research is conducted to obtain a view of the pattern of contract farming in PT SSS. Formulating the sustainable contract farming model needs a situational analysis of PT SSS and partner farmers. After having both sides' working performance views, the researcher mapped the pattern of contract farming adopted by a company. In addition, the researcher analyzed the problems relating to four sustainable dimensions, i.e. economic, social, environmental, and governmental to obtain the recommendation for sustainable contract farming.

2.3 Location and Time of Research

This research was conducted in PT SSS which locates in Megamendung Village, Cisarua Subdistrict, Bogor Regency, West Java. PT SSS was chosen as the locus of research because PT SSS is a company that implements an agricultural partnership system to meet product supply. However, the profit level of PT SSS tends to be stagnant from 2013-2017. In addition, conflicts between partner farmers and companies also often occur. Therefore, it is necessary to analyze further its sustainability and its managerial implications.

The time of research is on February 2022. By purposive sampling, the determination of research location was conducted by considering PT SSS is a company that applies the pattern of contract farming to fulfill the supply.

2.4 The Method of Collecting Data

The data used in this research are primary and secondary. The primary data are obtained by field observation and in-depth interviews by structural questionnaires to a partner company and partner farmers. Meanwhile, secondary data collection is obtained by a literature review of various existing pieces of literature. The respondent of PT SSS is the Head Division of Contract Farming. The number of partner farmers who are respondents is four persons. The researcher used purposive sampling by considering that PT SSS is a company that applies the contract farming pattern. Meanwhile, the number of partner farmers is determined by the sort of vegetables cultivated.

2.5 Data Analysis

This research is a case study research conducted in PT SSS, Megamendung Village, Bogor Regency. According to Tehubijuluw and Sugiarto (2014), a case study is a research that uses or examines one or more cases in a certain context and situation. This research was conducted on March 2022. The data that had been collected were transcripted, sorted (batched), coded, tabulated, and analyzed. Analysis methods to answer the first and second research intention are situational analysis of PT SSS and partner farmers and descriptive method to answer the second one. Zellatifanny and Mudjiyanto (2018) explained that the descriptive research method is a research method that figures the research on a subject or object objectively and some facts systematically. Descriptive research characterizes structurally, systematically, and monitored because the researcher began with an exact subject and figured out the research phenomenon accurately.

To get an overview of the research, a situational analysis was used which explained the company profile and partner farmers as well as the contract farming system applied using descriptive qualitative analysis. To answer the third research intention, i.e. analysis of the contract farming pattern problem, the used fishbone analysis which is a cause and effect analysis concept developed to describe the problem and the cautions in a fishbone framework researchers (Imani et al. 2018). In this research, the contract farming pattern sustainability problem is classified into 4 dimensions, i.e. economic, social, environmental, and governmental dimensions. After that, the formulation of a farming contract sustainability strategy was analyzed based on the results of situational analysis and problem analysis.

3. Results and Discussion

3.1 Results

3.1.1 Situational analysis of PT SSS

PT SSS is located in Megamendung Village, Bogor Regency. It was established in 2010 as a company's child of PT SM established before in 1986. The first commodity produced by PT SSS is edamame. Then, it is developing to be vegetable commodities, i.e. lettuces, bell peppers, Chinese mustard greens, sweet corns, cauliflowers, recent tomatoes, cherry tomatoes, mini cucumbers, shishito, etc. Those vegetable products are supplied to fast food restaurants and supermarkets, i.e. McD, KFC, Bakmi Gajahmada, Domino's Pizza, Lawson, Hokben, Hero, Carrefour, Hypermart, Lion Superindo, Ranch Market, Burger King, Sate Khas Senayan, Solaria, Pizza Marzano, Purantara Inflight Catering, Pizza Marzano, Purantara Inflight Catering, Lawson, Johny Rockets, PT. Intan Kenkomayo, Jaddi Foods, Rejuve, Nam Nam Resto & Noodle Bar, and Coffee Bean. PT SSS's products are whole fresh vegetables, vegetable fresh-cuts, mixed salad ready to eat, and boiled vegetables. The staff number of PT SSS is 115 persons. Table 1 mapped the staff characteristics based on education level, age, and sex. Generally, the staff of PT SSS are dominated by staff whose education levels are Junior High School, Elementary School, and not graduated, whose ages are about 20-39 years old, and who are males. In production management, PT SSS divides their staff into two shifts, i.e. morning shift and night shift according to the arrival of material.

During the COVID-19 pandemic on March 2020, the working performance of PT SSS was affected. That condition was reflected by the decreasing company's working performance, i.e. sales level, profit, and less labor. The decrease in the company's working performance not just occurred in PT SSS, but also among major companies in Indonesia affected by the global supply chain system (Anggia et al., 2021; Fu & Shen, 2020; Rababah et al., 2020; Shen et al., 2020). Not only in Indonesia, Shen et al. (2020) reported that the COVID-19 pandemic had a negative impact on industry performance, especially in the tourism, catering, and transportation sectors. Not only the manufacturing sector, but the banking sector was also negatively affected during the COVID-19 pandemic as reflected in the reduced performance of Return on Equity (ROE), Net Operating Margin (NOM), and Financing to Deposit Ratio (FDR) (Sutrisno et al., 2020)including reducing the performance of the world economy. The pandemic has changed human behavior so that it needs adaptation to new habits. Banking as a business group was also affected because the decline in company performance had an effect on the decline in banks, including Islamic banks. The purpose of this study is to examine the impact of the Covid-19 pandemic on the performance of Islamic banks in Indonesia. The performance of Islamic bank consist of capital adequacy ratio (CAR).

Table 1. PT SSS's Staff Characteristics

Respondent Characteristics	Number	Percentage (%)
Sort of staff		
permanent staff	43	37.39%
daily staff	27	23.48%
Wholesale staff	**45**	**39.13%**
Education		
Junior high school/Elementary School/Not graduated	**95**	**82.61%**
Senior High School	10	8.70%
Undergraduate (Diploma)	1	0.87%
Graduate (Bachelor)	9	7.83%
Age		

Respondent Characteristics	Number	Percentage (%)
20-39 years old	**99**	**86.09%**
40-50 years old	10	8.70%
> 50 years old	6	5.22%
Sex		
Male	**68**	**59.13%**
Female	47	40.87%

Source: Authors's calculations

Table 2. The Working Performance of PT SSS during 2021

No	Indicators of Working Performance	Trend
1	Sale	Increase
2	Profit	Increase
3	Market expansion	Increase
4	Labor increase	Increase
5	New technology adoption	Stable
6	Product innovation	Increase

Source: Authors's calculations

Table 1 shows PT SSS's working performance summarization during 2021. Generally, in 2021 the working performance was affected by the COVID-19 pandemic that entered Indonesia on March 2020. At the beginning of the pandemic, PT SSS suffered a decrease in sales turnover by 40% occurred during 5 months. Because the caution was most customers of PT SSS were affected by High Scale Social Limitation, the demand for product vegetables also decreased. The demand decrease also affected directly to 50% of PT SSS's staff who were housed, until 10% of those housed staff were terminated in working relationships because of the prolonged COVID-19 pandemic. Until now, PT SSS has not recovered as before the COVID-19 pandemic.

In 2021, the government lengthened again the policy of High Scale Social Limitation, but the rules were loosened until the end of December 2020. That condition affected positively the PT SSS's working performance in 2021. Although it has not recovered as before the pandemic, the company's working performance, i.e. selling level, profit, and labor addition show a positive trend. In 2021, there was a new customer, i.e. Sayurbox. The technology used during this time is manual and automatic technology. Although during 2021 there was no new technology adoption for all lines of management, there was a product innovation, i.e. boiled vegetables as customer's demand.

The establishment background of PT SSS involved the roles of partner farmers who have been cooperating since the beginning of the company's establishment. That condition causes this company considers the importance of partner farmers' existence to support its business management process. As PT SSS is continuing the agribusiness contract farming pattern with partner farmers in the future, the company's inclusivity will be obtained. Otherwise, there are some things to evaluate and monitor for avoiding conflicts of importance between the two sides. PT SSS admitted feeling satisfied with the working performance of the contract farming pattern applied during this time with farmers.

According to the analysis of external factors, the fertilizers' availability and affordability affect negatively the company's working performance and the sustainability of the contract farming system. It needs governmental intervention in a supply stability and fertilizer price for productivity and agribusiness' working performance generally. At the macro level, the fertilizers' availability and affordability are determinants for achieving the national food endurance. Ragimun et al. (2020) mentioned the strategies for distributing

subsidized fertilizers are implemented by some alternatives distribution, i.e. card utilization by gapoktan, subsidized fertilizer distribution by Pupuk Indonesia Mart merchant, and direct distribution to fertilizer producers. Setiawan et al. (2021) and Herath et al. (2015) stated the policy of subsidized fertilizers correlates positively to the production level and farmers' acceptance.

3.1.2 Situational analysis of partner farmer

In addition to a partner company, to analyze the sustainability of contract farming patterns, the researcher identified the background and contract farming perspective from the partner farmers' side. The number of contract farmers becoming respondents in this research is 4 persons having an area of 0.43 to 3.5 ha. In this research, the partner farmers analyzed have an education level that is not high and variation in cultivation duration, i.e. new farmers have 4 years of experience until experienced farmers for 27 years. The same condition occurred to partner farmers, i.e. new partnership for 2 years until a long partnership for 25 years. As Chinese mustard greens are the highest demand product in PT SSS, the majority of partner farmers cultivate Chinese mustard greens as the company's requirements. In addition to cultivation, some partner farmers are also sellers as their other job. Table 3 shows four profiles of partner farmers and their agribusiness.

The existence of PT SSS as the main partner of agricultural result marketing provides benefits for partner farmers because of the price certainty and market guarantee. The same condition also occurs in several agricultural partnerships in Indonesia, for example, the sugarcane partnership in Mojokerto Regency. Sugarcane companies provide market guarantees, capital assistance, and profit sharing (Azmie et al., 2019). Generally, the prices agreed by both sides tend to be higher than market prices, except when the market prices achieve the highest level. Generally, the conventional marketing by middlemen often harms the farmers because agriculture results in price information ignorance. The pattern of contract farming cuts the agricultural commodities' distribution chain becoming more efficient and effective and the farmers will receive higher profit (Meemken & Bellemare, 2020). Partner farmers admitted to being always partners of PT SSS. Another benefit received by partner farmers is an agricultural input loan accessibility paid after harvest season by direct cutting of agricultural result acceptance (Ton et al., 2018). The same partnership pattern also occurs at PT Bimandiri Agro Sedaya which also facilitates farmers by providing agricultural input credit assistance with the aim that supply chain performance can run smoothly (Rani et al., 2017).

Table 3. Partner Farmers' and Agribusiness Profile

Farmer's ID	001	002	003	004
Age	62 years old	51 years old	32 years old	41 years old
Education duration	12 years old	3 years old	6 years old	6 years old
Agricultural experience	20 years old	27 years old	4 years old	12 years old
Partnership duration	7 years old	25 years old	2 years old	10 years old
Area	3.5 ha	2 ha	0.43 ha	1 ha
Status of area	Private	Rent	Rent	Rent
Sort of vegetable becoming the product of contract farming	Chinese mustard greens	Chinese mustard greens	Chinese mustard greens	Chinese mustard greens, cauliflowers, and lettuces
Sidejob, except farmer	Seller, organic farming trainer	Seller	-	-

Source: Authors's calculations

This condition assists the capital of the partner farmer. For agribusiness, the financial capital is a crucial aspect used by farmers to purchase agricultural inputs, i.e. seeds, fertilizers, and pesticides. The loan scheme of agricultural inputs in this contract farming pattern is a policy that affects positively the sustainability of agribusiness. However, the partner farmers admitted that they have no guidance or training from the company. If there is a cultivation problem or technology/innovation adoption, a partner farmer will consult with other partner farmers having more experience.

The scarcity and high-tended price of agricultural input, i.e. fertilizers, become the general problems faced by partner farmers. Other agricultural input, i.e. pesticides, has a high-tended price. The use of chemical fertilizers and pesticides that intensity is high also affects negatively the environment. Chemical residues from pesticides affect negatively human health through pollution and food material. The use of chemical matter affects negatively pollution and global warming (Chandini et al., 2019; Tudi et al., 2021; Zhang et al., 2018). That condition affects the sustainability of contract farming, mainly from the environmental dimension. Azmie et al. (2019) explained that in order to reduce the environmental impact of the intensity of the use of chemicals, both parties, namely the Gempolkrep Sugar Factory and farmers, agreed to limit the use of chemicals, such as fertilizers and pesticides. It needs a government's participation to solve this problem. The training of synergized agricultural patterns including the environmental aspects should be conducted again by the government for obtaining the sustainability of agriculture.

3.1.3 The contract farming of PT SSS with farmers

The one of reasons of the contract farming pattern applied in PT SSS is to fulfill continuity and good quality because the product results of the area managed by PT SSS are not enough to fulfill consumers' demand. The contract farming pattern is conducted with farmers in Bogor Regency and Garut Regency. Vegetable products produced by partner farmers in Bogor Regency are all kinds of vegetables, including Chinese mustard greens, sweet corns, cauliflowers, tomatoes, cucumbers, and shishito. Meanwhile, in Garut Regency the area is specified for lettuces because lettuces cultivation is more appropriate in the area by the height of 1,000 meters on the sea surface. The number of partner farmers in Bogor Regency is 40 farmers, while in Garut Regency they are 50 farmers.

Figure 2 and Figure 3 show the comparison of vegetable land area and production in Bogor Regency and Garut Regency. Those figures show the vegetable land area and production in Garut Regency are higher than in Bogor Regency. The determination of PT SSS for conducting the expansion of contract farming with farmers in Garut Regency is evaluated right to fulfill the supply needs. Otherwise, in Bogor Regency and Garut Regency, the vegetable land area and production tend to decrease. That condition becomes a specific problem for the sustainability of PT SSS. As the harvest area decreases, the caution is the cultivation competition with other commodities and area conversion. They affect the product decrease that is not balanced with productivity increase. The climate and weather factor includes the main factor that is the caution of quality and productivity uncertainty. Climate change occurs globally that negatively affects the rainfall patterns and eventually, agricultural productivity (Ayinde et al., 2011; Bandara & Cai, 2014; Lal, 2011; Rahman & Anik, 2020).

There are two contract farming patterns of PT SSS and farmers, i.e. plasma core pattern and general trading pattern. Kundang (2017) stated that plasma core contract farming is a contract farming relationship with partner groups (farmers, farmer groups, farmer group association, cooperation, and small business) with partner farmers as core, while farmer groups as plasma. Partner company collects agricultural results, provides services, and guides farmers or farmer groups. The plasma nucleus partnership pattern has been widely adopted by various companies in Indonesia, including a partnership between eastern mushroom farmers and CV Asa Agro Corporation (Alam & Hermawan, 2017), a partnership between tea farmers and PT

Pagilaran (Perwitasari et al., 2021), and coconut farmers palm oil and PT Gunta Samba. Based on the analysis of the partnership pattern, shows a tendency that the majority of plasma farmers are satisfied with partnering with the other company, which is strongly influenced by market guarantees.

Figure 4 shows the relationship between the partner company and partner farmers in the plasma core pattern. In this research, PT SSS acts as a core that collects agricultural results and provides services. PT SSS provides the agricultural input loan scheme, i.e. seeds, fertilizers, and pesticides paid after harvest season. The agricultural input credit is not tied or partner farmers should not purchase the agricultural inputs from a partner company. The agricultural inputs, i.e. land and labor should be prepared by farmers themselves. According to the contract farming pattern, PT SSS obtains products as appropriate in number and quality, while partner farmers obtain market and price guarantees.

If the quality products are not appropriate, those products will be sold by partner farmers outside the company. In this research, the farmers or farmer groups that involve in plasma core contract farming patterns are mentioned as farmer partners, while the farmers or farmer groups that involve in general trading contract farming patterns are mentioned as partner purchasers. PT SSS also provides trainers providing a guide and training during cultivation. Several partnership patterns also provide training and mentoring for partner smallholders, an example is a partnership between PT Gunta Samba and oil palm farmers in East Kalimantan. Research conducted by Amam et al. (2019) explains that in general farmers are satisfied with the instruments contained in the partnership pattern.

In contract farming, PT SSS determines the number and sort of vegetables that will cultivate. Contract farming also relates to the purchasing price of vegetables from partner farmers consisting of the minimum and maximum prices that pattern follows the market price. Although there is a minimum purchasing price, partner farmers should have a profit because the purchasing price has considered fixed and variable production costs. The contract farming agreement runs in one cycle of plant cultivation. Then, there is a new agreement when enters the cultivation period. At first, the agreement characterizes in documents, but currently, the agreement is just characterized verbally because of the belief factor. Topan and Ifrani (2020) argue that written agreements on agricultural partnerships function as legal protection functions to resolve problems that occur. PT SSS needs to revise the partnership using a written agreement to reduce the conflicts that often occur between the two parties.

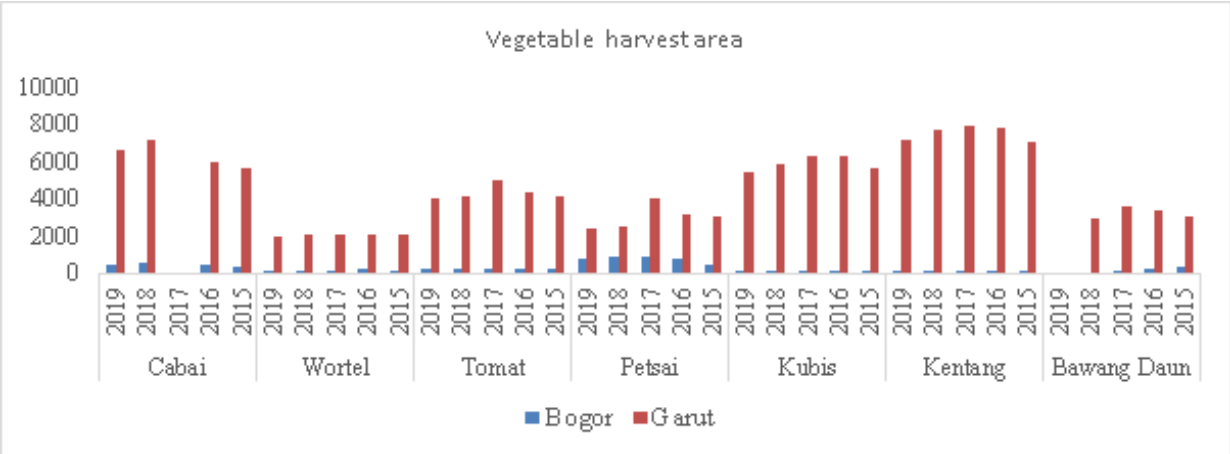

Figure 2. Vegetable Harvest Area in Bogor and Garut Regency (Source: BPS 2022)

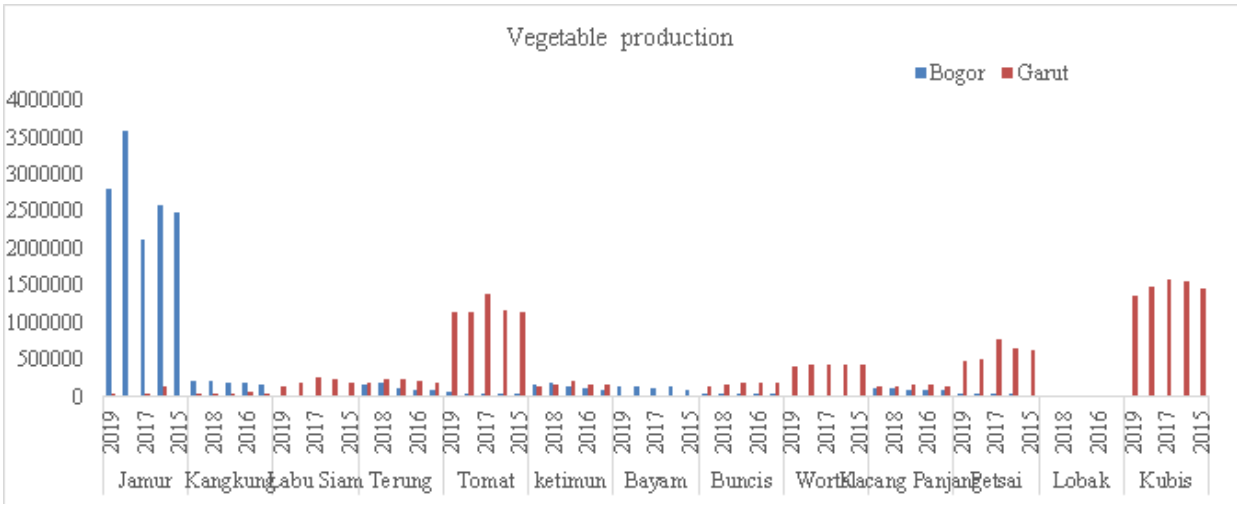

Figure 3. Vegetable production in Bogor and Garut Regency (Source BPS 2022)

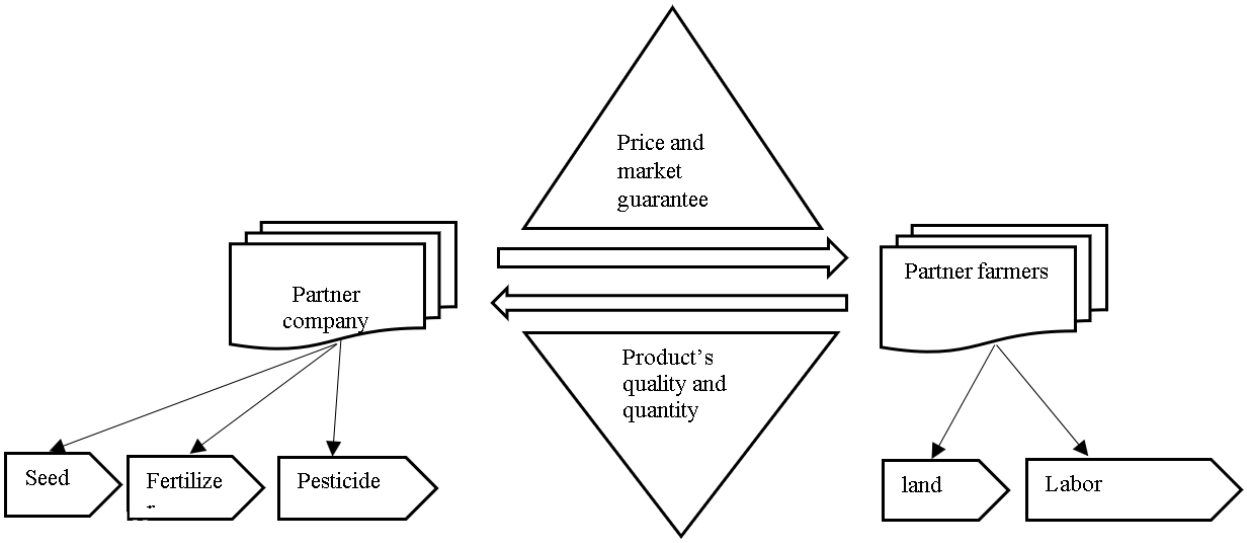

Figure 4. Nucleus Plasma Contract Farming Pattern

The plasma core contract farming pattern is applied in some sectors and other areas, i.e. broiler chicken farming in Magelang, Central Java. The research conducted by Daryanto et al. (2015) summarized the plasma core contract farming pattern enhances the economic benefits for breeders. That contract farming pattern is applied by a palm oil company in Indonesia that summarizes the plasma core contract farming simplifies the company to obtain a certificate of ISPO (Indonesia Sustainable Palm Oil) (Rosyani et al., 2021). The main farmer's motivation to conduct agribusiness is economic factor (Mariyono, 2019), so Smalley (2013) stated the farming contract pattern should be inclusively conducted, specifically to reach prosperous farmers. Second contract farming applied by PT SSS is the general trading pattern. Kundang (2017) stated the general trading pattern is a partnership between farmers or farmer groups with a partner company that just involves an agricultural result trading agreement. This contract farming pattern differs from plasma core pattern. In general trading pattern, PT SSS does not provide the facility of capital or agricultural input credit, i.e. seeds, fertilizers, and pesticides

such as in plasma core pattern. The general trading pattern is applied in PT SSS if less supply from partner farmers. The prices applied in the general trading pattern follow the market prices. The general trading pattern is important to solve the productivity uncertainty and high-quality product of vegetable cultivation. Both crucial factors are determined by external factors, i.e. weather and climate factor.

The general trading partnership pattern is also implemented by PT Nestle with coffee farmers. Even though it has several advantages such as the continuity of coffee products and value chain efficiency, coffee farmers have to work harder and add certain costs so that the quality meets the company's criteria. Just like what was done by PT SSS, the absolute price determination process was carried out by the company (Yoansyah et al., 2020). Romdhon and Sukoyono (2011) added that the general trade partnership pattern tends to require more capital because the cooperation is only limited to commodity sales, so farmers do not have credit facilities either cash or agricultural inputs to the company. Saptana et al. (2010) explain that the general trade partnership pattern tends to place farmers in a weak position, especially in terms of market guarantees and price certainty. This condition causes farmers to continue to experience the risk of price fluctuations. Generally, the general trading contract farming relationship between a partner company and partner purchasers is shown in Figure 5.

The general trading contract farming pattern adopted by lobster commodity in Bengkulu that affects positively the profit of breeder has a weakness because the contract farming agreement including the rights and obligations of company and breeder is just conducted verbally (Romdhon dan Sukiyono, 2011). The general trading pattern is also applied to the broiler chicken livestock business in Malang Regency, East Java. For sustainability that contract farming, the breeder's access to physical, economic, and social resources should be considered (Amam et al., 2019).

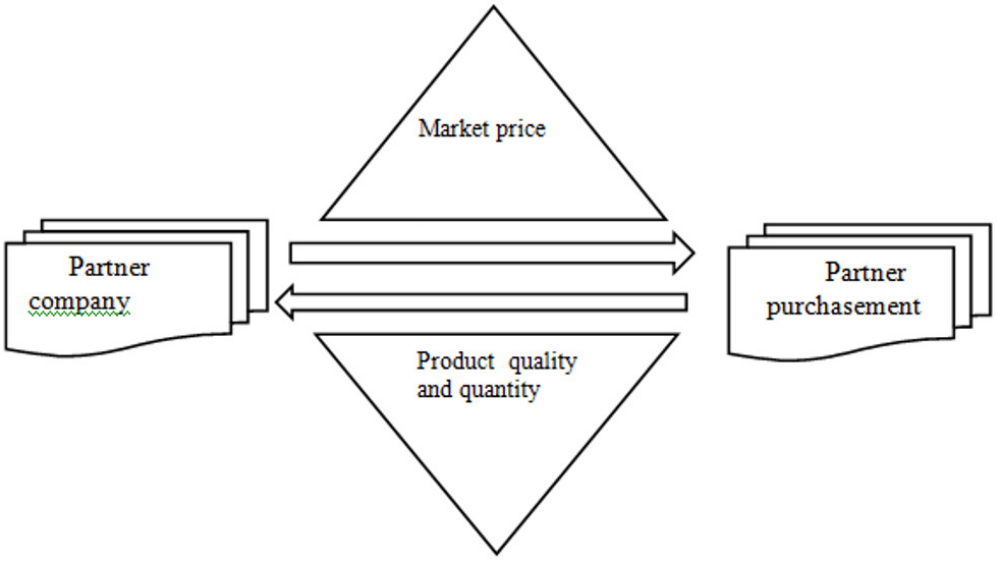

Figure 5. Relationship of the partner company and partner purchase in general trade contract farming pattern

3.1.4 Analysis of contract farming pattern problem

Many researchers stated that the contract farming pattern is a strategy to enhance profit financially for both partner companies and partner farmers side (Bellemare, 2015; Bellemare & Lim, 2018; Vande Velde and Miet, n.d.). However, in the development, there are some problems both problems caused by involving internal side and external that threaten the sustainability of contract farming. The analysis of the problem in contract farming pattern that both problems occurred by a partner company and partner farmers is shown comprehensively in Figure 6. Four main dimensions affect the sustainability of contract farming, i.e. economic, social, environmental, and governmental dimensions. Those dimensions relate to each other. The economic, social, and environmental dimensions are crucial aspects that affect the sustainability of food and agriculture (Bacon et al., 2012; Choi & Ng, 2011; Francis & Porter, 2011; Latruffe et al., 2016; Nurjati, 2022)), (Nurjati, 2022)while the governmental dimension by governmental management plays a role significantly to the competitiveness and sustainability of agricultural sector (Sebudubudu, 2010; Ugwu & Kanu, 2012). If there is a problem in a dimension, then it will affect the working performance of other dimensions (Dempsey et al., 2011).

In the economic dimension, both a partner company and partner farmers have interrelated problems. The cultivation is affected by external factors that can not be controlled, i.e. climate and weather factor that often causes harvest failure. As decreasing production and inappropriate quality cause the partner company not to purchase the agricultural results, the partner farmers will sell them to others at a lower price. The uncertainty of supply quality and quantity becomes a crucial problem in contract farming.

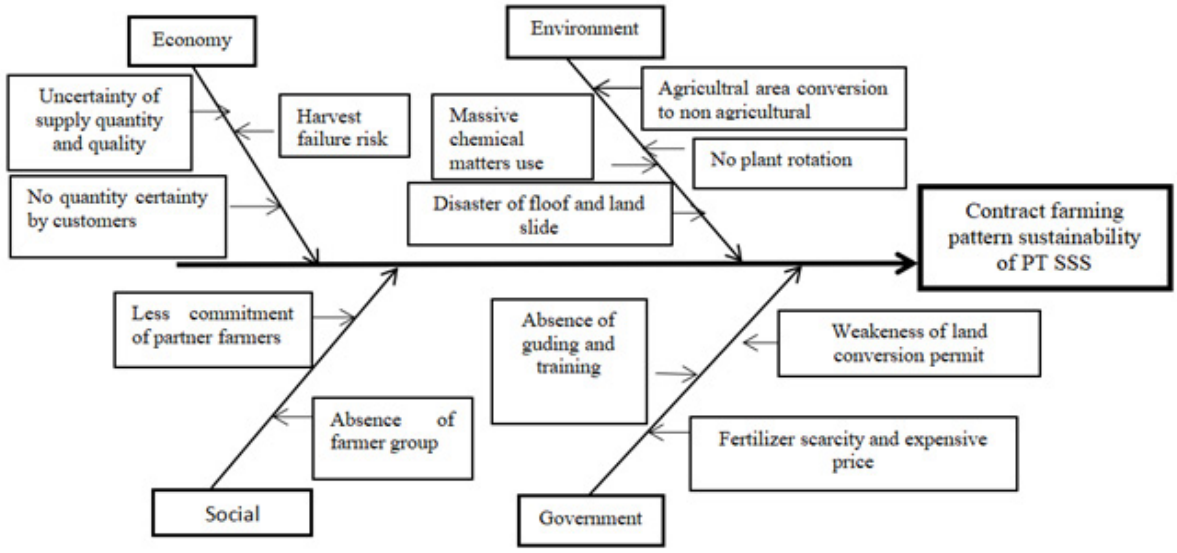

Figure 6. Fishbone Analysis

According to the environmental dimension, various problems threaten the sustainability of contract farming patterns. The problems occurred in the environmental dimension generally cause economic problems. The continuity of vegetable demand causes no plant rotation in agricultural areas. The plant rotation system is plant cultivation by rotating or planting more than one sort of different plant at different times. That system has various benefits, i.e. 1) capable to decrease the intensity of pests and illness, 2) enhancing the fertility of the soil, and 3) being a

micro ecosystem stabilizer. Because of no plant rotation, the soil's fertility decreases, and the pests and plant illnesses increase. Furthermore, that condition disturbs the ideal ecosystem. No plant rotation causes a decrease in productivity level and an increase in agricultural input costs, mainly pesticides that cause profitability received by farmers tend to decrease (Makarim & Mejaya, 2017; Taufiqurrohman et al., 2013). Certainly, it threatens the agriculture's competitiveness and sustainability, specifically vegetables. Kuntasgula and Mulenga (2014) stated the farmers in Zambia have adopted the strategy for decreasing the climate change impact by plant rotation system that also affects farmers' income by agricultural result productivity increase.

In addition, the agricultural area conversion to non-agricultural massively occurred in Puncak area, specifically Megamendung Village, Bogor Regency, becomes an important problem that should be managed. In addition, causing the vegetable land area to decrease, the area conversion also decreases the ecosystem support power needed for cultivation. The building establishment activity affects main agricultural inputs, i.e. water and soil quality decrease (Riskanita & Widowaty, 2019). Furthermore, that establishment impact also tends to cause disasters, i.e. landslides and floods (Firdaus et al., 2021; Riskanita & Widowaty, 2019). That condition is one of the main threats to the sustainability of agriculture. Government participation is needed to implement the policies regarding the environmental aspects.

Another dimension that affects the sustainability of contract farming patterns is the government that acts essentially to formulate the policies. Fertilizer is a problematic agricultural input because of the scarcity and expensive price. Government intervention is needed for farmers to obtain fertilizers at affordable prices for their cultivation. In addition to subsidized fertilizers, the strategy for distributing fertilizers to exact targets should be developed (Adnyana & Mohktar, 2019; Darwis & Supriyati, 2016). In addition, government obliges to provide training and guidance regarding cultivation to produce a harvest that obtains quality and quantity requirements. The policy regarding area conversion also needs government intervention for the sustainability of agriculture.

3.2 Discussion

The Indonesian economy relies on agricultural productivity because the agricultural sector is a sector that has a crucial influence on economic growth. However, farmers as the main actors in the agricultural sector have relatively low levels of welfare. One strategy to reduce the high level of economic inequality between farmers and traders or agricultural companies is through contract farming. Through the contract farming system, agricultural productivity can increase due to the competency and intensity of the partnership. Farmers are required to produce quality agricultural products in order to meet the specifications set by the company. On the other hand, the company provides technical guidance and counseling to increase the competence of farmers so that it has a positive effect on agricultural competitiveness. The agricultural partnership system can improve the people's economy, especially in rural areas because small farmers are assumed to get greater added value than conventional farming systems. However, the sustainability of the contract farming system needs to be analyzed further by considering several dimensional aspects and several other important issues.

The analysis of problems according to the sustainable dimension was conducted to obtain an effective policy recommendation mapping. The strategy of sustainable contract farming pattern needs an active role for various sides, not just partner companies, and partner farmers. The agribusiness problem complexity starts from upstream to downstream of agriculture. Table 4 is a mapping result for recommending the policy based on the analysis of the problem existing in each sustainable dimension. At the agricultural upstream level, a high harvest failure risk often occurs by farmers. Cultivation has a higher risk than other businesses. Zakirin et al. (2014) stated that condition is affected by climate and weather condition that can not be controlled. In addition, high-risk cultivation is also affected by

the agricultural result that tends to be perishable and durable (Musfirah et al., 2018; Rahmawati & Fariyanti, 2018; Sudrajat, 2018). That condition harms two sides, both partner farmers and partner companies that threaten the sustainability of contract farming patterns. The partner farmers suffer financial losses that can not be solved by another side. The harvest failure causes the partner companies to search for other sellers that product purchasing prices tend to be higher and need other additional costs, i.e. distribution and transportation costs.

To solve the cultivation uncertainty, the farmers need protection in a policy instrument as a mitigation step to decrease the harvest failure risk. The agricultural insurance scheme provides comfort in cultivation and the certainty to activate in the agricultural sector (Pasaribu, 2014). The agricultural insurance shows the partiality to farmers for anticipating the cultivation loss risk. With paddy cultivation insurance, there is a guarantee of plant damage because of flood, dryness, pest attack, and plant illness or plant disturbance organism. Therefore, the farmers should receive the compensation as a working capital for the sustainability of cultivation (Hidayat, 2019; Mustika et al., 2019; Septian & Anugrah, 2014; Siswadi & Syakir, 2016).

The environmentally friendly technology and knowledge adoption are essential for the sustainability of agribusiness, mainly in cultivation effectiveness and efficiency aspects needed by all lines of agribusiness, starting from cultivation, harvest, post-harvest, process until marketing (Cavallo et al., 2014). The vegetable cultivation problem generally is a high attack of pests and plant illness. For the cultivation phase, it needs technologies, i.e. adoption of pests and certain illnesses resistant seeds and more environmentally friendly biopesticides. In addition, it needs a post-harvest technology that optimizes machine use for decreasing the damage to the product. It needs a digital marketing technology for the efficiency of the value chain to accelerate the product distribution process to end consumers. Basically, technology has a function as a tool or method for the agricultural value chain that is more effective and efficient. The determination of PT SSS to prepare the purchasing partnership scenario with farmers or other sellers when supply lack of partner farmers is right because of the high uncertainty of supply.

Table 4. Recommendation of sustainable contract farming pattern based on the analysis of the problem

No	Dimension	Problem	Recommendation
1	Economy	Harvest failure risk	✓ farmer insurance formation ✓ be partner purchaser with other partner farmers ✓ adoption of environmentally friendly technology and knowledge to decrease harvest failure risk
		Supply's quality and quantity uncertainty	✓ adoption of environmentally friendly technology and knowledge to enhance agricultural results' productivity and quality ✓ be partner purchaser with other partner farmers
		No quantity certainty by customers	✓ has alternative new consumers ✓ demand increase
2	Social	Less commitment of partner farmers	✓ need written agreement between both sides ✓ existence of punishment and reward in contract farming agreement ✓ selling price should be above than market price
		Absence of farmer group	✓ coordination with local government relating to farmer group formation

No	Dimension	Problem	Recommendation
3	Environment	Massive use of chemical matters	✓ cooperation with universities or other research institutions relating to more environmentally friendly technology and knowledge adoption
		Disasters of flood and landslide	✓ law implementation relating to establishment permit in Puncak area, Bogor Regency ✓ farmer insurance formation
		Agricultural area conversion to non-agricultural	✓ law implementation relating to establishment permit, mainly agricultural area use change to non-agricultural
		No plant rotation	✓ coordination with partner company relating to plant rotation ✓ partner farmer addition to manage less supply
4	Government	Absence of guidance and training	✓ cooperation with local government to form farmer groups and activate guidance and training activities
		Weakness of area conversion permit	✓ enhancement of agricultural competitiveness prioritizing farmers' welfare ✓ strengthening the environmental permit in Puncak area, Bogor Regency
		Fertilizer scarcity and expensive prices	✓ need central government intervention to reallocate fertilizer amounts in certain areas. Therefore, there is no lack or excessive supply. ✓ monitoring the fertilizer distribution more intensively ✓ fertilizer subsidy system in long term ✓ utilization organic fertilizer which is a more affordable price

Source: Authors

In the social dimension, less commitment of partner farmers in contract farming is reflected in the disobedience of partner farmers that sell their agricultural results to other sellers. That condition is conducted by partner farmers when market prices are higher than the maximum prices agreed. As it harms the partner company by disturbing the supply plan, the alternative strategy to solve that problem is a written agreement stating the rights and obligations of both sides and providing the punishment and reward to partner farmers. Partner farmers get a punishment when they disobey the written agreement. On contrary, they get a reward when they obey the rules. In a contract farming agreement, the maximum price that is appropriate to the market price is applied for a sustainable contract farming pattern. Therefore, the partner farmers will be loyal to the partner company because their income is guaranteed by the contract farming pattern scheme.

Partner farmers admit they do not join the farmer groups. Even they do not know the existence of farmer groups. The absence of farmer groups in partner farmers limits the access to information about agriculture among cultivation, post-harvest, and marketing aspect. Through farmer groups, partner farmers will obtain technology and knowledge dissemination easily (Nikoyan et al., 2020). The effort to form farmer groups needs an initiation from the local government and partner company. The existence of partner farmer groups activates routine activities, i.e. training, guidance, and new knowledge and technology dissemination. Therefore, partner farmers are not just demanded to produce high-quality products

and productivity, but they also get a facility to develop their capability by participating in farmer groups.

Environmental dimension roles essentially in the sustainability of contract farming. If an aspect of the environmental dimension is disturbed, it will affect negatively other dimensions, i.e. economic and social. There are some activities of partner farmers that threaten the sustainability of the environment, i.e. the use of chemical matters such as fertilizers and pesticides (Datta et al., 2016). By in-depth interview, partner farmers tend to use fertilizers and pesticides intensively and they consider the use of fertilizers and pesticides as the only alternative to conduct agricultural intensification. That situation is against the sustainable cultivation concept that prefers using more environmentally friendly organic materials, considering humans as consumers. For creating sustainable agriculture, organic material dissemination as the substitute for chemical fertilizers and pesticides is needed by cooperating with local government or a partner company with research institutions, ministries, or universities that relate to organic fertilizer and pesticide dissemination.

Puncak area is a partner farmers' cultivation area that currently often occurs disasters, i.e. flood and landslide because of the forestry area conversion to non-forestry. With less water absorbance causes flood often occurs, and the partner farmers suffer harvest failure. Law implementation regarding the establishment permit in Bogor area needs to conduct and cooperate with various sides. In addition, it needs to form farmer insurance as a mitigation effort against cultivation risks. Because the farmers are actors who mostly suffer, they need farmer insurance.

Another problem appearing in the environmental dimension is no plant rotation that affects to environment's quality decrease reflected in decreasing productivity and pests and plant illness increase. The company's demand that needs vegetables during time is a caution that farmers can not rotate plants in the agricultural area. It needs the partner company's consideration to apply a plant rotation to partner farmers' agricultural areas to maintain the environment's quality. Alternatively, the partner company adds the number of partner farmers to fulfill the supply.

Partner farmers suffer fertilizers' scarcity and expensive prices. Most Indonesian farmers suffer from that situation because of the subsidized fertilizer policy on the national scope. The fertilizers' scarcity is caused by high demand, i.e. the agricultural production increase and the habit of farmers tend to fertilize plants intensively. In addition, there is a problem with the fertilizer value chain that inhibits the distribution. As the central government is an actor who roles essentially in fertilizers' scarcity and expensive prices, the central government should conduct various strategies to solve the problem. The government should reallocate the amount of fertilizer in some areas to avoid excessive or lack of supply. In addition, fertilizer distribution monitoring should be conducted intensively. The government needs to formulate a long-term policy to enhance the fertilizers' accessibility and price affordability. More environmentally friendly organic fertilizer use dissemination is an alternative to fertilizer utilization among national fertilizer problems. As the utilization of organic fertilizer has the benefit of being more environmentally friendly, it plays a role in creating sustainable agriculture.

4. Conclusions

The result of situational analysis of the partner company is reflected in various working performance indicators, i.e. selling, profit, market expansion, labor addition, new technology adoption, and product innovation. In 2021, working performance indicators, i.e. selling, profit, market expansion, labor addition, new technology adoption, and product innovation, tend to enhance, and there is no new technology adoption. Working Performance 2021 was affected by governmental policies about the COVID-19 pandemic that has loosened the social limitation. Therefore, the value chain of vegetables as the main product of PT SSS tends to be smooth. The working performance of partner farmers during contract farming with the company tends to

benefit economically. The existence of market and price certainty minimizes the agribusiness loss risk. In addition, the existence of an agricultural input credit scheme paid when harvest season decreases the agribusiness cost. In addition, the agricultural input credit scheme decreases the agribusiness cost, mainly at the beginning of cultivating time. Both a partner company and partner farmers agree to still conduct a contract farming pattern in the future. There are two pillars of contract farming used by PT SSS, i.e. plasma core contract farming and trading contract farming. The difference between both contract farming patterns is the rights and obligations received by both sides. In the plasma core contract farming, the partner company obliges to collect the harvest result of the partner farmer as the number and price agreement. In addition, the partner company also provides the credit facility for agricultural inputs, i.e. seeds, fertilizers, and pesticides paid when harvest season. The partner farmers should have some guidance and training programs. On contrary, in the trading contract farming pattern, there is no purchasing agreement of agricultural results both in number and price side. The partner company does not provide various facilities, i.e. agricultural input credit and guidance. The trading contract farming just occurred when the supply number of plasma core contract farming does not fulfill the company's demand.

According to fishbone analysis, there are problems summarized into four dimensions, i.e. economic, social, environmental, and governmental. The problems existing in a dimension affect other dimensions. Because the problem in the environmental dimension, i.e. no plant rotation, tends to cause high attack by Plant Disturbance Organism, it has a harvest failure risk. As the agricultural intensification causes farming focuses on productivity increase, the use of chemical matters tends to be massive and impacts negatively the environment. The area conversion to the building establishment sector is a disaster caution such as landslides and floods. That condition affects the decrease in profitability economically. The absence of farmer groups also weakens the contract farming pattern sustainability prospect. The fertilizers' scarcity and expensive price are macro problems that should be solved by Stakeholders, i.e. government and academicians.

According to the problem mapping in the sustainable dimensions of contract farming, its strategy formulation needs the collaboration of various sides, i.e. partner farmers, partner company, local government, central government, and academicians. The sustainability of contract farming needs a commitment from two sides, i.e. partner company and partner farmers relating to economic, social, and environmental dimensions. Sinergy among actors is a crucial step to conduct.

The managerial implications needed are: 1) Strengthening the commitment to continue mutually beneficial partnerships, 2) Written partnership contracts containing rights and obligations, rewards and punishments, 3) Establishment of farmer insurance, activation of farmer groups, and mentoring and counseling programs, 4) Adoption of more environmentally friendly technology and improvement of farm's and company's efficiency, 5) The adoption of innovation in marketing, products, and methods/ processes/production techniques for PT SSS, 6) Government's commitment to reconsideration land conversion, 7) Coordination with the government regarding the accessibility and affordability of subsidized fertilizers.

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6. References

Abdi Seyyedkolaee, M., Tehranchian, A. M., Jafari Samimi, A., & Mojaverian, S. M. (2017). Does agriculture price index respond to ex-

change rate fluctuations in iran? *International Journal of Agricultural Management and Development (Ijamad)*, *7*(4), 407–413. https://doi.org/10.22004/ag.econ.292504

Adnyana, I. P. C. P., & Mohktar, M. S. (2019). Optimalisasi kinerja sistem distribusi pupuk bantuan pemerintah di provinsi NTB. *SOCA: Jurnal Sosial Ekonomi Pertanian*, *13*(2), 201. https://doi.org/10.24843/soca.2019.v13.i02.p05

Alam, A. S., & Hermawan, H. (2017). Faktor-faktor yang mempengaruhi hubungan kemitraan antara petani budidaya jamur tiram. *Faktor-faktor yang mempengaruhi hubungan kemitraan antara petani budidaya jamur tiram*, *7*(1), 214–219.

Ali, R., & Leifu, G. (2016). The impact of technology orientation and customer orientation on firm performance: Evidence form chinese firms. *International Journal of Management and Marketing Research*, *9*(1), 1–11.

Amam, A., Fanani, Z., Hartono, B., & Nugroho, B. A. (2019). Usaha ternak ayam pedaging sistem kemitraan pola dagang umum : Pemetaan sumber daya dan model pengembangan. *Sains Peternakan*, *17*(2), 5. https://doi.org/10.20961/sainspet.v17i2.26892

Anggia, F., Panjaitan, B. K., Mokhtar, S., Achmad, M., & Tri, A. (2021). The impact of the covid-19 pandemic on the batik industry: An empirical study in indonesia. *Journal of Asian Finance*, *8*(5), 923–0930. https://doi.org/10.13106/jafeb.2021.vol8.no5.0923

Ayinde, O. E., Muchie, M., & Olatunji, G. B. (2011). Effect of Climate Change on Agricultural Productivity in Nigeria: A Co-integration Model Approach. *Journal of Human Ecology*, *35*(3), 189–194. https://doi.org/10.1080/09709274.2011.11906406

Azmie, U., Dewi, R. K., & Sarjana, I. D. G. R. (2019). Pola kemitraan agribisnis tebu di kecamatan jetis kabupaten mojokerto. *Agrisocionomics: Jurnal Sosial Ekonomi Pertanian*, *3*(2), 119–130. https://doi.org/10.14710/agrisocionomics.v3i2.5062

Bacon, C. M., Getz, C., Kraus, S., Montenegro, M., & Holland, K. (2012). The social dimensions of sustainability and change in diversified farming systems. *Ecology and Society*, *17*(4). https://doi.org/10.5751/ES-05226-170441

Bandara, J. S., & Cai, Y. (2014). The impact of climate change on food crop productivity, food prices and food security in south asia. *Economic Analysis and Policy*, *44*(4), 451–465. https://doi.org/10.1016/j.eap.2014.09.005

Barrett, C. B., Bachke, M. E., Bellemare, M. F., Michelson, H. C., Narayanan, S., & Walker, T. F. (2012). Smallholder participation in contract farming: Comparative evidence from five countries. *World Development*, *40*(4), 715–730. https://doi.org/10.1016/j.worlddev.2011.09.006

Bellemare, M. F. (2015). The magazine of food, farm, and resource issues contract farming: What's in it for smallholder farmers in developing countries? *CHOICES 3rd Quarter*, *30*(3), 1–4. http://www.choicesmagazine.org.

Bellemare, M. F., & Lim, S. (2018). In all shapes and colors: Varieties of contract farming. *Applied Economic Perspectives and Policy*, *40*(3), 379–401. https://doi.org/10.1093/AEPP/PPY019

By Katrien Vande Velde and Miet Maertens, Division of Bioeconomics, KU Leuven. (n.d.).

Cahyadin, M., Sari, V. K., & Juwita, A. H. (2021). New evidence of environmental kuznets curve hypothesis in developing countries. *Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi Dan Pembangunan*, *22*(2), 251–262. https://doi.org/10.23917/jep.v22i2.15794

Cariappa, A. A., Acharya, K. K., Adhav, C. A., Sendhil, R., & Ramasundaram, P. (2021). Impact of COVID-19 on the indian agricultural system: A 10-point strategy for post-pandemic recovery. *Outlook on Agriculture*, *50*(1), 26–33. https://doi.org/10.1177/0030727021989060

Cavallo, E., Ferrari, E., Bollani, L., & Coccia, M. (2014). Strategic management implications for the adoption of technological innovations in agricultural tractor: the role of scale factors and environmental attitude. *Technology Analysis and Strategic Management*, *26*(7), 765–779. https://doi.org/10.1080/09537325.2014.890706

Chandini, Kumar, R., Kumar, R., & Prakash, O. (2019). The impact of chemical fertilizers on our environment and ecosystem. *Research Trends in Environmental Sciences*, *February*, 69–86.

Choi, S., & Ng, A. (2011). Environmental and economic dimensions of sustainability and price effects on consumer responses. *Journal of Business Ethics*, *104*(2), 269–282. https://doi.org/10.1007/s10551-011-0908-8

Chongela, J. (2015). Contribution of agriculture sector to the Tanzanian economy. *American Journal of Research Communication*, *3*(7), 57–70. www.usa-journals.comwww.usa-journals.com.www.usa-journals.com

Courtois, P., & Subervie, J. (2014). Farmer bargaining power and market information services. *American Journal of Agricultural Economics*, *97*(3), 953–977. https://doi.org/10.1093/ajae/aau051

Darwis, V., & Supriyati, N. (2016). Subsidi pupuk: Kebijakan, pelaksanaan, dan optimalisasi pemanfaatannya. *Analisis Kebijakan Pertanian*, *11*(1), 45. https://doi.org/10.21082/akp.v11n1.2013.45-60

Daryanto, Supardi, S., & Subekti, E. (2015). Analisis pendapatan peternak ayam ras pedaging pola kemitraan inti plasma (studi kasus peternak plasma PT. Genesis di Kecamatan Grabag Kabupaten Magelang Jawa Tengah). *Mediagro*, *11*(1), 92–105.

Datta, S., Singh, J., Singh, S., & Singh, J. (2016). Earthworms, pesticides and sustainable agriculture: a review. *Environmental Science and Pollution Research*, *23*(9), 8227–8243. https://doi.org/10.1007/s11356-016-6375-0

Dempsey, N., Bramley, G., Power, S., & Brown, C. (2011). The social dimension of sustainable development: Defining urban social sustainability. *Sustainable Development*, *19*(5), 289–300. https://doi.org/10.1002/sd.417

Firdaus, M. A., Wicaksana, M. A., Hilmi, M. Z., Syafatullah, M. D. A., Romaita, N. R., Kristianti, Q. V. D., Soekamto, H., & Putra, A. K. (2021). Pengaruh alih fungsi lahan terhadap resiko longsor di Desa Ngadirejo. *Jurnal Integrasi Dan Harmoni Inovatif Ilmu-Ilmu Sosial*, *1*(7), 852–859. https://doi.org/10.17977/um063i1v72021p852-859

Francis, C. A., & Porter, P. (2011). Ecology in sustainable agriculture practices and systems. *Critical Reviews in Plant Sciences*, *30*(1–2), 64–73. https://doi.org/10.1080/07352689.2011.554353

Freguin-Gresh, S., D'Haese, M., & Anseeuw, W. (2012). Demythifying contract farming: Evidence from rural South Africa. *Agrekon*, *51*(3), 24–51. https://doi.org/10.1080/03031853.2012.749567

Fu, M., & Shen, H. (2020). COVID-19 and corporate performance in the energy industry. *Energy RESEARCH LETTERS*, *1*(1), 1–5. https://doi.org/10.46557/001c.12967

Gani, I., Umma, E., & Gaffar, A. (2021). Sustainable Livelihood Framework Approach of Communities in Agricultural Sector of Middle Mahakam River *, East Kalimantan Indonesia*. *22*(2), 139–152. https://doi.org/10.23917/jep.v22i2.15569

Gatto, M., Wollni, M., Asnawi, R., & Qaim, M. (2017). Oil palm boom, contract farming, and rural economic development: Village-level evidence from Indonesia. *World Development*, *95*, 127–140. https://doi.org/10.1016/j.worlddev.2017.02.013

Herath, H. M. K. V., Gunawardena, E. R. N., & Wickramasinghe, W. M. A. D. B. (2015). The impact of "Kethata Aruna" fertilizer subsidy programme on fertilizer use and paddy production in Sri Lanka. *Tropical Agricultural Research*, *25*(1), 14. https://

doi.org/10.4038/tar.v25i1.8026

Hidayat, D. (2019). Penguatan asuransi usaha tani padi (AUTP) Untuk Perlindungan Petani dan Usaha Tani Padi yang Berkelanjutan. *Jurnal LIPI*.

Junaidi, M. A., & Maghdafanti, E. P. (2020). Dampak pola kemitraan melalui e-commerce pertanian. *Manajemen Agribisnis*, *20*(2), 88–92. https://ejournal.uniska-kediri.ac.id/index.php/agribisnis/article/view/1118

Kundang, H. (2017). Edisi Mei 2017 Volume X No. 1. *Issn 1979-8911*, *X*(1), 1–15.

Kuntashula, E., Chabala, L. M., & Mulenga, B. P. (2014). Impact of minimum tillage and crop rotation as climate change adaptation strategies on farmer welfare in smallholder farming systems of Zambia.*Journal of Sustainable Development*, *7*(4), 95–110. https://doi.org/10.5539/jsd.v7n4p95

Lal, M. (2011). Implications of climate change in sustained agricultural productivity in South Asia. *Regional Environmental Change*, *11*(SUPPL. 1), 79–94. https://doi.org/10.1007/s10113-010-0166-9

Latruffe, L., Diazabakana, A., Bockstaller, C., Desjeux, Y., Finn, J., Kelly, E., Ryan, M., & Uthes, S. (2016). Measurement of sustainability in agriculture: A review of indicators. *Studies in Agricultural Economics*, *118*(3), 123–130. https://doi.org/10.7896/j.1624

Liang, T. P., You, J. J., & Liu, C. C. (2010). A resource-based perspective on information technology and firm performance: A meta analysis. *Industrial Management and Data Systems*, *110*(8), 1138–1158. https://doi.org/10.1108/02635571011077807

Makarim, A. K., & Mejaya, J. (2017). Rasionalisasi pola rotasi tanaman pangan berbasis ketersediaan air. *Iptek Tanaman Pangan*, *12*(2), 83–90.

Mariyono, J. (2019). Motivating factors of farmers to engage vegetable-based agribusiness in east java and bali , indonesia. *20*(2), 163–175. https://doi.org/10.23917/jep.v20i2.7186

Meemken, E. M., & Bellemare, M. F. (2020). Smallholder farmers and contract farming in developing countries. *Proceedings of the National Academy of Sciences of the United States of America*, *117*(1), 259–264. https://doi.org/10.1073/pnas.1909501116

Mhlanga, D., & Dunga, S. H. (2020). Measuring financial inclusion and its determinants among the smallholder farmers in zimbabwe: An empirical study. *Eurasian Journal of Business and Management*, *8*(3), 266–281. https://doi.org/10.15604/ejbm.2020.08.03.008

Michalak, D. (2016). The analysis of a weather risk in agriculture as an important part in the process of adaptation to the climate change. *Ekonomia I Srodowisko-Economics and Environment*, *2*(57), 95–111.

Mishra, A. K., Kumar, A., Joshi, P. K., D'Souza, A., & Tripathi, G. (2018). How can organic rice be a boon to smallholders? Evidence from contract farming in India. *Food Policy*, *75*(February), 147–157. https://doi.org/10.1016/j.foodpol.2018.01.007

Mulyaningsih, Y., Darwin, Soesilowati S, E., Adam, L., Thoha, M., Septia, Y., Ermawati, T., Sarana, J., Endah, N. H., Adityawati, S., Edi, R. Y., Inayah, I., & Nurjati, E. (2020). *Pengembangan Budaya Entrepreneurship Berbasis Sumber Daya Alam*.

Muradi, A. J., & Boz, I. (2018). The contribution of agriculture sector in the economy of Afghanistan. *International Journal of Scientific Research and Management*, *6*(10). https://doi.org/10.18535/ijsrm/v6i10.em04

Musfirah, A., Remmang, H., & Idris, M. (2018). Penerapan marketing mix terhadap pengolahan usaha tani holtikultura di Kabupaten Enrekang. *Jurnal Ecosystem*, *19*(2), 195–205.

Mustika, M., Fariyanti, A., & Tinaprilla, N. (2019). Analisis sikap dan kepuasan petani terhadap atribut asuransi usahatani padi di Kabupaten Karawang Jawa Barat. *Forum Agribisnis*, *9*(2), 200–214. https://doi.

org/10.29244/fagb.9.2.200-214

Muttaqin, G. F., Taqi, M., & Arifin, B. (2020). Job performance during COVID-19 pandemic: a study on indonesian startup companies. *Journal of Asian Finance, Economics and Business*, *7*(12), 1027–1033. https://doi.org/10.13106/JAFEB.2020.VOL7.NO12.1027

Nikoyan, A., Kasim, S., Uslinawaty, Z., & Yani, R. (2020). Peran dan manfaat kelembagaan kelompok tani pelestari hutan dalam pengelolaan taman hutan raya nipa-nipa. *Perennial*, *16*(1), 34–39.

Nurjati, E. (2022). The Determinants of Food Consumption Expenditure in Central Java. *Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi Dan Pembangunan*, *23*(1), 63–78. https://doi.org/10.23917/jep.v23i1.17648

Otsuka, K., Nakano, Y., & Takahashi, K. (2016). Contract farming in developed and developing countries. *Annual Review of Resource Economics*, *8*(1), 353–376. https://doi.org/10.1146/annurev-resource-100815-095459

Pasaribu, S. M. (2014). Penerapan Asuransi Pertanian Di Indonesia. *Pendekatan Pembangunan Dan Pengelolaan Sumber Daya Pertanian*, 491–514.

Perwitasari, H., Widada, A. W., Pranyoto, A., Mulyo, J. H., Sugiyarto, S., & Anggrasari, H. (2021). Keberlanjutan Kemitraan Petani Plasma Teh Dan. *SEPA*, *17*(2), 156–164.

Prowse, M. (2012). Contract farming in developing countries - A Review. *The A Savoir Collection*, *February*, 1–30.

PT SSS. (2022). *Sayuran Siap Saji [Internet]*. PT Sayuran Siap Saji. https://doi.org/https://sayuransiapsaji.co.id/

Rababah, A., Al-Haddad, L., Sial, M. S., Chunmei, Z., & Cherian, J. (2020). Analyzing the effects of COVID-19 pandemic on the financial performance of Chinese listed companies. *Journal of Public Affairs*, *20*(4). https://doi.org/10.1002/pa.2440

Ragimun, Makmun, & Setiawan, S. (2020). Strategi Penyaluran Pupuk Bersubsidi Di Indonesia. *Jurnal Ilmiah M-Progress*, *10*(1), 1–21. https://journal.universitas-suryadarma.ac.id/index.php/ilmiahm-progress/article/view/369

Rahman, S., & Anik, A. R. (2020). Productivity and efficiency impact of climate change and agroecology on Bangladesh agriculture. *Land Use Policy*, *94*(May). https://doi.org/10.1016/j.landusepol.2020.104507

Rahmawati, A., & Fariyanti, A. (2018). Analisis Risiko Harga Komoditas Sayuran Unggulan Di Indonesia. *Forum Agribisnis*, *8*(1), 35–60. https://doi.org/10.29244/fagb.8.1.35-60

Rani, I., Sari, M., Winandi, R., & Tinaprilla, N. (2017). Kinerja Rantai Pasok Sayuran dan Penerapan Contract Farming Models. *Jurnal Ilmiah Manajemen*, *VII*(3), 498–517.

Riskanita, D., & Widowaty, Y. (2019). Upaya Pemerintah Daerah Mengatasi Kerusakan Lingkungan Akibat Alih Fungsi Lahan Berdasarkan Konsep Negara Kesejahteraan. *Supremasi Hukum: Jurnal Penelitian Hukum*, *28*(2), 123–135. https://doi.org/10.33369/jsh.28.2.123-135

Rokhani, Rondhi, M., Kuntadi, E. B., Aji, J. M. M., Suwandari, A., Supriono, A., & Hapsari, T. D. (2020). Assessing determinants of farmer's participation in sugarcane contract farming in Indonesia. *Agraris*, *6*(1), 12–23. https://doi.org/10.18196/agr.6187

Romdhon dan Sukiyono, K. (2011). POLA KEMITRAAN PEMASARAN LOBSTER DI KOTA BENGKULU (PARTNERSHIP PATTERN IN MARKETING OF LOBSTER IN BENGKULU CITY) M . Mustopa Romdhon Ketut Sukiyono ABSTRACT. *Sosial Ekonomi Pertanian*, *10*(1), 126–137.

Rosli, M. M., & Sidek, S. (2013). The Impact of Innovation on the Performance of Small and Medium Manufacturing Enterprises: Evidence from Malaysia. *Journal of Innovation Management in Small & Me-*

dium Enterprise, *2013*, 1–16. https://doi.org/10.5171/2013.885666

Rosyani, Edison, Ulma, R., & Aziz, M. (2021). Study of sustainability status of the implementation of ISPO (Indonesian Sustainable Palm Oil) in plasma farmers oil palm plantation. *IOP Conference Series: Earth and Environmental Science*, *716*(1). https://doi.org/10.1088/1755-1315/716/1/012114

Santos, J. B., & Brito, L. A. L. (2012). Toward a subjective measurement model for firm performance. *BAR - Brazilian Administration Review*, *9*(SPL. ISS), 95–117. https://doi.org/10.1590/S1807-76922012000500007

Saptana, S., Indraningsih, S., & Hastuti, E. L. (2010). *ANALISIS KELEMBAGAAN KEMITRAAN USAHA DI SENTRA SENTRA PRODUKSI SAYURAN (Suatu Kajian Atas Kasus Kelembagaan Kemitraan Usaha di Bali, Sumatera Utara, dan Jawa Barat)*.

Satiti, R., Lestari, D. A. H., & Suryani, A. (2017). Sistem Agribisnis dan Kemitraan Usaha Penggemukan Sapi Potong di Koperasi Gunung Madu. *Jurnal Ilmu-Ilmu Agribisnis*, *5*(4), 344–351.

Sebudubudu, D. (2010). The impact of good governance on development and poverty in Africa: Botswana -A relatively successful African initiative. *African Journal of Political Science and International Relations*, *4*(7), 249–262. http://www.academicjournals.org/ajpsir

Septian, D., & Anugrah, G. C. (2014). Perlindungan petani melalui konsep asuransi pada Gabungan Kelompok Tani Desa Argorejo, Kabupaten Bantul. *Jurnal Penelitian Hukum*, *1*(2), 92–108.

Setiawan, A. C., Mursinto, D., Haryanto, T., & Timur, J. (2021). Direct Fertilizer Subsidies on Production and Household Income in Indonesia. *Trikonomika*, *20*(1), 1–10. https://doi.org/10.23969/trikonomika.v20i1.3896

Shafiai, M. H. M., & Moi, M. R. (2015). Financial problems among farmers in Malaysia: Islamic agricultural finance as a possible solution. *Asian Social Science*, *11*(4), 1–16. https://doi.org/10.5539/ass.v11n4p1

Shen, H., Fu, M., Pan, H., Yu, Z., & Chen, Y. (2020). The Impact of the COVID-19 Pandemic on Firm Performance. *Emerging Markets Finance and Trade*, *56*(10), 2213–2230. https://doi.org/10.1080/1540496X.2020.1785863

Shokoohi, Z., Chizari, A. H., & Asgari, M. (2019). Investigating bargaining power of farmers and processors in Iran's dairy market. *Journal of Agricultural and Applied Economics*, *51*(1), 126–141. https://doi.org/10.1017/aae.2018.26

Sinuraya, J. F., & Muslim, C. (2020). *Menyediakan Lapangan Kerja Untuk Buruh Perkotaan Pada Masa Covid-19. Setiyanto 2015*, 843–862.

Siswadi, B., & Syakir, F. (2016). Respon petani terhadap program pemerintah mengenai Asuransi Usahatani Padi (AUTP). *Prosiding Seminar Nasional Pembangunan Pertanian 2016*, *53*(9), 169–177.

Smalley, R. (2013). *Plantations, Contract Farming and Commercial Farming Areas in Africa: A Comparative Review Land and Agricultural Commercialisation in Africa (LACA) project Working Paper series*. *April*, 1–72. http://www.fao.org/uploads/media/FAC_Working_Paper_055.pdf

Subkhie, H., Peternakan, F., & Manusia, F. E. (2009). Analisis kelayakan usaha peternakan ayam pedaging dengan pola kemitraan di Kecamatan Ciampea Kabupaten Bogor. *MANAJEMEN IKM: Jurnal Manajemen Pengembangan Industri Kecil Menengah*, *7*(1), 54–63.

Sudrajat, S. (2018). Analisis Ketidakpastian dalam Memanfaatkan Lahan Pertanian di Desa Sukasari Kaler Kecamatan Argapura Majalengka. *Majalah Geografi Indonesia*, *32*(1), 84. https://doi.org/10.22146/mgi.32985

Suryahadi, A., Hadiwidjaja, G., & Sumarto, S. (2012). Economic growth and poverty reduc-

tion in Indonesia before and after the Asian financial crisis. *Bulletin of Indonesian Economic Studies*, *48*(2), 209–227. https://doi.org/10.1080/00074918.2012.694155

Sutrisno, S., Panuntun, B., & Adristi, F. I. (2020). The Effect of Covid-19 Pandemic on the Performance of Islamic Bank in Indonesia. *Equity*, *23*(2), 125–136. https://doi.org/10.34209/equ.v23i2.2245

Taufiqurrohman, T., Afandi, A., Novpriansyah, H., & Pangarso, F. D. (2013). SIFAT FISIK TANAH PADA PERTANAMAN NANAS (Ananas comosus) UMUR 6 BULAN DENGAN ROTASI TANAMAN SINGKONG (Manihot esculenta Crants) DI PT GREAT GIANT PEANAPPLE TERBANGGI BESAR LAMPUNG TENGAH. *Jurnal Agrotek Tropika*, *1*(3), 341–345. https://doi.org/10.23960/jat.v1i3.2062

Tehubijuluw, F., & Sugiarto. (2014). *Metodologi Penelitian*. Matana Bina Utama.

Ton, G., Vellema, W., Desiere, S., Weituschat, S., & D'Haese, M. (2018). Contract farming for improving smallholder incomes: What can we learn from effectiveness studies? *World Development*, *104*, 46–64. https://doi.org/10.1016/j.worlddev.2017.11.015

Tongchure, S. (2013). Cassava Smallholdersâ€™ Participation in Contract Farming in Nakhon Ratchasrima Province, Thailand. *Journal of Social and Development Sciences*, *4*(7), 332–338. https://doi.org/10.22610/jsds.v4i7.769

Topan, M., & Ifrani. (2020). Peran Koperasi Pada Program Kemitraan Inti Plasma Perkebunan Kelapa Sawit Untuk Meningkatkan Taraf Hidup Masyarakat. *Al Adl Jurnal Hukum*, *12*(2), 317–333.

Tuan, N., Nhan, N., Giang, P., & Ngoc, N. (2016). The effects of innovation on firm performance of supporting industries in Hanoi – Vietnam. *Journal of Industrial Engineering and Management*, *9*(2), 413–431. https://doi.org/10.3926/jiem.1564

Tudi, M., Ruan, H. D., Wang, L., Lyu, J., Sadler, R., Connell, D., & Chu, C. (2021). *Tudi2021. Pdf*. 1–23.

Ugwu, D., & Kanu, I. (2012). Effects of agricultural reforms on the agricultural sector in Nigeria. *Journal of African Studies and …*, *4*(March), 51–59. https://doi.org/10.5897/JASD11.029

Vicol, M. (2017). Is contract farming an inclusive alternative to land grabbing? The case of potato contract farming in Maharashtra, India. *Geoforum*, *85*(March), 157–166. https://doi.org/10.1016/j.geoforum.2017.07.012

Wiryawan, F. S. (2018). *Analisis rantai nilai dan keberlanjutan produk sayur potong (studi kasus di pt sayuran siap saji)*. http://repository.sb.ipb.ac.id/3312/

Yang, M., Bento, P., & Akbar, A. (2019). Does CSR influence firm performance indicators? Evidence from Chinese pharmaceutical enterprises. *Sustainability (Switzerland)*, *11*(20), 1–18. https://doi.org/10.3390/su11205656

Yoansyah, A., Ibrahim, A., & Abidin, Z. (2020). Analisis Kemitraan Petani Kopi Dengan PT Nestle Dan Analysis of Coffee Farmers Partnership with PT Nestle And Its Effect On Coffee Farmers Income In Sumber Jaya Subdistrict, Lampung Barat District. *Journal of Tropical Upland Resources ISSN*, *02*(02), 191–203.

Yu, J., & Wu, J. (2018). The sustainability of agricultural development in China: The agriculture-environment nexus. *Sustainability (Switzerland)*, *10*(6), 1–17. https://doi.org/10.3390/su10061776

Zakirin, M., Yurisinthae, E., & Kusrini, N. (2014). Analisis Risiko Usahatani Padi Pada Lahan Pasang Surut Di Kabupaten Pontianak. *Jurnal Social Economic of Agriculture*, *2*(1), 75–84. https://doi.org/10.26418/j.sea.v2i1.5122

Zellatifanny, C. M., & Mudjiyanto, B. (2018). Tipe Penelitian Deskripsi Dalam Ilmu Komunikasi. *Diakom : Jurnal Media Dan Komunikasi*, *1*(2), 83–90. https://doi.org/10.17933/diakom.v1i2.20

Zhang, L., Yan, C., Guo, Q., Zhang, J., & Ruiz-Menjivar, J. (2018). The impact of agricultural chemical inputs on environment: Global evidence from informetrics analysis and visualization. *International Journal of Low-Carbon Technologies*, *13*(4), 338–352. https://doi.org/10.1093/ijlct/cty039