

Strengthening of the Formal Complementary Paddy Seeding System and Informal to Fulfill Demand of Quality Paddy Seeds and to Develop Seed Farming Business in West Java

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Abstract. The era of seed commercialization with agribusiness perspective is marked by the stipulation of Government Regulation No. 22/191. However, in general the stipulation of the government regulation has not been able to provide quality paddy seeds according to farmers' needs and instead the paddy production tends to be stagnant. In very difficult conditions to carry out intensification and conversion of agricultural land that continues to suppress food production, the position and function of quality paddy seeds becomes very strategic in the increasing production, therefore, quality paddy seeds must be available enough for all farmers. The current problems in the supply of quality paddy seeds from the formal channel, among others: lack of cooperation between institutions and weak supervision. Under these conditions the role of informal paddy seeds is large enough to support paddy production so that West Java paddy production can be met according to the targets set. Therefore, solutions should be found in the supply of quality paddy seeds, not only through formal channels, but also through informal channels. This study uses descriptive analysis to formulate institutional strengthening of formal and informal complementary paddy seed systems to increase production and income of paddy farmers in West Java.

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1 PREFACE

Paddy is the main food for the majority of the population. As a strategic commodity, its availability must always be sufficient to be able to meet the food needs of rice for the Indonesian population. Because its availability is targeted to always be able to meet the needs, it needs to be supported with production inputs, one of which is quality paddy seeds. The position of quality paddy seeds is very strategic in increasing paddy production. Seed quality will determine the applied quality of technology and management [1].

Since the stipulation of Government Regulation No. 22/1971, formal paddy seeds have been provided by the Government through PT Sang Hyang Sri and PT Pertani. However, through the flow of business entities, it has not been able to guarantee the availability of paddy seeds according to farmers' needs. The problems are, among others: 1) weak cooperation between institutions dealing with seeds, and 2) weak supervision of the circulation of certified seeds. The lack of supply of quality paddy seeds to farmers, has led to rice production in these two decades tend to be stagnant. Under these conditions the role of informal paddy seeds is still quite large and if the quality of informal paddy seeds is improved it is not impossible that West Java paddy production can be improved and can always meet the targets set.

The description of the problems above, it is necessary to find a solution in the supply of quality paddy seeds, not only through formal channels that have always been intensified, but also through informal channels. Providing quality paddy seeds through informal channels is very possible, in addition to regulatory support, informal paddy seeds have adapted to the local environment, and experience states that their productivity is not much difference from the productivity of paddy seeds produced from formal channels.

This study uses secondary data (series) of rice production, and West Java paddy seeds and relevant references. The data, and references are then elaborated

descriptively to formulate a coordinated model of supplying quality paddy seeds at the farmer's level in six ways: right variety, right amount, right quality, right location, right time, and right price.

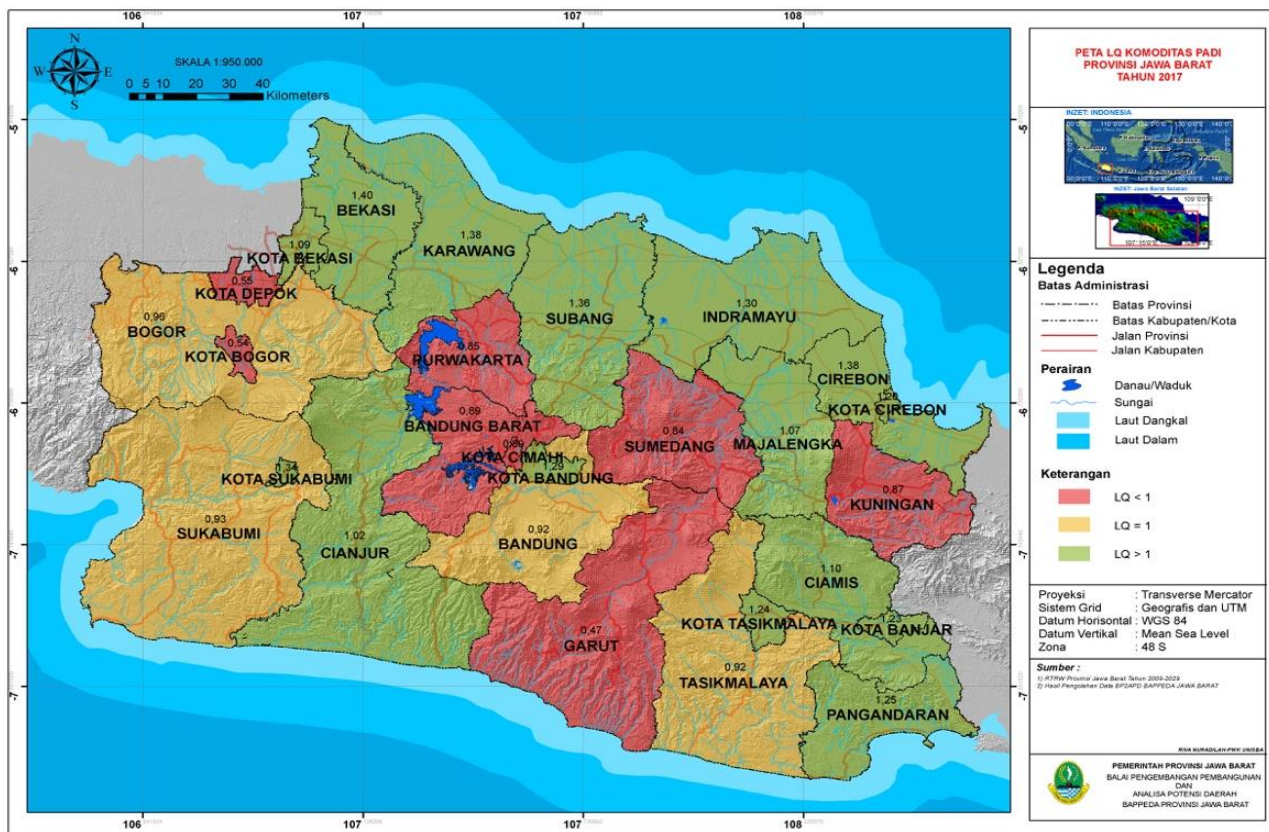
2 LAND AND PADDY PRODUCTION

2.1 Paddy fields

Paddy fields are the main component supporting paddy production whose existence must be maintained and added so that paddy production can be provided sustainably. Paddy fields in West Java covering area of 1,010,938 hectares, consisting of irrigated paddy fields covering 827,134 hectares (81.82%) and non-irrigated paddy fields covering 183,804 hectares (18.18%). Thus, paddy production is mostly produced from irrigated paddy fields. At present, the position of paddy fields is increasingly threatened, because it is converted to non-agricultural land. On the other hand, the implementation of intensification through the printing of new paddy fields faces many obstacles, so that additional paddy fields each year are insignificant compared to the area of converted paddy fields. As a result, paddy fields are rapidly decreasing and narrower.

2.2 Production of lowland paddy

West Java Region is divided into 27 Regencies / Cities, based on Location Quotient (LQ) analysis using data on production of lowland paddy in 2011-2016, there are 15 Districts / Cities as the basis for lowland paddy production ($LQ > 1$) whose production in addition to meeting paddy needs for its region can also contribute to meet the needs of paddy for other regions [2].



Source: [2]

Figure 1. Map of Paddy Production Base in West Java.

West Java lowland paddy production of 11,419,829 tons per year. From the paddy production, 7,307,397 tons of rice are produced per year. Rice produced is mostly needed to meet a population consumption. With a population of 44,987,310 people, and a level of rice consumption of 114.6 kg per capita per year, 5,155,546 tons per year of rice are needed for consumption in West Java. From this calculation, rice production in West Java had a surplus of 2,151,851 tons per year.

Despite the rice surplus, West Java's lowland paddy production actually continues to decline. [3] stated that during 1973-1983 there was a decline in paddy production by 5.51 percent per year, then in

1983-1993 it fell to 2.69 percent per year, and in 1993-2003 it only reached 0.83 percent per year. The same condition as reported by [2], in 2012-2016 paddy production in several production base districts / cities experienced a decline, namely: Ciamis Regency (-8.72%), Indramayu Regency (-1.25%), Subang Regency (-1.86%), Karawang Regency (-0.24%), Bekasi Regency (-5.56%), Bogor City (-28.72%), Sukabumi City (-2.14%), Cirebon City (-10.95%), Bekasi City (-5.14%), City of Tasikmalaya (-3.19%), and City of Banjar (-3.63%).

Table 1. Paddy and rice production of West Java Rice, 2008-2017.

Year	Paddy field (ha)			Production		Population (Person)	Rice Consumption (ton)**)	Surplus (ton)
	Irrigation (ha)	Non Irrigation (ha)	Total (ha)	GKG (ton)	Rice (ton) *)			
2008	944,888	183,756	1,128,644	10,113,538	6,345,234	42,194,869	4,835,532	1,509,702
2009	949,914	185,519	1,135,433	11,322,682	7,258,971	42,693,951	4,892,727	2,366,245
2010	942,411	185,519	1,127,930	11,737,069	7,524,635	43,021,826	4,930,301	2,594,334
2011	942,974	182,040	1,125,014	11,633,890	7,458,487	43,826,775	5,022,548	2,435,938
2012	756,757	181,301	938,058	11,271,861	7,226,390	44,548,431	5,105,250	2,121,140
2013	751,428	187,925	939,353	12,083,162	7,746,515	45,430,799	5,206,370	2,540,146

2014	749,033	187,496	936,529	11,644,899	7,465,545	46,029,668	5,275,000	2,190,545
2015	749,033	187,496	936,529	11,644,899	7,465,545	46,709,569	5,352,917	2,112,628
2016	748,267	180,827	929,094	11,373,144	7,291,323	47,379,389	5,429,678	1,861,645
2017	736,635	176,159	912,794	11,373,144	7,291,323	48,037,827	5,505,135	1,786,188
Average	827,134	183,804	1,010,938	11,419,829	7,307,397	44,987,310	5,155,546	2,151,851

Source: [4-13]; *) Number conversi GKP to Rice year 2005-2007 = 62,74%; **) Rice consumption = 114.6 kg / capita / year; GKG = Milled Dry Grain.

3 LAND AND PADDY SEED PRODUCTION

Quality paddy seeds should be available enough for farmers. In addition to determining the life of plants, seed quality is one of the determinants of output growth [14]. Based on the hierarchy of paddy seeds consisting of: 1) Nucleus seed (NS) is White Label seed, 2) Breeder seed / BS Seed is Yellow Label seed, 3) Foundation seed (FS) is a Label seed White, 4) Stock seed (SS) is a Purple Label seed, and 5) Extension seed (ES) is a Blue Label seed. Paddy seeds produced in West Java include BS, FS, SS and ES class paddy seeds. BS class paddy seeds are produced and will be propagated into FS class paddy seeds, FS class paddy seeds will be propagated into SS class paddy seeds, and then SS class paddy seeds will be propagated into ES class paddy seeds. ES class paddy seed is produced the most because it will be used to produce consumption grain. ES class paddy seeds may not be used to produce lower or equal seed classes, but only for consumption purposes. [15].

3.1 Area of seed production land

The FS class paddy seed production area is 337.87 hectares, SS class is 5,487.63 hectares, and ES class is 12,568.54 hectares. The growth of paddy seed production land area tends to fluctuate with the production performance tends to be unstable, at certain times has increased and at other times has decreased. The reason for this condition because the demand for paddy seeds is very much determined by:

1) how much consumer / distributor orders, and the need for paddy seeds to fulfill government programs, 2) the uptake of the use of new certified paddy seeds at each planting season is still low due to the use of paddy seeds only by most farmers after two planting seasons and even more. [16] states that if the price difference between grain, and seed prices is too large, and farmers have not obtained convincing evidence about the superior quality of the seeds of a variety, farmers will be very careful to buy the seeds.

Besides being determined by the demand, and absorption character, there are several other factors that affect formal paddy seed uptake, namely: 1) informal paddy seed is believed by most farmers to have a high adaptability because it has been tested with the local environment, and its productivity is not much difference from certified paddy seeds, and 2) the use of informal paddy seeds is often linked to a belief in information and experience of fellow farmers, or to the results that have been experienced by farmers themselves.

In the period of 2008-2017, the average production of formal paddy seed: FS class was 817.16 tons, SS class was 11,594.82 tons, and ES class was 28,715.84 tons. Production of FS, SS, and ES class paddy seeds in 2016, is the largest production compared to production in previous years, and paddy seed production in 2017.

Table 2. Land area and paddy seed production in West Java, 2008-2017.

Year	FS		SS		ES	
	Large (ha)	Production (ton)	Large (ha)	Production (ton)	Large (ha)	Production (ton)
2008	174.49	492.39	3,367.09	4,903.76	15,684.94	37,431.77
2009	210.69	653.39	2,035.54	2,963.34	14,171.57	39,596.94
2010	307.11	520.45	3,701.02	4,818.60	16,762.46	39,762.46
2011	233.94	1,015.60	2,906.12	6,596.49	15,141.98	46,489.54
2012	445.49	1,110.05	4,098.81	8,313.97	19,221.02	48,219.77
2013	437.88	657.61	6,845.51	12,046.06	14,928.13	20,534.44
2014	276.77	812.76	6,810.31	15,140.19	6,099.34	7,841.33
2015	332.35	1,173.69	7,473.65	17,894.47	6,776.17	11,876.31

2016	564.00	1,735.66	10,864.30	27,170.50	10,778.03	21,782.10
2017	396.00	1,332.15	6,773.93	16,100.81	6,121.80	13,623.70
Average	337.87	817.16	5,487.63	11,594.82	12,568.54	28,715.84

Source: [17-26]

Many of the formal paddies seeds produced in West Java include: Ciherang, Mekongga and Inpari 30 (Table 3). Paddy seeds of the Ciherang variety are the most sought after seeds. Some factors that support this, are: 1) farmers' tastes (71%), 2) production (52%), 3) land area (58%), 4) land suitability (78%) [27]. [28] highlighted the main reasons farmers chose the

Ciherang variety: a) high grain yields, b) good rice flavor, and c) slim grain form, and d) high rice prices. The choice of farmers to Ciherang paddy seeds and certain preferred varieties of paddy seeds indicates that farmers' preferences are a determining factor in the implementation of paddy seed production. Not only at high target yields, but taste, shape, and price are the most important factors to consider.

Table 3. Vairetas and rice seed classes produced in West Java, 2017.

Varieties	FS		SS		ES	
	tons	(%)	tons	(%)	tons	(%)
Ciherang	482.27	36.20	5,489.97	34.10	5,620.46	41.26
Mekongga	239.49	17.98	3,665.59	22.77	3,516.03	25.81
Inpari 30	106.58	8.00	1,625.25	8.72	1,630.69	11.97
Inpari 32	96.56	7.25	1,404.10	5.51	712.96	5.23
Situ Bagendit	78.37	5.88	946.37	5.88	149.08	1.09
IR 64	26.85	2.02	887.80	10.09	757.80	5.56
Others	328.883	24.69	2,081.72	18.44	1,385.78	10.17
Total	1,332.15	100.00	16,100.81	100.00	13,623.70	100.00

Source: [27]

3.2 Potential of local paddy seeds

As an agricultural area, West Java has the potential of diverse local paddy seed resources that can be used as a part of the supply of quality paddy seeds. Some local paddy varieties is even preferred because seeds are always available and are more resistant to pests and diseases. The distinctive taste of rice and high consumer demand, and a high selling prices also strengthen the perception of farmers to grow local paddy varieties. [30], mentions that local paddy varieties is known as paddy seeds produced from the informal sector paddy seed system that has existed and is cultivated for generations by the farmers and belongs to the community and is controlled by the state.

Local paddy seed resources in several areas in West Java, among others [31, 32]: Bongong varieties (Indramayu), Serendet (Karawang), Pandan Wangi and Beureum Seungit (Cianjur), and Mentik (Subang).

Table 4. Some local paddy genetic resources collection in West Java.

No.	Variety Name	Place of Origin
1	Si Gadis	Bogor Regency
2	Mangkar	Cianjur Regency
3	Mentik	Subang Regency

No.	Variety Name	Place of Origin
4	Golek	Majalengka Regency
5	Cere Beureum	Kuningan Regency
6	Torondol	Tasikmalaya Regency
7	Gumbira	Sumedang Regency
8	Mojang	Garut Regency
9	Bulu Putih	Bekasi Regency
10	Jaer	Ciamis Regency
11	Mayar	Bandung Regency
12	Puhatji	Sukabumi Regency
13	Bengkok	Indramayu Regency
14	Cere Mentik	Purwakarta Regency
15	Serendet	Karawang Regency
16	Meriyem	Cirebon Regency

Source: [32]

3.3 Needs and availability of paddy seeds

Captive breeding and propagation of paddy seeds in West Java are held in 18 regencies / cities by 199 breeders / producers with potential captive land of 13,870 hectares per year and potential candidates for paddy seeds produced by 56,232 tons per year. The paddy seedlings / producers consist of: 1) Individuals,

2) Business Entities, 3) Source Seed Management Unit (UPBS) at the Institute Assessment for Agricultural Technology, and 4) UPTD Paddy Seed Hall owned by Provincial and Regency / City Governments. The pattern of captive breeding / production of certified paddy seeds is mostly done with a partnership (83.33%) and independent business (16.67%) and paddy seed production is carried out Based on orders from distributors, local governments, farm stalls, and other breeders with marketing targets namely: a) in the regency / city area (8.22%), b) in the province (46.55%), and c) outside the province (45.23%). The pattern of captive breeding and propagation of paddy seeds also contributed as a reason so far only some formal paddy seeds have been accepted by farmers, and many farmers still use their own production of paddy seeds. According to [33] farm saved seed are referred

to as seeds produced from seeding in the informal sector.

Based on the area of paddy fields that can be planted with paddy and the average volume of paddy seed use of 25 kg per hectare, the need for paddy seeds to produce consumption paddy is 25,273.45 tons per year, consisting of 20,678.35 tons per year of paddy seeds for land irrigated paddy fields and 4,595,095 tons per year of paddy seeds for non-irrigated paddy fields (Table 6).

Farmers' habits in paddy production mostly use SS and ES class paddy seeds. Assuming the number of certified paddy seeds received by farmers is 35 percent, every year in West Java there is a deficit of the availability of quality paddy seeds on average by 11,164.72 tons per year.

Table 5. Analysis of paddy seed needs in West Java, 2008-2017

Year	Paddy Fields *)			Paddy Seed Needs		
	Irrigation (ha)	Non Irrigation (ha)	Total (ha)	Irrigation (ha)	Non Irrigation (ha)	Total (ha)
2008	944,888	183,756	1,128,644	23,622.200	4,593.900	28,216.100
2009	949,914	185,519	1,135,433	23,747.850	4,637.975	28,385.825
2010	942,411	185,519	1,127,930	23,560.275	4,637.975	28,198.250
2011	942,974	182,040	1,125,014	23,574.350	4,551.000	28,125.350
2012	756,757	181,301	938,058	18,918.925	4,532.525	23,451.450
2013	751,428	187,925	939,353	18,785.700	4,698.125	23,483.825
2014	749,033	187,496	936,529	18,725.825	4,687.400	23,413.225
2015	749,033	187,496	936,529	18,725.825	4,687.400	23,413.225
2016	748,267	180,827	929,094	18,706.675	4,520.675	23,227.350
2017	736,635	176,159	912,794	18,415.875	4,403.975	22,819.850
Average	827,134	183,804	1,010,938	20,678.350	4,595.095	25,273.445

Source: *) [4-13]

Table 6. Calculation of needs and availability of rice seeds in West Java, 2008-2017.

Year	Production		Seeds received by farmers (tons / year) *)	Seed needs (tons/year)	Surplus/Defisit (ton/year)
	SS (ton)	ES (ton)			
2008	4,903.76	37,431.77	14,817.44	28,216.10	(13,398.66)
2009	2,963.34	39,596.94	14,896.10	28,385.83	(13,489.73)
2010	4,818.60	39,762.46	15,603.37	28,198.25	(12,594.88)
2011	6,596.49	46,489.54	18,580.11	28,125.35	(9,545.24)
2012	8,313.97	48,219.77	19,786.81	23,451.45	(3,664.64)
2013	12,046.06	20,534.44	11,403.18	23,483.83	(12,080.65)
2014	15,140.19	7,841.33	8,043.53	23,413.23	(15,369.69)
2015	17,894.47	11,876.31	10,419.77	23,413.23	(12,993.45)
2016	27,170.50	21,782.10	17,133.41	23,227.35	(6,093.94)
2017	16,100.81	13,623.70	10,403.58	22,819.85	(12,416.27)
Average	11,594.82	28,715.84	14,108.73	25,273.45	(11,164.72)

*) Assumption of certified paddy seeds received by farmers by 35 percent

4 THE CONCEPT OF A COMPLEMENTARY MODEL OF THE PADDY SEED INDUSTRY

The condition of deficit quality paddy seeds experienced by West Java, confirms that the era of seed commercialization with agribusiness perspective in Indonesia has not succeeded in providing quality seeds for all farmers. Therefore, solutions are needed to supply quality seeds not only through formal channels, but also through informal channels. Efforts to increase the role of paddy seed in the informal sector are needed, because this sector plays a significant role in the supply of seeds [34].

The relevance of developing an informal paddy seed system is the implementation of the provisions in Law Number 12 of 1992, Constitutional Court Decree in July 2013, Minister of Agriculture Regulation Number 40 / PERMENTAN / TP.010 / 11/2017, and Minister of Agriculture Regulation Number 12 / AGRICULTURE / TP.020 / 04/2018. The regulation allows: a) small farmers to develop superior varieties without having to obtain government permission, b) varieties of breeding results by small farmers are exempted from the provisions of testing, assessment, procedures for release and withdrawal of varieties, c) varieties of breeding results for smallholder food crops compulsory registered by the authorized office in the field of food crops, and d) local variety seed production can be carried out by the farmers, farmer groups, or farmer groups combined after obtaining a recommendation from the Regional Technical Services Unit (Unit Pelayanan Teknis Daerah/UPTD), owning or controlling land and seed processing facilities.

Other considerations in the development of informal paddy seed systems, are: (1) most of the use / application of paddy seeds by farmers in paddy fields are adhered to by the principles of informal relations that take place with adherence to social capital that has been built and applies for a long time to the local community; (2) the sizable contribution of farmers' seed networks in the seed delivery shows that they currently serve farmers' needs quite well, and can benefit regarding choice, accessibility, costs, and non-economic utility (for example, social value); (3) farmers' seed networks can provide quality planting material that is acceptable to farmers [35]; (4) that farmers' networks can maintain morphological characteristics and improved yield varieties for several seasons [36]; (5) farmer networks generally supply materials valued by the farmers, including varieties with traits not produced by formal breeding (such as tolerance of typical local stresses, or certain organoleptic qualities; [37, 38] or neglected plants by formal research; (6) there is a plenty of room to improve quality in farmers networks, because the quality of formal seeds can also be poor due to improper standards or weak enforcement of regulations [39]; (7) The government will not be able to provide all certified paddy seeds or seeds needed by the farmers

through the formal sector paddy seed industry, at any time; and (8) Agroecosystem and Sociocultural diversity cannot be fully managed by the formal sector paddy seed system. The paddy seed system can even vary greatly between plants in one, farm [28].

The research results of [28] in North Sumatra (Batubara, Serdang Bedagai and Simalungun Regencies) illustrates that regarding strengthening the informal paddyseed system, some efforts are still needed to improve the quality of informal paddy seeds, namely: a) the adequacy of skilled and certified human resources and b) application of superior technology, including: a) cultivation / production, b) processing, c) packaging and storage after harvesting and d) distribution of seeds to farmers.

The concept of strengthening the informal paddy seed system through a coordinated model of supplying quality paddy seeds at the farm level is six precisely, starting from two challenges in the seed supply, namely: 1) weak contraction between institutions and 2) weak supervision. The concept to be developed is to place the informal paddy seed system as a complementary to the formal paddy seed system through the input-process-output management stage in consideration of the potential and capability of informal paddy seed resources in West Java. The management stages is as described below.

- **Input stages:** aim to ensure the sustainability of production. In the formal paddy seedling system, it is needed: regulations, Germplasm, seed sources of new varieties location-specific / preferred by farmers, researchers, extension workers, supervisors of plant seeds (PBT), facilities and infrastructure, as well as budgets. Then in the informal paddy seed system it is needed: regulation, Germplasm, seed sources of local superior varieties, certified skilled / trained farmers, facilities and infrastructures, as well as the budget.
- **Process Stages:** aim at the transfer of knowledge and technology from formal institutions to informal institutions, namely: strengthening research, breeding, releasing varieties, improving quality and supervision, technical assistance and guidance, education and training, cooperation, and partnerships. The formal institutions referred to are: a) Research, Breeding, Release of Variety Institutions; b) Supervision and Certification Body; c) Supporting Institutions; and d) Production and Distribution Institutions.

Informal Institutions are farmer groups in which Seedling Sections are formed, covering Sub Sections: 1) Research and Breeding, 2) Quality and Supervision, and 3) Production and Distribution, each of which are filled by skilled / trained and certified farmers. The farmer is technically and operationally tasked with providing quality paddy seeds according to the needs of his group.

Institutional strengthening in the informal paddy seed system is empowering, by making

planned changes with the goal of forming a reliable group in the supply of quality paddy seeds. Planning in institution is carried out Based on mutual agreement and carried out consciously and seriously by the members who are attached to local wisdom relations sharing, sharing roles, beliefs and shared responsibilities. Thus, the institution that was built was not merely a collection of individuals [40].

In addition to institutional strengthening in the informal paddy seed system, cooperation and partnerships with institutions in the formal seed system is also established. Cooperation and partnerships are needed to strengthen the interconnection and coordination in the implementation of superior knowledge and technology transfer functions to farmer groups. Superior knowledge and technology transferred, including: a) breeding, b) cultivation / production,

c) processing, d) packaging and storage after harvest, e) distribution, and f) quality control.

- **Output Stages:** activity output is the establishment of formal and informal complementary paddy seed system as a service unit of a reliable farmer group in the supply of quality paddy seeds with six appropriate for farmer groups in their environment.

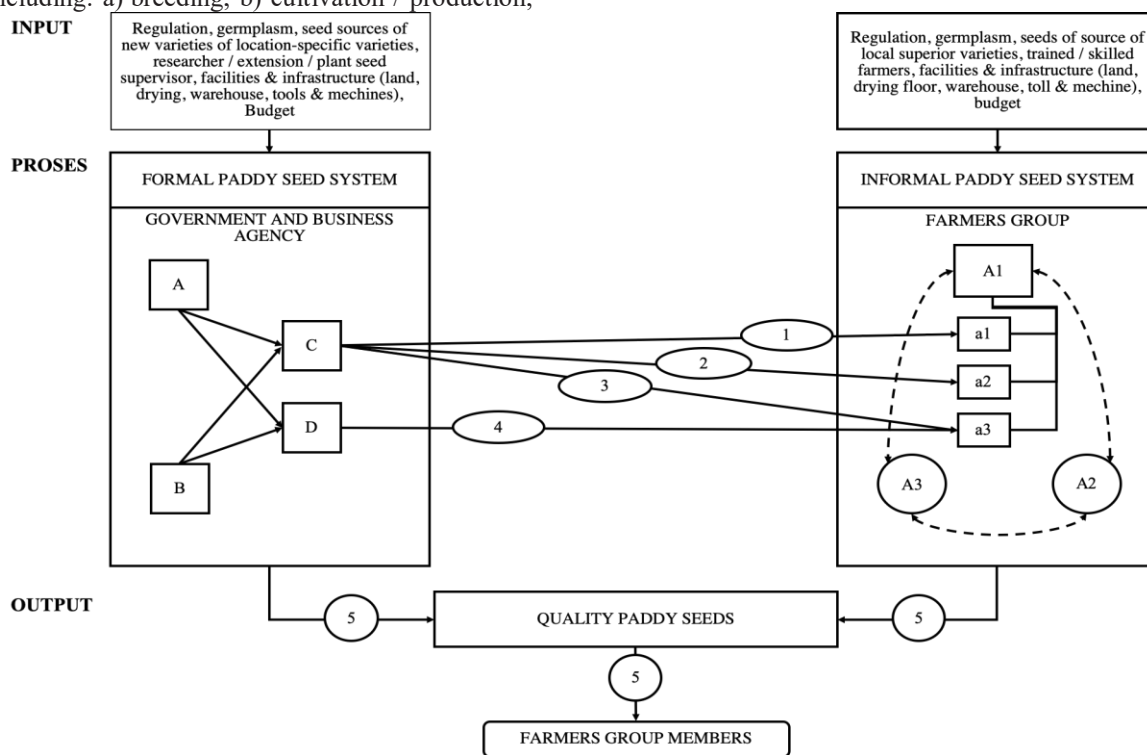


Figure 2. The Concept of a Complementary Model of the Formal and Informal Sector Paddy Seed System.
 Description of Fig. 2:

- A = Research Institute, Breeding, Release of Varieties
- B = Institute for Supervision and Certification
- C = Supporting Institution (Institute Assessment for Agricultural Technology, Provincial / District / City Agriculture Agency, Agricultural Extension Center)
- D = Institute for Production and Distribution (Business Entity and Source Seed Management Unit)
- 1+2+3 = Education and Training, Counseling + Coaching + Cooperation
- 4 = Education and Training, Counseling + Coaching + Partnership
- 5 = Distribution
- A1 = Seed Section
- a1 = Research and Breeding sub-section
- a2 = Quality and Supervision sub-section
- a3 = Production / Distribution sub-section
- A2 = Paddy Production Section
- A3 = Other Business Sections in the Community / Group Farmers

5 FARM INCOME

The development of complementary synergy between the formal and informal rice seed system is expected to be sufficient to supply quality rice seeds for all farmers and provide farming benefits. The results of farming analysis state that rice seed farms that apply superior rice varieties provide benefits and consumption rice farming that applies new improved varieties and local rice varieties provide benefits.

Table 6. Financial analysis of paddy seed breeding farming in West Java

Description	Financial Analysis (/ha)	
	A	B
a. Production facilities cost (IDR / ha)	8,342,478	3,935,000
b. Labor costs (IDR / ha)	7,845,252	7,850,000
c. Others cost (IDR / ha)	1,700,882	9,045,000
d. Total ((IDR / ha)	17,888,611	20,830,000
e. Production (ton/ha)	6,49	5,00
f. Price (IDR / kg)	5,100	8,500
g. Acquisition (IDR / ha)	33,076,917	42,500,000
h. Income (IDR / ha)	15,188,306	21,670,000
i. R/C	1,85	2,04

Source: A [41], B [42]

Table 7. Performance of lowland paddy farming using new superior varieties and local varieties in West Java

Description	New Superior Varieties		Local Varieties Pandan Wangi (C)
	Mekongga (A)	Inpari 7 (B)	
a. Production facilities cost (IDR / ha)	2,216,498.85	2,180,000	1,064,155.54
b. Labor costs (IDR / ha)	8,431,208.83	16,520,000	3,264,804
c. Others cost (IDR / ha)	3,288,718.49	5,350,000	14,486,531.64
d. Total ((IDR / ha)	13,936,426.17	24,125,000	18,815,491.18
e. Production (ton/ha)	5,59	9,76	7,58
f. Price (IDR / kg)	4,673.33	5,000	3000
g. Acquisition (IDR / ha)	26,134,106.09	48,800,000	22,731,288
h. Income (IDR / ha)	12,197,679.39	24,675,000	3,916,336.82
i. R/C	1.88	2.02	1.21

Source: A = [43], B = [44], C = [45]

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

The conclusions of this study were:

- In addition to weak ties between institutions and weak supervision in the supply of quality paddy seeds, several other problems that accompany them are the decreasing number of paddy fields, and paddy production which tends to be stagnant.

- Institutional strengthening of formal and informal seed systems can be done through the empowerment of farmer groups Based on mutual agreement and bonded with local wisdom relations that apply in the community.
- Complementary models of formal and informal paddy seed systems in the form of institutional coordination with the aim of carrying out the function of transfer of knowledge and technology to farmer groups to be able to provide six quality paddy seeds appropriately.

6.2 Recommendations

Complementary models of formal and informal paddy seed systems are needed to provide quality paddy seeds for all farmers. Therefore, policy support, human resources, budget, infrastructure and facilities are needed so that the knowledge and technology of paddy seedlings can be immediately mastered by the farmer groups. With the availability of farmers who are skilled / trained and certified in the seed technology will be built management of reliable quality paddy seed production at the scale of farmer groups and the availability of sustainable quality paddy seeds.

REFERENCES

- [1] S. Sadjad, S., F.C. Suwarno, S. Hadi, *Tiga Dekade Berindustri Benih di Indonesia*, Gramedia (2001)
- [2] Bappeda Jawa Barat, *Kajian Ekonomi Pertanian Tentang Ketahanan Pangan di Jawa Barat*, (2017)
- [3] Irawan, B. 2004. *Kelembagaan Program Rintisan dan Akselerasi Pemasyarakatan Inovasi Teknologi Pertanian (Prima Tani)*, ((to be published)
- [4] BPS Jawa Barat, *Jawa Barat Dalam Angka 2008* (2009)
- [5] BPS Jawa Barat. *Jawa Barat Dalam Angka 2009* (2010)
- [6] BPS Jawa Barat, *Jawa Barat Dalam Angka 2010* (2011)
- [7] BPS Jawa Barat, *Jawa Barat Dalam Angka 2011* (2012)
- [8] BPS Jawa Barat, *Jawa Barat Dalam Angka 2012* (2013)
- [9] BPS Jawa Barat, *Jawa Barat Dalam Angka 2013* (2014)
- [10] BPS Jawa Barat, *Jawa Barat Dalam Angka 2014* (2015)
- [11] BPS Jawa Barat, *Jawa Barat Dalam Angka 2015* (2016)
- [12] BPS Jawa Barat, *Jawa Barat Dalam Angka 2016* (2017)
- [13] BPS Jawa Barat, *Jawa Barat Dalam Angka 2017* (2018)
- [14] P. Vashishta, *Economic Analysis of Formal and Informal Seed Supply Chain for Rabi Sorghum in Marginal Environments of Sat India*, Report Submitted to International Crops Research Institute for the Semi-Arid Tropics Patancheru, 502 324. Andhra Pradesh, India (2013)
- [15] H. Kuswanto, Sidik, *Produksi dan Distribusi Benih* (1994)
- [16] U. Nugraha, B. Sayaka, *Industri dan Kelembagaan Perbenihan Padi. Dalam: Ekonomi Padi dan Beras Indonesia*. Forum Komunikasi Dan Antar Peminat dan Ahli Benih. Balittas. Malang (2009)
- [17] BPSBTPH Jawa Barat, *Laporan Tahunan Balai Pengawasan dan Sertifikasi Benih Tanaman Pangan, Provinsi Jawa Barat Tahun 2008* (2009)
- [18] BPSPTPH Jawa Barat, *Laporan Tahunan Balai Pengawasan dan Sertifikasi Benih Tanaman Pangan, Provinsi Jawa Barat Tahun 2009* (2010)
- [19] BPSPTPH Jawa Barat, *Laporan Tahunan Balai Pengawasan dan Sertifikasi Benih Tanaman Pangan, Provinsi Jawa Barat Tahun 2010* (2011)
- [20] BPSPTPH Jawa Barat, *Laporan Tahunan Balai Pengawasan dan Sertifikasi Benih Tanaman Pangan, Provinsi Jawa Barat Tahun 2011*(2012)
- [21] BPSPTPH Jawa Barat, *Laporan Tahunan Balai Pengawasan dan Sertifikasi Benih Tanaman Pangan, Provinsi Jawa Barat Tahun 2012* (2013)
- [22] BPSPTPH Jawa Barat, *Laporan Tahunan Balai Pengawasan dan Sertifikasi Benih Tanaman Pangan, Provinsi Jawa Barat Tahun 2013* (2014)
- [23] BPSPTPH Jawa Barat, *Laporan Tahunan Balai Pengawasan dan Sertifikasi Benih Tanaman Pangan, Provinsi Jawa Barat Tahun 2014* (2015)
- [24] BPSPTPH Jawa Barat, *Laporan Tahunan Balai Pengawasan dan Sertifikasi Benih Tanaman Pangan, Provinsi Jawa Barat Tahun 2015* (2016)
- [25] BPSPTPH Jawa Barat, *Laporan Tahunan Balai Pengawasan dan Sertifikasi Benih Tanaman Pangan, Provinsi Jawa Barat Tahun 2016* (2017)
- [26] BPSPTPH Jawa Barat, *Laporan Tahunan Balai Pengawasan dan Sertifikasi Benih Tanaman Pangan, Provinsi Jawa Barat Tahun 2017* (2018)
- [27] R. Siata, Faktor-Faktor yang Mempengaruhi Petani dalam Penerapan Benih Padi Varietas Ciharang di Desa Pudak Kecamatan Kumpeh Ulu. *Sosiohumaniora*, Vol. **18 No. 3** : 240 - 247 (2016)
- [28] S.A.F. Wahyuni, V. Yuningsih, M.L. Widiastuti, *Teknik Pengelolaan dan Mutu Benih yang Dihasilkan dari Sektor Perbenihan Informal*. Prosiding Temu Teknologi Padi, 2015, Buku-2 (2016)
- [30] BB Padi, *Pengertian Umum Varietas, Galur, Inbrida, dan Hibrida*. Sumber Iptek Tanaman Padi. <http://bbpadi.litbang.pertanian.go.id/index.php/info-berita/info-teknologi/pengertian-umum-varietas-galur-inbrida-dan-hibrida> (2015)
- [31] E. Paturohman, Sumarno, 2017, *Sistem Perbenihan Formal dan Informal Tanaman Pangan (Formal and Informal Seed System in the Food Crops Production)*. Iptek Tanaman Pangan Vol. **12 No. 2**, Pusat Penelitian dan Pengembangan Tanaman Pangan. Bogor (2017)
- [32] Balai Besar Biogen, *Katalog SDG Tanaman Pangan* (2017)

- [33] O. Digna, J.D. Manzanilla, J.DE, Johnson, *Membangun Sistem Perbenihan Berbasis Masyarakat*, Manual Pelatihan, (1993)
- [34] M.R. Turner, M.R., *Problems of privatizing the seed supply in self-pollinated garin crops*. In: H. van Amstel, J. W. T. Bottema, M. Sidik and C. E. Van Santen (eds.). *Integrating Seed Systems for Annual Food Crops*, CGPRT (No. **32**:17-29, 1996)
- [35] L. Sperling, S.J. Mc Guire, *Persistent myths about emergency seed aid*. *Food Policy* **35**, (195–201, 2010b)
- [36] M. Deu, E. Weltzien, C. Calatayud, Y. Traoré, D. Bazile, E. Gozé, G. Trouche, K.v. Brocke, *How an improved sorghum variety evolves in a traditional seed system in Mali: effects of farmers' practices on the maintenance of phenotype and genetic composition*. *Field Crops Res.* **167**, (131–142, 2014)
- [37] S. Ceccarelli, *Specific adaptation and breeding for marginal conditions*. *Euphytica* **77**, (205–219, 1994)
- [38] M.R. Bellon, D. Hodson, J. Hellin, J., *Assessing the vulnerability of traditional maize seed systems in Mexico to climate change*. *Proc. Natl. Acad. Sci. USA* **108**, (13432–13437, 2011)
- [39] R. Tripp, N. Louwaars, W.J. Van Der Burg, D.S. Virk, J.R. Witcombe, *Alternatives for seed regulatory reform an analysis of variety testing, variety regulation and seed quality control*, Agricultural Research and extention network Paper. **69** (1997)
- [40] World Bank, *"The Initiative on Defining, monitoring and Measuring Social Capital: Text of Proposal Approved for Funding"*. Social Capital Initiative Working Paper No. 2. The World Bank, Social Development Family, Environmentally and Socially Sustainable Development Network. June (1998)
- [41] D. Kusnadi, D. Herdiansah Sudjaya, Z. Normansyah, *Analisis Usahatani Penangkaran Benih Padi (Oryza sativa l.) Varietas Ciherang (Studi Kasus Pada Seorang Penangkar Benih di Desa Purwajaya Kecamatan Purwadadi Kabupaten Ciamis)*. *Jurnal Ilmiah Mahasiswa AGROINFO GALUH* Vol. **1** No. **2**, (89-96, Januari 2015)
- [42] Y. Haryati, *Model Sekolah Lapang Kedaulatan Pangan Mendukung Swasembada Pangan Terintegrasi Desa Mandiri Benih*. Laporan Akhir Tahun, Badan Penelitian dan Pengembangan Pertanian Balai Pengkajian Teknologi Pertanian Jawa Barat (62, 2017)
- [43] F. Firmana, R. Nurmalina, *Dampak Penerapan Program SLPTT terhadap Pendapatan Usahatani Padi di Kecamatan Telagasari Kabupaten Karawang*. *Jurnal Agrikultura*, **27** (1) (38-48, ISSN 0853-2885, 2016)
- [44] S. Lia Mulijanti, R. Sianipar, *Analisis Profitabilitas Usahatani Beberapa Vub Padi Pada Musim Kemarau Panjang di Kabupaten Sumedang*. *Prosiding Seminar Nasional 2016*. Balai Besar Penelitian Tanaman Padi, Badan Penelitian dan Pengembangan Pertanian **Buku-2, Bagian 2** (1047, 2017).
- [45] D. Murdani, *Analisis Usahatani dan Pemasaran Beras Varietas Pandan Wangi dan Varietas Unggul Baru (Kasus Kecamatan Warungkondang, Kabupaten Cianjur, Jawa Barat)*. Skripsi Program Sarjana Agribisnis Penyelenggaraan Khusus Departemen Agribisnis Fakultas Ekonomi Dan Manajemen Institut Pertanian Bogor (103, 2008)