Partnership model for sericulture development to improve farmer’s welfare (a case study at bina mandiri farmer group at Sukabumi Regency)

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Abstract. One of the agro-industrial sectors that has the potential to improve the welfare of the community is sericulture. Sericulture is an activity in the silk agroindustry, ranging from mulberry cultivation, silkworm cultivation, yarn, and fabric production to marketing. However, 95% of domestic demand for silk yarn is still imported from China although the quality local silk yarn is not inferior to Chinese products. Problems hindering silk development in Indonesia include limited capital and access, technology, and markets. Also the lack of policy supports for the development of sericulture. This paper presents partnership patterns in sericulture development between related parties (government, entrepreneurs, and silk farmers). The research was conducted at the Bina Mandiri Farmers Group, Sukamaju Village, Kadudampit District, Sukabumi Regency. The research method used was descriptive qualitative. The results showed that the partnership pattern developed was the plasma nucleus pattern. The step of cooperation in forming a business partnership is one strategy to develop a business for farmers. It requires maximum support from entrepreneurs through training packages for farmers. Guidance is carried out through the transfer of technology for enhancement productivity to increase farmer’s competence. In addition, coaching is also carried out by developing sericulture agribusiness institutions through cooperatives to improve farmers' welfare further.

1. Introduction

One of the five national superior non-timber forest product commodities is silk [1]. Silk is a very strategic commodity to be developed. It is because silk has an essential role as a raw material for the national textile industry and is a source of livelihood for people from upstream to downstream industries. The development of silk commodities is needed to fill the national textile industry raw materials, in which all this time it has been filled with imports.

The Royal Silk Indonesia Foundation chairman stated that Indonesia could only fill the domestic supply of silk yarn by 5% of the total demand for 900 tons/year. Therefore, 95% of yarn needs are imported from China [2]. Meanwhile, domestic and export market demand and yarn prices tend to increase from year to year. This condition has destroyed many silk craftsmen and farmers. For this reason, it needs to be controlled by revitalizing the national sericulture because Indonesia has great potential to develop it.

Indonesia has advantages in developing sericulture, both in terms of geography, human resources, and technology. As an agricultural country, Indonesia has a vast landscape and an agro-climate that is suitable for sericulture development. Human resources are widely scattered throughout the
countryside, in accordance with the labor-intensive silk business. Likewise, sericulture is also available, both superior seed technology and sericulture procedures.

Indonesian silk experienced several obstacles in its development and could not compete with silk from other silk-producing countries. Constraints faced include (1) Productivity and quality of seed and cocoons are still low; (2) Business capital and extension workers are still limited; (3) Farmers' skills are still limited; (4) Farmer group institutions are weak; (5) Limited access to market information and technological innovation; and (6) Lack of policy support for the development of the national silk agribusiness.

Sericulture is a long series of activities from planting mulberry as silkworm feed, producing silkworm seeds, rearing silkworms to produce cocoons, processing cocoons and spinning cocoons into yarn, and weaving yarn into silk fabric. Sericulture can be a family business, either as a main or a side business, on a small and medium scale business. The activities themselves are labor-intensive and can be done by everyone, both men and women, adults and children. This activity can be a source of community income and is an alternative to increase the role of the forestry sector in encouraging the economy of rural communities [4].

The government realizes those small businesses are the most significant part of the primary support for the national economy and make a substantial contribution to national development, and can absorb a large enough workforce. The fundamental problem of small businesses is the lack of management skills and professionalism and limited access to capital, technological innovation, and marketing networks. This factor is an obstacle to the development of small businesses and is often the reason for large entrepreneurs not cooperating with small entrepreneurs [5].

Silkworm cultivation as an upstream sericulture sector has become the government's focus in revitalizing national silk production. Silk farmers to become resilient requires capacity building related to human resource skills and productivity-enhancing technologies. In addition, it is also necessary to create a conducive business climate for the development of farmers' businesses.

Efforts to improve the business capabilities of silk farmers have been initiated with a pattern of cooperation in the development of sericulture among stakeholders. The three stakeholders are farmers, entrepreneurs, and the government. The government, in this case, is the Agency for Research and Development and Innovation – Forest Research and Development Center (FRDC) as the owner of sericulture superior seed technology. The target farmer is the Bina Mandiri farmer group (BM FG), while the entrepreneurs involved are PT. Begawan Sutra Nusantara (PT. BSN). Cooperation is carried out to transfer technology for developing superior seeds (silkworms and mulberry) to silk farmers with a partnership system. This partnership model trial will increase cocoon production and positively impact farmers' income.

This study aims to determine the partnership mechanism between silk farmers and the company and find out the benefits obtained and the obstacles faced in making the partnership pattern.

This result of the study will provide information on how the performance of the silk development model with the partnership scheme between BM FG and PT. BSN. Furthermore, this information can be used as a basis for formulating a silk development model to open up business opportunities and encourage the natural silk industry to rise again to meet the needs of the silk industry.

2. Methodology
2.1. Time and location of research
The research was conducted in March 2020 in Sukamaju Village, Kadudampit District, Sukabumi Regency - West Java.

2.2. Data collection method
The study method used is a "case study," the selection of research sites is carried out purposively with the fundamental consideration that there is one farmer group that has carried out partnership activities for sericulture in that location. In addition, Sukabumi Regency is also included in the five distribution areas of natural silk production centers in West Java. Types and sources of data collected consist of
primary and secondary data. Primary data collection uses (1) Interviews and (2) Field Observations and secondary data obtained by conducting a literature study.

2.3. Data analysis method
The data analysis used was descriptive qualitative and quantitative [6].

3. Result and discussion
3.1. Series of sericulture activities
Silk has long been an inseparable part of the culture of various ethnic groups in Indonesia. Silk is beautiful, and it has fine fibers which can be processed into various types of clothing products, such as woven fabrics, batik, kebaya, to distinctive and classy sarongs. Silk cloth turned out to be the result of a long activity and activities that involved a lot of energy.

Sericulture is an agro-industrial activity which consists of activities of moriculture, sericulture, filature and manufacture. Moriculture activity means cultivating mulberry plants to feed silkworms. While sericulture is the activity of rearing silkworms to produce cocoons (cocoons) as raw materials for making silk threads. As for filature activities, processing cocoons into silk yarn and manufacturing activities, weaving and making silk threads into silk fabrics and other finished goods products based on silk, including marketing.

Good quality cocoons are needed to produce good quality silk, therefore mulberry for silkworm food must be maintained properly in order to grow fast and produce a lot of fresh green leaf production. The quantity and nutritional content present in mulberry leaves is very important for the growth of silkworms. This will affect cocoon production and the quality of cocoons produced by silkworms so that the quantity and quality of silk threads produced will be affected both directly and indirectly [7, 8, 9, 10, 11].

Mulberry plants, which are recommended because of their superiority, both productivity and leaf quality, are Morus cathayana, Morus alba, Morus multicaulis, Morus kanka (from India), Morus multicaulis and Morus alba (Calafat). These species have adapted quite well. Mulberry plants can grow all year round in tropical climates so that silkworm cultivation can be carried out continuously [12]. Conditions for growing mulberry plants include clean environmental conditions free from pollution and adequate irrigation and drainage [13]. Good growing conditions for mulberry plants include fertile soil, located at an altitude between 300-800 m above sea level, rainfall between 2,500-3,000 mm/year, wide soil pH between 6.5-7, full sun from morning to evening day, temperature between 25-300 C, clean environmental conditions from pollution, adequate irrigation and drainage [14].

Mulberry plants can be intercropped with seasonal plants or other plantation crops. The planting plan, the area of land used, and the method of planting mulberry must be adjusted to the silkworm rearing plan. Mulberry leaves can be harvested for the first time when they are 5-6 months old, after that mulberry plants can be harvested every 2-3 months. To increase the productivity of mulberry leaves, fertilization and pruning are carried out periodically. The productivity of the mulberry plant can be maintained until the 15th year after that replanting is needed to improve its productivity again [15, 10]. The quality of mulberry leaves greatly determines cocoon production. It takes approximately 850 kg of mulberry leaves for one box (25,000 silkworm eggs) for one cycle (28-30 days).

Furthermore, the activities carried out are the maintenance of silkworms which are divided into:
- Small Silkworms maintenance (Instar I-III). Small silkworms actively eat for ±12 days and experience 3 x sleep periods. Silkworm health depends on well qualified and healthy leaves. The suitability of mulberry leaves as food for small silkworms is based on the position of their shoots.
- Large Silkworms maintenance (Instar IV-V). The caterpillar actively eats for as long ± 14-16 days before finally the silkworms begin to coke and experience 1x existences. The number of leaves + twigs given to the big caterpillar is ± 1.2 tons/box. Feeding was carried out 4 times a day by considering the possibility of leaf wilting, cocoon production efficiency, and labor management efficiency. One of the feedings is for large silkworms with whole leaves.
Cocooning and harvesting of cocoons are the last steps in the maintenance of silkworms. If this is not done properly, it can adversely affect the quality of the cocoon filament. The fifth instar caterpillar will begin to form cocoons on day 6. At that time the caterpillar's body size begins to shrink, the feces become soft, the caterpillar stops eating, and it begins to spin around by lifting its head and part of its body. At this stage the body starts to appear somewhat transparent. In this phase, the silkworms are said to be ripe and ready to coce. A cocoon that circles the caterpillar's body when spun into a filament reaches 900 m or even 1800 m.

Cocoon production is strongly influenced by many factors, that is, quality silkworm seeds, the availability of silk worm feed, labor factors, and silkworm cage space that meets the requirements to produce quality cocoons [16]. Spinning is the process of joining filaments from cocoons to be spun into yarn.

Weaving is a production stage after carrying out the spinning process. This weaving activity is the process of making fabrics from raw materials using yarn machine or loom. Silk weaving in Indonesia uses two types of looms, namely, machine looms (ATM) and non-machine looms (ATBM). ATM productivity is higher and the quality is better than that of ATBM. For weaving using ATM, the density of the woven silk cloth will be evenly distributed and vice versa when using ATBM [17].

It takes 28 days to produce silk thread, starting from the silkworm egg breeding process to yarn spinning. Most silk yarn craftsmen use conventional technology in the production process. The technology applied in the yarn business is relatively simple, which can only produce 1-2 kilograms of yarn per day, meanwhile, when using a machine spinning machine, it can produce 5-6 kilograms of yarn per day.

Silk cultivation does not require a long time so that silkworm cultivation can range from 6 to 10 times/year. The number of maintenance periods will have an impact on silk household income [16].

3.2. Partnership concept
The basic concept of partnership has actually been stated in Law Number 9 of 1995 concerning Small Business (State Gazette of 1995 Number 74, Supplement to State Gazette Number 3611) which states that "Cooperation between small businesses and large businesses should be supported by continuous fostering and development from medium to large businesses by considering the principles of mutual need; mutually strengthening and mutually beneficial". This concept is clarified in Government Regulation Number 44 of 1997 which explains that the ideal form of partnership is mutually reinforcing, mutually beneficial, and mutually supportive. The purpose of the partnership is to improve the quality of resources and business of the partner group and to increase the income/profit of each partner.

In the era of globalization, the development of agribusiness partnerships is faced with several opportunities, including increased marketing volume, more competitive product selling prices, more affordable prices for production facilities, more advanced and efficient science and technology, and increasingly open access to capital. These opportunities require agribusiness partnerships to synergistically produce products that have competitive advantages. Thus, agribusiness partnerships must be developed effectively and fairly through the integration and synchronization of business activities between Farmer Groups/Gapoktan/Farmers' Cooperatives and other agribusiness actors, starting from the provision of production facilities, implementation of cultivation business, post-harvest handling, processing and marketing, both domestic and international [5, 18,19].

The basic concept of partnership is the establishment of cooperation between two or more parties in certain business activities, in which the working parties (partners) have an "equal standing" position. The partnership process will occur and it can really be called a partnership if the basic principles are met, namely, mutual need, complementarity, mutual benefit, mutual strengthening and mutual sustainability.

The process of building a competitive and sustainable agribusiness partnership starts with getting to know the potential partners, knowing the strengths and weaknesses of the business, determining the goals or targets of the partnership, starting to build a joint strategy, implementing and continuing to
monitor and evaluating until the targets are achieved including how to enter into agribusiness business partnerships, requirements for conducting agribusiness business partnerships, steps to enter into agribusiness partnerships, and the need for reliable organizational support. This process must be observed from the start so that the problems that arise can be identified, such as technical, economic, and socio-institutional problems, and policy aspects as well as the steps to solve them [5, 18, 19].

The sequence of the agribusiness partnership development process is carried out regularly and gradually to get good results. The planning and implementation includes the following stages: (a) Starting to build relationships with potential partners; (b) Understanding the business conditions between the parties to be partnered; (c) Determining the goals or targets to be achieved; (d) Developing strategies and assess business details; (e) Developing an agribusiness partnership program; (f) Starting the implementation of agribusiness business partnerships; and (g) Monitor and evaluate the development of agribusiness partnerships. [20]

If the small business has not yet developed, in a position that is "not yet equal", the partnership must continue and this is where the role of the government as the supervisor bridges the positions of the partners. It is not easy to pursue this partnership because each other needs to have the same commitment (small business empowerment) and needs support from relevant stakeholders.

The implementation of the rights and obligations agreed upon by the two partners with full awareness and responsibility is the main condition for the success of a partnership. In order to realize a business partnership that enables people's economic development, it is urged to clearly define the role of each party involved in the partnership. The various roles of the business partnership actors are as follows:

- The company’s role: (1) Prepare a business plan with partner farmers to be mutually agreed upon. (2) Guide in increasing the quantity and quality of products to farmers. (3) Guarantee the purchase of farmers’ products under mutual agreements.

- Role of farmers: (1) Together with the company, compile a business plan for agreement. (2) Carry out the provisions under mutually agreed agreements. (3) Developing and enhancing capabilities in business and production technicalities.

3.3. Mechanisms for implementing silk farmer partnerships with partner companies

Like other businesses, natural silk farming is also less able to meet the requirements because its business activities tend to be inefficient and do not meet economies of scale. The selling price of cocoons does not provide incentives to farmers because the product is still low and does not meet quality standards. The product depends on the season and is not continuous. This causes farmers to have a weak bargaining position against other market players [21]. They find it difficult to determine the selling price. Consequently, they "give up" to accept the price determined by the collecting traders, wholesalers including exporters.

To overcome problems in the upstream sector, especially related to the low production of cocoons, the use of superior seeds is a promising alternative solution. Various breeding efforts to obtain superior seeds have been carried out and in 2013 the Agency for Research and Development and Innovation has produced superior hybrid silkworm seeds PS 01 (launched by Decree of the Minister of Forestry No. SK. 794/Menhut-II/2013 dated November 13, 2013 ) which is adaptive to various conditions and is able to increase cocoon production significantly. In addition, there is a superior mulberry plant for silkworm feed that has high productivity and can adapt to various natural conditions in Indonesia, namely. SULI (launched by Decree of the Minister of Forestry No. SK. 793/Menhut-II/2013 on November 13, 2013). The combined field test results increased cocoon production by 39% compared to normal silkworm production and resulted in a 20% longer yarn [22].

To take advantage of this innovation, the Agency for Research and Development and Innovation (BLI) asked PT. BSN to transfer the technology for developing silkworm eggs and hybrid mulberry eggs to the MB FFG in Sukabumi, West Java. A cooperation mechanism was carried out by the government (here BLI) with the private sector by sharing resources, knowledge, and risks in order to increase the efficiency of production and distribution of products and services to generate various benefits called the Public-Private Partnership (PPP) [23].
The function of the PPP is to reduce production costs, reduce business risk at each chain of activities it passes, improve the quality of the products produced and in accordance with the utilization of the technology used, and increase human resources capacity involved in every process carried out and increase product power and marketing accessibility. Thus, PPP will increase the benefits received by both parties working together, especially increasing income (farmers), finance (working capital), and knowledge transfer [23].

![Diagram]

**Figure 1.** Implementation of silk farmer partnerships with partner companies.

The Bina Mandiri Farmers Group was established in 2006. Most of its members are familiar with the cultivation of mulberry and silkworms for an average of more than ten years. Ownership of land by farmers is generally in their property, and there is also a lease status. The average land area owned is 1 ha, with an intercropping pattern. The average farmer keeps 1.5 boxes of caterpillars. In one maintenance cycle, the gross yield obtained is around Rp. 2 - 2.5 million. If the farmer maintains eight maintenance cycles, the gross income in a year is around Rp. Twenty million from silkworm cultivation. Total revenue will be much higher with the expected harvest of other commodities produced in intercropping areas.

In general, farmers are interested in making profit-oriented partnerships, developing businesses, availability of sufficient workforce, experience, and mastery of good cultivation techniques. Reasons for farmers to follow the partnership pattern (1) marketing guaranteed, (2) available seeds/superior seeds (3) higher productivity and (4) mentoring activities.

Most farmers do planning based on their own experience and coupled with the experience of others. Recording of farming activities is still not done in detail. These conditions indicate that the behaviour of farmers is still traditional. So far farmers have only thought about increasing production; there is no desire to expand their business elsewhere, and they have not accessed many formal financial institutions (banks). Therefore, it is necessary to strive towards fostering agribusiness-oriented farming, which leads to more positive progress in terms of the quality/ability of farmers in doing business.

PT. Begawan Sutera Nusantara is a limited liability company as a subsidiary of PT Atisa Tenun Nusantara, engaged in the production and export of silk fabrics. Partner companies have known each other with partner farmers long before the partnership agreement contract. The company operates from the upstream sector in mulberry cultivation to the natural silk agro-industry level, producing fabrics, marketing and exporters. In this partnership, the company (1) made efforts to help procure seeds, (2) increased farmers’ income, through guaranteed cocoon purchases, (3) bought cocoons at an agreed
price (4) improved farmers' skills in natural silk cultivation (5) increased the role of the private sector in the development of Indonesian natural silk in accelerating the increase in cocoon production.

PT. BSN hatches superior silkworm eggs from R&D and maintains small caterpillars (1 to 3 instars) for approximately 13 days. This period is a critical phase in the silkworm metamorphosis, which causes high mortality rates from disease and weather and reduces production costs. Furthermore, the small caterpillars are packed in boxes and handed over to partner farmers to be cared for until they enter the adult caterpillars (instars 4 and 5) and turn into cocoons. Adult caterpillars are kept for approximately 14-15 days, after which the caterpillars turn into cocoons; partner farmers sell the cocoons to the company. One box of silkworms can produce about 37 - 40 kilograms of cocoons. Currently, the price of cocoons is around Rp. 40,000 per kilogram.

The silk yarn produced by farmers in terms of quality is not inferior to imported yarn and has a fairly good market for both domestic and export. For silk fans, they can tell the difference between genuine fabrics and imported threads. Each yarn quality has a niche market. We must know the consumer personally in this niche market. PT Begawan Company wants to support the development of natural silk that is 100% original Indonesian silk. With the collaboration between KT Bina Mandiri and PT Begawan Sutera Nusantara, it is hoped to expand SULI 01 and PS 01 to encourage an increase in national natural silk production.

Partner companies provide silkworm seeds, technical guidance, and product purchase guarantees, while partner farmers provide land, caterpillar houses and labour. This partnership model is included in the subcontract partnership pattern. [18.] Advantages of subcontracting partnerships are: These partnerships formulate a collective contract agreement covering volume, price, quality, and time. The subcontracting pattern is very beneficial for creating transfer of technology, capital, skills, and productivity, and guaranteeing product marketing to partner farmer groups.

Table 1. Partnership assessment results.

| Number | Item | Current condition |
|--------|------|-------------------|
| 1. | Quality of seeds provided by PT. BSN | The superior seeds are the result of a collaboration between PT Begawan as a breeder and R&D as the patent holder for superior silkworms. Furthermore, it is distributed to partner farmers in the form of small caterpillars to reduce the risk of death. This makes farmers always sell their crops to the company. |
| 2. | Field technical skills | The head of FFG is very experienced in the field of sericulture (> 20 years) |
| 3. | The given cultivation technique | The company provides it to farmers because they are considered experienced enough and free guidance and training is available |
| 4. | There is a clear SOP to get quality products product | Available |
| 5. | The suitability of the cocoon harvest absorbed by the company | The company buys cocoons from farmers as a partner and farmers are obliged to sell it to the company |
| 6. | The suitability of the resulting cocoon production | 38 - 40 kg per box. |
| 7. | The suitability of the quality of the resulting cocoons | The grade is accepted by the company |
| 8. | Selling price compatibility | The price set by the company is relatively similar to that of market price (Rp 40,000/kg cocoon for all grades) |
| 9. | Ease of product delivery | Farmers get a means of transporting cocoons from farmers' fields to the company |
| 10. | Payment time after product deposit | The payment system accepted by farmers is cash. This makes farmers do not believe in always selling their crops to the company. |


| Number | Item                                | Current condition                                                                 |
|--------|-------------------------------------|----------------------------------------------------------------------------------|
| 11.    | Increased income felt by farmers    | Farmers feel there is an increase in income.                                      |
| 12.    | Field response to farmer complaints | Provide a discussion medium for farmers to exchange information, consult and find solutions that are monitored by the company |
| 13.    | Market Information Disclosure       | Not yet available, still limited to increasing production.                        |

The silk yarn produced by farmers in terms of quality is not inferior to overall, the contributions made by partner companies have been met, and the farmers feel that they are in line with their needs. Contribution is at the core of a partnership relationship. This essence is emphasized by [24] that the essence of the partnership lies in mutual contributions, both in the form of labour, land and capital for economic purposes, where management is carried out jointly, as well as profit and loss sharing.

Partner companies have been very good with contributions as expected. However, there is still a need to improve infrastructure, such as the availability of irrigation so that it does not depend on the season so that feed sources are available at all times. As well as the condition of the caterpillar house which is less than expected.

Mastery of information, especially market information, is one of the determinants of the success of agricultural commodity agribusiness partnership activities. The various market information types are price, quantity demanded, quality improvement, desired product type and form, market absorption, market objectives and market segments. Information may also include government and other relevant party policies that will affect agribusiness partnerships. Under certain conditions, this is closely related to promotional activities to increase volume and expand market objectives [25].

3.4. Benefits and obstacles in implementing partnerships between sericulture farmers with companies

3.4.1. Benefits of partnership. Partnerships have basic principles that must be met, namely, mutual need, mutual benefit and mutual strengthening. The words are mutually interpreted that in the partnership process, each actor gets benefits. The benefits of partnerships between partner farmers and partner companies can be assessed economically, technically and socially.

Economic benefits for farmers are increased income, available markets and competitive prices according to the agreement. Partner companies will get a guaranteed supply of cocoons as the raw material needed by the company. Continuity and guarantee of raw materials make the company's revenue and income relatively stable. Both parties benefit, and each party wishes to develop a business scale.

The technical benefit is an increase in the ability of farmers to produce cocoons both in terms of quantity and quality, namely, from seed quality factors and mastery of technology. Improving the quality of human resources is carried out with guidance and assistance. The perception of farmers and partner companies on the quality of cocoons produced through partnerships is good. This common perception also indicates that there has been an increase in technological mastery.

The social benefit is that there is no conflict between farmers and partner companies. If a problem arises, a solution will be found jointly so that no silk farmers sell cocoons to other parties even though they are offered a higher price than PT. BSN. A well-established social partnership relationship results in the desire for continuity of cooperation. This means that there is a possibility to continue the cooperative relationship. Socially, a cooperative relationship needs to be maintained through open communication and a commitment to finding solutions to every obstacle encountered. Partner companies continue to conduct studies, research and development to find solutions and applied technologies that are easy for silk farmers to implement.

3.4.2. Obstacles of partnership. Partnership that comes out of the partnership concept fails if its application only benefits one party or violates the agreement [25]. A partnership is impossible without obstacles, so is a sericulture business partnership in Sukabumi.
First, cocoon production between farmers is around 38-40 kg per box. This difference occurs because the level of patience of farmers is different although technically, all sericulture activities is mastered and easy. The existence of environmental disturbances at the time of sericulture activities so that it is not following the SOP makes variations in cocoon production.

Second, the problem of continuity of cocoon supply from farmers faced by the company. If the supply decreases, it will reduce production and sales, but the production costs will increase. Constraints especially occur during the dry season. Mulberry cultivation is disrupted and even causes death due to lack of water supply. Only a few farmers use water pumps; other farmers who do not have the capital tend to dry out mulberry plants. This obstacle is related to nature because mulberry cultivation is highly dependent on environmental conditions, such as irrigation and sunlight and is free from the influence of insecticides. Pests and diseases are also problems that often arise and require information on how to handle them. Second, the company encounters the problem of continuity of cocoon supply from farmers. If the supply decreases, it will reduce production and sales, but the production costs will increase. Constraints especially occur during the dry season. Mulberry cultivation is disrupted and even causes death due to lack of water supply. Only a few farmers use water pumps; other farmers who do not have the capital tend to dry out mulberry plants. This obstacle is related to nature because mulberry cultivation is highly dependent on environmental conditions such as irrigation and sunlight and is free from the influence of insecticides. Pests and diseases are also problems that often arise and require information on how to handle them.

PT. BSN can overcome problems related to yarn quality with various tricks. Among them are producing multiple markets, creating techniques using defective threads, creating various designs with distinctive/unique motifs using low-quality yarns. Each of these tricks has its specific market. This action is taken as an effort by the company to carry out its commitments and find solutions faced when carrying out sericulture (personal communication).

Some of the principles applied from the farmers, partner companies, FFG management, are (1) Equality, companies and farmers apply this. The company considers farmers to be business partners who need each other, (2) applying the principles of not disappointing partners, understanding each other, and trying to fulfill the wishes of farmers, and buying farmers' products at sufficient prices, (3) Win-win solution, so that the partnership lasts long term, (4) maintaining each other's good name, (5) provide good service from the company through field officers and other staff, (6) commitment of both parties carried out without coercion to assess and remind each other (personal communication).

An effective partnership will motivate every individual who works to achieve the targeted goals. The principles adopted by the partnership actors are mutual need, mutual support, and mutual benefit. Partner participants can gain value, manage their business independently, progress and develop professionally, not only live and survive but also develop a strong business. Partner companies strive to create a friendly business atmosphere, growing trade, capital and solid investment [26].

Partnerships with good performance will lead to high satisfaction, and there is an expectation of sustainability. Some recommendations for good partnership are 1) maintaining and improving communication between parties; 2) developing and improving pricing mechanisms; 3) using technological innovations for mulberry and silkworm cultivation; 4) improving open and comprehensive information systems related to cooperation. Such as market information, prices and volumes; 5) developing plans to increase the business properly so that it can be right on target; 6) developing and improving profit-sharing schemes that are more profitable and adjusted to the level of risk experienced; 7) further strengthen coordination with the parties.

3.5. Sericulture partnership pattern to increase production and farmer welfare
The demand for silk yarn is predicted to continue to increase along with the increase in population and lifestyle. The ISA estimates an increase of around 2%-3% per year (ISA), the FAO estimates 5% [26], while the domestic market predicts an increase of 12.24%. Sericulture can produce results in a short time. Based on serial financial analysis, the results are quite reasonable with varying B/C ratios. However, several other financial analyzes have shown that sericulture is not feasible because family
labour is considered a cost factor [27, 28, 29,30]. Sericulture can benefit farmers if the final product is yarn, not just cocoons.

Sericulture can be an alternative business to increase the community's income around the forest because of the limited business opportunities in rural areas. Sericulture development does not only produce yarn and cocoons, and there are many other product opportunities, such as silkworm as fish food, mulberry leaf tea, a medicine derived from pupae, manure from silkworm droppings, and carpets or doormats from discarded threads or parts of cocoons [31].

The requirements for developing sericulture do not require large cultivation areas. The result of personal communication with BM FFG stated that with the ownership of a quarter of a hectare land area, it is sufficient to plant mulberry as feed and maintain two boxes of caterpillar eggs (1 egg box consisting of 25,000 silkworm eggs).

To encourage the development of sericulture, the Extension Center at the Ministry of Environment and Forestry collaborates with the BM FFG to organize sericulture training. BM FFG is set to become Wanawiyata Widyakarya, a sericulture pilot. Wanawiyata Widyakarya is a business model in forestry and or the environment, owned and managed by community groups or individuals, set by the Minister of Environment and Forestry as a pilot, training place, and internship for other communities that have interest in sericulture business. The participants are from Sukabumi Regency and other regencies such as Cianjur, Garut, etc. Nine partner farmer groups are currently running, and others are still learning. Several sub-districts are starting to grow interested in sericulture.

BM FFG in addition to collaborating with the EC at MEF, also received guidance from the Social Forestry and Environmental Partnership the MEF as a social forestry business group (SFBG). SFBG is a holder of a Social Forestry Permit/Right who has been running a business as a pioneer for the community in and around the forest.

One of the SFBG activities supported by FRDC is a partnership pattern built between farmers/agro-industry actors and the private sector to increase production and farmers' income. This activity needs to be continuously supported and considered very appropriate to increase the acceleration of the development of natural silk more broadly.

4. Conclusion
The collaboration between the Government (FRDC) with PT. Begawan Sutera Nusantara (PT. BSN) in the transfer of superior seed innovation carried out by the Bina Mandiri Farmers Group (BM FG) succeeded in increasing the silkworm cultivation business. The mechanism for implementing the partnership between PT. BSN and BM FG is a sub-contract, in which the company provides superior silkworm seeds (PS 01) and mulberry cuttings (SULI 01) and provides farmer guidance and marketing guarantees. In contrast, farmers provide land (feed and silkworm houses) and a workforce. With the motivation of both parties to consistently carry out the agreed commitments, the result is that farmers and companies get benefits economically, technically, and socially so that partnerships are built to strengthen each other, meaning mutually beneficial and sustainable for each other.

The sub-contract partnership pattern between private companies and silk farmers with mechanisms, such as those carried out by PT. BSN and BM FG is considered relevant to be developed in increasing farmers' income and skills and increasing the role of the private sector in developing sericulture.

The key to the success of sericulture development is the use of innovative technology, coaching and guidance, expanding marketing areas, providing advice and training to new enthusiasts, developing and expanding cultivation activities, optimizing cooperative relationships and information networks with various parties, also business improvement and access to capital.

Building strategic partnerships in developing sericulture takes seriousness and commitment from stakeholders. Cooperation between the private sector and the government and farmers indicates that the government supports the community for an equal position to achieve the target of partnerships. If national sericulture is managed carefully and accordingly, it can reach the hope of sericulture to support the national economy.
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