A Model for Accelerating Rice Planting in Paddy Fields to Provide Food in Banten Province during the Covid-19 Pandemic

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ABSTRACT The Indonesian government continues to ensure the availability of rice as a staple food through various programs, including optimization of paddy fields. Paddy field management is directed and encouraged more intensively by accelerating planting and minimizing idle land. The form of support and stimulation provided by the government to farmers is in the form of counseling and assistance, providing seed assistance, and facilitation of agricultural machinery and other facilities so that rice fields can be more intensive and productive. The study was conducted in Lebak Regency and Serang City, Banten Province from April to August 2020. Data and information were obtained through surveys and interviews with farmers, extension agents, researchers, and agricultural department officials. The research method used a systems approach based on soft systems methodology. The results of the study showed the acceleration of planting as an indicator of the optimization of wetland land in Lebak Regency and Serang City had been achieved as targeted. The role of the extension agents as a driving force was very decisive in the achievement of additional planting areas. The use of information technology, such as applications for monitoring standing crops, was very helpful for extension agents in detecting land to be planted, planting achievements, and reported data. The system of coordination and guidance between agencies and officers to accelerate planting was quite effective and efficient. Support and facilities for agricultural extension agents had to be improved to achieve accelerated planting performance.

1. Introduction
Rice is the staple food for Indonesian. The government needs to ensure national rice production’s sufficient to support national food security. Banten is one of the national rice producers with a potential agricultural land of about 96,285 hectares of rice fields, including irrigated rice fields about 98,227 hectares and rainfed about 98,058 hectares, also has dryland about 203,728 hectares [1]. The most rice producers in Banten are Pandeglang District, Lebak District, Serang District, and Tangerang District. Banten Province in 2018 produced rice about 1,643,046 tons [2].

Rice production in Banten Province can be increased by intensifying the land, Government is supporting to increase the planting area and productivity. Intensification programs provide tangible results to increase production [3]. Increasing the planting area or increasing the cropping index still takes into account land resources and the environment. [4] Increasing productivity by applying location-specific technologies,
including the use of early age seeds, mechanization, and site-specific fertilization. The application of technology at the farm level is still low and the technology adoption process is gradual. They will select the technology components that are seen as having a big influence on rice production. Several considerations in selective technology are economic, social, and environmental factors. Economic and social factors determine the adoption of technology at the farm level. For farmers, good technology is still difficult to obtain, and even though there is an application, it is difficult because it usually requires the use of more input factors. As a result, even though it is known by farmers, most of them are doubtful to apply the new technology in their rice production. Phenomenal innovation is the green revolution in rice agribusiness through the discovery and use of new high yielding, short-lived, superior varieties that are resistant to pests and diseases.

2. Material and Methods
The research was conducted in Banten Province from April to August 2020. Data and information were collected through surveys, Focus Group Discussions (FGD), and in-depth interviews with farmers, extension agents, and policymakers. Data collected in this research is harvested area data, productivity, production, agricultural tools and machinery, and the response of farmers and extension agents to the program. This study used the Soft Systems Methodology (SSM) approach to find problems in the field, the concept of the model changes offered to the opportunities for implementing the model in solving problems such as the stages of SSM research Figure 1 [5,6]

![Figure 1. Stages of research with the Soft Systems Methodology (SSM)](image)

Seven steps were taken in the research, (1) Identify the problem; the rice production intensification problem, (2) Express the problem situation (Expressing the problem situation) knowing the problems and the roles of various parties involved in the rice production system (3) Formulate root definitions of relevant systems of purposeful activity, which is to identify the stakeholders involved, transformation,
Weltanschauung (perspective), and the environment to then build a system definition of human activities needed to improve problem situation. (4) Build conceptual models of the systems named in the root definitions (build a conceptual model) based on the Root Definition for each defined element, then build the conceptual model needed to achieve the ideal goal. (5) Compare models with real-world action (comparison between conceptual models and problem situations / comparing models with reality) is to compare the conceptual system models created with what happens in the real world. (6) Defining possible changes that are both desirable and feasible is to create a public debate to identify these feasible changes. (7) Take action to improve the problem situation (take corrective action) using an action plan to improve the problem situation. The scope of this research was up to stage 4 considering the limited time.

3. Results and Discussion
3.1. Potential of Agricultural Land
The rice field area in Banten Province is shown in Table 1. About 50.04% of the rice field is irrigated rice fields and about 49.96% of the rice field is rainfed rice fields [7]. The most potential rice field to be increased in the cropping index is irrigated rice fields. The irrigated rice field is the rice field with a good water resource and infrastructure that can provide water every season of the year. In contrast, the rainfed land can only be planted once a year.

| Regency / City | Number of Regions | Rice Field (ha) | dryland (ha) |
|---------------|-------------------|-----------------|--------------|
|               | villages / Sub-    | Irrigation      | rainfed      | amount       | plantation | forest | Not cultivated |
|               | districts          |                 |              |              |            |        |               |
| Pandeglang    | 35                | 339             | 27.746       | 32.022       | 54.768     | 63.331  | 31.408        | 4,990 |
| Lebak         | 28                | 345             | 22.747       | 25.006       | 47.753     | 19.062  | 28.131        | 2,772 |
| Tangerang     | 29                | 274             | 23.744       | 12.687       | 36.231     | 9.241   | 0             | 1,202 |
| Serang        | 29                | 326             | 23.887       | 147          | 47.578     | 19.266  | 7.269         | 631   |
| Serang City   | 13                | 104             | 316          | 1.503        | 463        | 546     | 36            | 246   |
| Cilegon City  | 8                 | 43              | 0            | 3.152        | 1.503      | 2.715   | 1.871         | 1,133 |
| Serang City   | 6                 | 67              | 4.787        | 54           | 7.939      | 7.279   | 1.723         | 0     |
| Tangerang City| 7                 | 54              | 0            | 54           | 47.28     | 478     | 375           | 23    |
| Summary       | 155               | 1,552           | 98.227       | 98.058       | 196.285    | 121.918 | 70.813        | 10,997|

3.2 Availability of agricultural machinery
Agricultural machinery is an important means needed for agricultural intensification. The types of agricultural machinery needed for accelerated planting were a tractor for tillage, a transplanter for planting, a Thresher / combine harvester for harvesting tools. Based on the data on the availability and adequacy of the tools and machines, most of them were fulfilled optimally. The tools and machines that were quite adequate were tractors. Meanwhile, transplants and combine harvesters were in a very poor status. For the threshing tool, some areas in the Serang Regency had exceeded (saturated) status, while the districts/cities with very poor status (Table 2).
Table 2. Adequacy of agricultural machinery in districts/cities in Banten Province

| Types of agricultural machinery | Regency / City | Needs (unit) | Availability (unit) | Deficiency (unit) | Adequacy (%) | Adequacy status |
|---------------------------------|---------------|-------------|---------------------|------------------|--------------|----------------|
| Tractor                         | Serang city   | 753         | 334                 | 419              | 44           | Less           |
|                                 | Lebak         | 2283        | 2202                | 81               | 96           | Enough         |
|                                 | Pandeglang    | 2803        | 2239                | 564              | 80           | Enough         |
|                                 | Serang        | 2654        | 2040                | 614              | 77           | Enough         |
|                                 | Tangerang     | 2186        | 1462                | 724              | 67           | Enough         |
|                                 | Serang city   | 84          | 4                   | 80               | 5            | Very less      |
|                                 | Lebak         | 254         | 95                  | 159              | 37           | Very less      |
| Transplanter                    | Pandeglang    | 312         | 94                  | 218              | 30           | Very less      |
|                                 | Serang        | 295         | 77                  | 218              | 26           | Very less      |
|                                 | Tangerang     | 243         | 79                  | 164              | 33           | Very less      |
|                                 | Serang city   | 1117        | 99                  | 1072             | 8            | Very less      |
| Thresher                        | Lebak         | 3551        | 282                 | 3269             | 8            | Very less      |
|                                 | Pandeglang    | 4361        | 201                 | 4160             | 5            | Very less      |
|                                 | Serang        | 4128        | 6078                | -                | 147          | Saturated      |
|                                 | Tangerang     | 3401        | 67                  | 3334             | 2            | Very less      |
|                                 | Serang city   | 88          | 24                  | 64               | 27           | Very less      |
| Combine Harvester               | Lebak         | 267         | 64                  | 203              | 24           | Very less      |
|                                 | Pandeglang    | 328         | 86                  | 242              | 26           | Very less      |
|                                 | Serang        | 310         | 75                  | 235              | 24           | Very less      |
|                                 | Tangerang     | 256         | 32                  | 224              | 12           | Very less      |

3.3 Rice production intensification program

To increase rice production, the Government sets a rice production target for each district/city in Banten Province every year. In 2020, Banten was targeted for rice production of about 1,707,721 tons of rice with a harvested area of about 325,872 hectares. Furthermore, in 2020, Banten Province has set rice planting targets in each district/city as presented in Table 3.

Table 3. Target of Rice Planting Areas in Banten Province in 2019/2020

| Regency / City | Rice Paddy planting period (month) |
|----------------|------------------------------------|
|                | October - March | April - September | Amount |
| Pandeglang     | 76.736           | 59.767            | 136.503          |
| Lebak          | 53.471           | 48.329            | 101.800          |
| Tangerang      | 28.756           | 28.334            | 57.690           |
| Serang         | 46.334           | 44.580            | 90.914           |
| Tangerang city | 296              | 211               | 507              |
| Cilegon city   | 1.262            | 641               | 1.903            |
| Serang city    | 7.680            | 6.136             | 13.816           |
| Tangsel city   | 36               | 40                | 76               |
| Total          | 214.752          | 188.638           | 403.210          |

To achieve these targets, the government provided production facilities assistance to farmers in the form of 45,000 ha of inbred rice seeds and agricultural machinery consisting of 20 units of power thresher; 2 units of power thresher, husker, and polisher. Besides, the agriculture machinery assistance, the government also
assists in increasing knowledge of the farmer and agriculture extension agent about rice production intensification program and technology. During the Covid 19 pandemic, the assistance was carried out virtually. This method was only used during the pandemic period from July to August. We analyzed the response of assistance and the effectiveness of the training method. It was done virtually to record and the feedback on the methods and material presented from the participants. The topic of material conveyed by the planting calendar information technology was a tool for reference in designing a planting schedule in line with climate change [8].

The training or assistance was conducted for agricultural extension agents in Lebak Regency in July 2020 with 74 participants. The purpose of this training is to increase the participants' knowledge of the Cropping Calendar Information System (CCIS). The participant ranges from aged 20 to 50 years old and 43% of the participant has a formal education until high school, 57% of the participant has a formal education until college education. The study showed 74% of participants had never previously attended training on the planting calendar information system. Then, 27% of participants had used planting calendar information technology recommendations and 35% of participants had recommended SI Katam information to farmers. Participants responded well enough and provided benefits in carrying out their duties to be used as a reference in coaching farmers.

### Table 4. Participants' responses to planting calendar information Katam

| Description                                | Not yet known | Already known |
|--------------------------------------------|---------------|---------------|
| Have attended Katam Training               | 55            | 19            |
|                                           | 74.32%        | 25.68%        |
| Already using Katam                        | 47            | 27            |
|                                           | 63.51%        | 36.49%        |
| Disseminate katam information to farmers   | 39            | 35            |
|                                           | 52.70%        | 47.30%        |

### Table 5. Participants' responses to the development of planting calendar information technology

| Description                                | Not good | pretty good | good |
|--------------------------------------------|----------|-------------|------|
| Information material as needed             | 0        | 47          | 27   |
|                                           | -        | 63.51%      | 36.49% |
| adequacy of implementation time            | 0        | 56          | 18   |
|                                           | -        | 75.68%      | 24.32% |
| the ability of the resource person         | 0        | 41          | 33   |
|                                           | -        | 55.41%      | 44.59% |
| suitability of training media (virtual)    | 1        | 59          | 14   |
|                                           | 1.35%    | 79.73%      | 18.92% |
| Ease of receiving materials                | 1        | 49          | 24   |
|                                           | 1.35%    | 66.22%      | 32.43% |
| Effectiveness of media for training        | 2        | 56          | 16   |
|                                           | 2.70%    | 75.68%      | 21.62% |

3.4 Rice Production Performance in Lebak Regency and Serang City

During the period of 2015 to 2019, the production performance of Lebak district shows harvested areas ranging from 101,712 - 154,506 ha/year with an average of 118,998 ha/year, production 607,222-869,869 t / year with an average of 709,693 t / year). Furthermore, productivity ranges from 5.63 to 6.30 t / ha with an average productivity of 6.02 tonnes/ha. The area of harvest and production experienced positive growth of 0.45 and 0.38 respectively, while productivity experienced negative growth of (-0.053) (Table 7.). These results indicate that the increase in lowland rice production in Kab. Lebak contributed more from the harvested area, not from the productivity of rice production. Now and in the future, dryland conversion is one of the rice production problems, so if it just depends on the harvested area it will be difficult to maintain rice production. It is needed to increase rice production through optimization land with increased rice cropping index and the application of technology to encourage increased rice productivity.
Table 6. Lowland Rice Production and Productivity in Lebak regency and Serang city

| Commodity and Variables | Years | average | Growth |
|------------------------|-------|---------|--------|
|                        | 2015  | 2016    | 2017   | 2018   | 2019   |        |
| Lebak regency          |       |         |        |        |        |        |
| a. Harvest area (ha)   | 101.712 | 107.114 | 107.809 | 120.542 | 154.506 | 118.336 | 0.459 |
| b. Production (ton)    | 607.222 | 674.818 | 657.634 | 738.922 | 869.869 | 709.693 | 0.386 |
| c. Productivity (t/ha) | 5.97  | 6.30    | 6.10    | 6.13    | 5.63    | 6.02    | -0.053 |
| Serang city            |       |         |        |        |        |        |
| a. Harvest area (ha)   | 13.455 | 15.550  | 14.418  | 13.820  | 14.305  | 14.309  | 0.076 |
| b. Production (ton)    | 77.837 | 88.862  | 80.755  | 80.443  | 80.254  | 77.630  | 0.126 |
| c. Productivity (t/ha) | 5.78  | 5.73    | 5.60    | 5.60    | 5.45    | 5.63    | -0.052 |

Lowland rice production performance has the same pattern as the production performance of Lebak Regency, where there was positive growth in the planting area and production with a value of 0.076 and 0.126, while productivity had negative growth with a value of -0.052. The role of planted area and productivity on production gave a pattern like in the province of East Java [9].

3.5 Rice Production Problems
The problems faced in increasing the planting area, harvested area, and productivity were closely related to the availability of land resources, including land-use change, availability of agricultural equipment and machinery, human resources (capacity and capability), and government programs to increase rice production. [5] In summary, production problems and solution efforts that can be done by connecting all actors involved in the production, namely Customers / Clients, Actors, Transformation Processes, Weltanschauung, Owners, Environment Constraints (CATWOE) are shown in Table 8.

Table 7. Root Definition of rice production

| Component | Definition |
|-----------|------------|
| 1 Customer/ Clients | Farmer Group |
| 2 Actors | Government |
| 3 Transformation Process | Increased facilities and knowledge of farmer groups about climate, planting schedules, management of agricultural machinery |
| 4 Weltanschauung | Optimization of land supports increased rice production. |
| 5 Owner | Government |
| 6 Environment Constraint | Climate change and conversion of agricultural land. |

Client or customer is a group of farmers who act as beneficiaries to move farmers to optimize agricultural land, agricultural machinery so that they are more productive in producing rice. Actors who play a role are the government as the driving force, regulation so that business actors are able to follow programs and targets to meet food needs. The transformation is carried out in the form of intensification and optimization of agricultural land through accelerating planting and increasing the index so that rice production will increase. The Weltanschauung step is the effort to optimize agricultural land to increase rice production and national food supply. As Owner, the government through the Ministry of Agriculture has a role to ensure
the availability of food for the Indonesian community. Meanwhile, Environment Constraints are aspects that have the potential to hinder the implementation of programs to be carried out by various parties, including climate change and conversion of agricultural land functions. [10].

3.6 Conceptual Model of increasing the rice planting index

Based on the results of the analysis, a conceptual model can be built for intensification of agricultural land so that there will be an increase in the cropping index and rice production in Banten province [11,12]. Figure 2 is a conceptual model for intensification or improvement of the cropping index with 9 stages and activities starting from evaluation in production in terms of land, human resources, application of technology, facilities, and programs so that problems and needs are needed in the field can be identified. Furthermore, planning efforts to increase production are carried out.

**Figure 2.** Conceptual Model of increasing cropping index and harvested area to increase production

Important efforts that need to be made for this purpose can be grouped into two aspects, namely increasing production facilities and increasing the capacity of human resources. These two aspects will further improve and enhance the ability of business actors in designing planting schedules, managing agricultural machinery, and improving mastery of cultivation and post-harvest technology. Through these stages, changes in the cropping index will be obtained and then re-evaluated. Program evaluation and performance achievements include effectiveness, efficiency, and efficacy.
4. Conclusion

Rice production in Banten Province was more influenced by planted area and harvested area than crop productivity. This was reflected in the positive growth in Lebak Regency 0.459 and Kota Serang 0.126. The cropping index (planting area) could be increased again through increasing the capacity of human resources (farmers, Gapoktan), especially in designing planting schedules, managing agricultural machinery, and applying cultivation and post-harvest technology. Another important thing was that the government needs to provide support so that production facilities are fulfilled optimally, especially agricultural machinery such as tractors, transplanters, combine harvesters, and water pumps.

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