

# Farmer's Technology Capability Model through Farmer Own Enterprises

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## Abstract

This research aimed to develop a model for enhancement capability of farmer's technology through partnerships with Farmer-Owned Enterprises (BUMP). The model for enhancement capability of farmer's technology consists of a technology needs sub-models, technology capability measurement sub-models, and program formulation for enhancement capability of farmers technology sub-model. The analysis used in this research is Analytical Hierarchy Process, Multi Expert Multi-Criteria Decision Making (ME-MCDM), ESCAP, and Business Process Mapping. The results of the research program in the form of capacity building of farmers through partnerships BUMP technology.

**Keywords:** Analytical Hierarchy Process, Multi Expert Multi Criteria Decision Making, ESCAP, Business Process Mapping

## Introduction

Indonesian rice productivity from 1998 to 2007 experienced an increasing trend. However, the trend of increased productivity when compared to the increase in productivity in other countries, Indonesia is still lagging. Based on data from IRRI (2009), up to 2000, productivity of rice Indonesia ranks fourth in Asia, under Japan, South Korea, and China. In 2002, productivity of rice Indonesia began lagging behind Vietnam. In 2006, Iran began to beat Indonesian rice productivity. Therefore, starting in 2006, Indonesia, which originally was ranked 4th in Asia, the current ranking to drop to rank 6 in Asia

One reason of the decreased productivity of rice in Indonesia rank is the lack of technological capability of farmers and the problems that occur in the presence of the farmer. Based on the interview with farmers in Karawang (2010), the issues raised in the farmer is the need to borrow capital, have difficulty in dealing with pests / plant diseases, at the time of post-harvest, farmers are removing the rice with the rice grains banged and taking done simultaneously, so that the grain which should be used as GKP (Dry Grain Harvest) disappears with pengasakan rice, and farmers' difficulty in selling rice.

This research aimed to develop a model for enhancement technological capability of farmers through partnerships with Farmer-Owned Enterprises (BUMP). Focusing on increasing technological capabilities of farmers, there are four activities in this research such as post-harvest activities, namely rice harvesting, threshing grain, grain drying and storage of grain. The fourth activity is a key activity in the post-harvest rice so that in the event of an increase in technological capability, will also be expected to increase rice productivity.

## RESEARCH METHOD

### Research Framework.

A model for enhancement technological capability of farmers through partnerships BUMP is a model that is compiled by using the intelligence system approach. Intelligence system approach are required to replicate the expertise possessed by the management of technology expert and interpret them to resolve issues related to farmers associated with post-harvest technology capability of farmers. Problems occurred are complex and unstructured until the required techniques/methods of soft system to solve them (Eriyatno and Sofyar 2007).

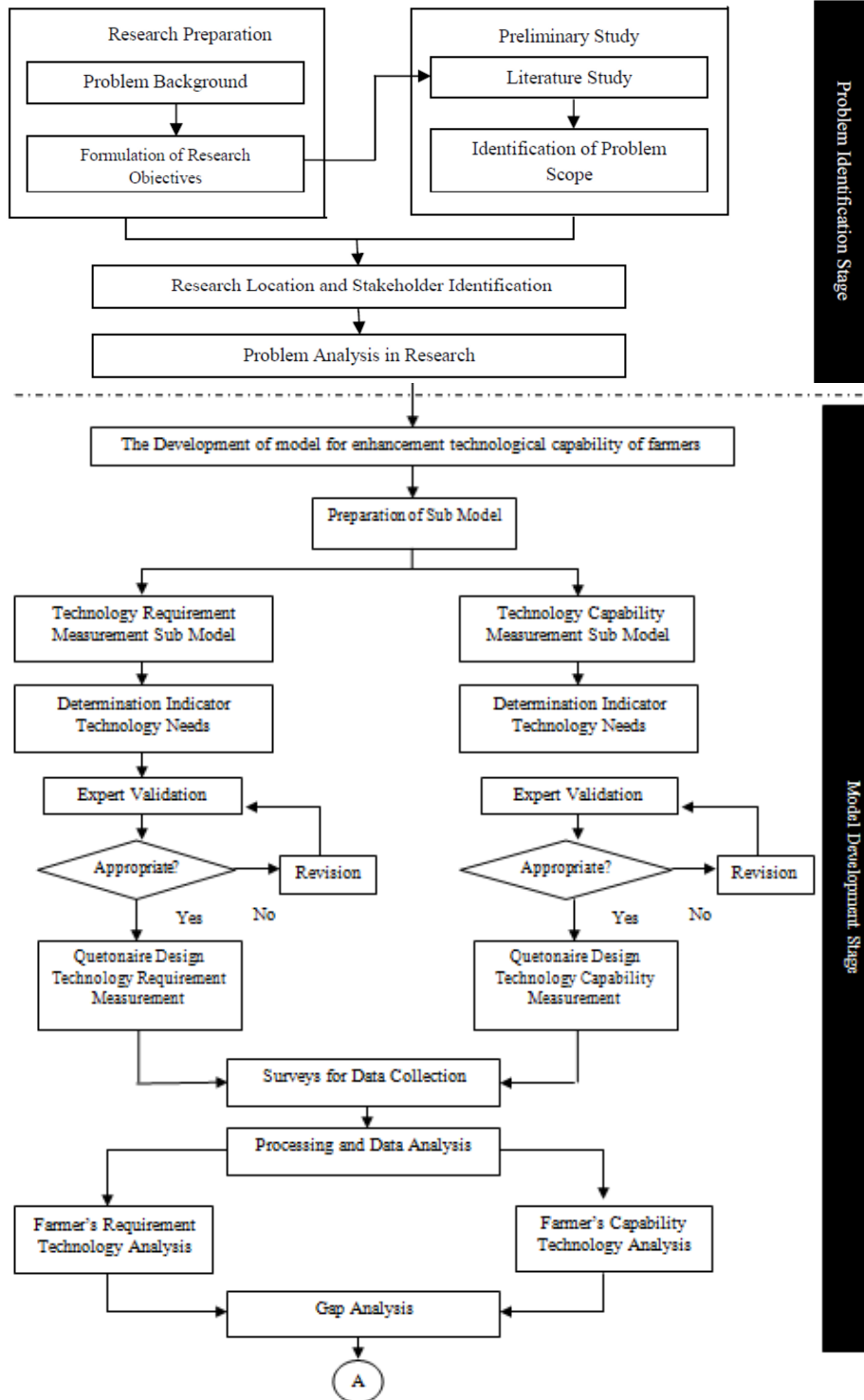
This research is motivated by an attempt to answer the problems associated with post-harvest of paddy i.e. the ability and needs of farmers technology that is used by farmers on the post-harvest of paddy; the gap between technological capabilities and the needs of farmers in the post-harvest of paddy activity; the programs that can improve the ability of farmers through technology partnership BUMP and business processes of the program; and the strategies of implementation program for enhancement technological capability of farmers through the partnership with BUMP

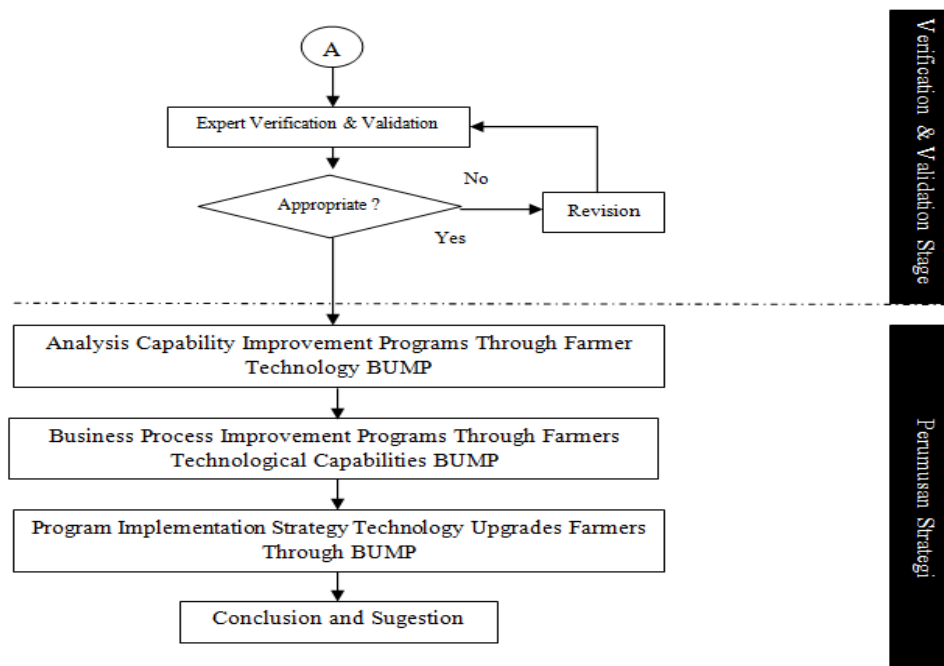
Figure 1. below show the research methodology of model for enhancement technological capability of farmers through the partnership with BUMP

### The Stages Of Research.

The Engineering stages of model for enhancement technological capability of farmers through the partnership with BUMP beginning with the identification of technology needs of farmers in post-harvest activities, the gap between technological capabilities and the needs of farmers in the post-harvest of paddy activity; the programs that can improve the ability of farmers through technology partnership BUMP and business processes of the program; and the strategies of implementation program for enhancement technological capability of farmers

through the partnership with BUMP





Gambar 1. Research Methodology of Capability Famer's Technology Improvement Engineering Model Through BUMP

Generally, there are 4 stages to develop a Capability Farmer's Technology Improvement Model Through BUMP, such as :

a. Problem Identification Stage.

Activities undertaken at this stage is preliminary study which includes the study of literature and identification of issues; identification of study sites and relevant stakeholders, and analysis of problems in research.

b. Model Development Stage.

At this stage the activity is the development of sub-models. Sub-model that is developed are model developed measurement technology needs and technology capabilities measurement model. In the preparation of the sub-models is to determine the needs and capabilities of technology indicators, designing questionnaires, surveys, data analysis processing funds.

c. Verification and Validation Stage.

Verification and validation is the third activity that used to ensure if the model is made in accordance with the representation of the real system.

d. Strategy Formulation Stage.

At this stage of strategy formulation, the activities carried out by an analysis of programs to improve the technological capabilities of farmers, business processes of these programs, structuring and preparation of strategy implementation programs to improve the technological capabilities of farmers through BUMP.

**Data Collection.**

Data used in this study, namely primary data and secondary data. Primary data came from a sample of rice farmers research and research resource persons. Data from industry collected using questionnaires and interviews, while the data coming from the speakers was obtained by interview. Meanwhile, secondary data collection is done by the study of literature.

**Data Processing and Analysis.**

To support research Capability Improvement Model Engineering Technology through the BUMP will use primary and secondary data. Secondary data were obtained from journals, research related to the model built from the Ministry of Agriculture, the Central Statistics Agency, Bulog, association, group union, and the company that became the object of research. While the primary data obtained in the following manner:

- Field observations to the location of the farm to find out the problems occurred. Information obtained through interviews with representatives of farmers / farmer groups, government, and universities / research institutes of technology to determine the problems that occurred in farmers. Interviews were also used to determine the technological needs of farmers and partnership programs BUMP.
- In-depth interviews conducted using the Delphi method to determine the capabilities, requirements and technology programs are needed.

- Expert judgment done to obtain knowledge base through in-depth interviews and questionnaires to acquire the knowledge of experts associated measurement needs and technological capabilities.

The data processing method used in this research are as follow :

- *Analytical Hierarchy Process (AHP)* used to determine indicator weight of technology capability.
- ME MCDM used to measure the farmer's technology capability level.
- ESCAP used to identify technology needs.

#### **Verification and Validation Model**

Process validation is used to validate the model built is Delphi method through expert opinion (expert's judgment). Experts requested the opinion and judgment through questionnaires and in-depth interviews of the models that have been constructed so as to obtain the shortcomings of the model so that the model can be improved. Experts will be engaged to model validation is an academic expert, expert research institutions, and actors / practitioners rice. While the verification process conducted on indicators of technological capabilities and the needs of farmers and the results of the analysis of programs to improve the ability of farmers through BUMP technology.

### **ANALYSIS AND DISCUSSION**

#### **Identification of Farmer's Technology Needs.**

The steps for identifying technology needs have been prepared by the ESCAP (1988) and Alkadri *et al* (2001). Based on that steps, Based on these measures, to identify technology needs of farmers in post-harvest rice in Karawang district. The results of the identification of technology needs are as follows:

- Identification of relevant technologies with the vision, mission, and goals of development.
- Formulation of technology policy criteria.
- Forecasting the global market and technological trends
- Determination of the need for technology

The Policy that was implemented in Karawang district and the Ministry of Agriculture Directorate of Food Crops have in common is the mechanization of agriculture. This is evident from the focus of the revitalization of the agricultural sector in Karawang local government is facilitating technology and mechanization of agriculture and agricultural inputs support of the Directorate General of Food Crops which leads to the mechanization of agriculture. Based on the two policies can be specified requirement postharvest technology of paddy farmers in Karawang is a technology that supports the efforts of agricultural mechanization.

#### **Analysis of Famer's Technology Capability.**

Technological capabilities are grouped into very low, low, medium, high, and very high. Being on the technological capabilities of each technology grouping capabilities are:

a. Very low technology capability.

- Harvesting of paddy: ani-ani (traditional device for cutting)
- Threshing grain: done by trampling.
- Drying grain: dried on the ground without pedestal
- Storage of grain: implemented in addition to the home
- Marketing: no marketing because it meets the needs of its own
- Relationship : there has been no activity relationships

b. Low technology capability.

- Harvesting of paddy: using a sickle.
- Threshing grain: threshing grain with a flail on a body.
- Drying grain: dried on a floor that has been prepared grain drying
- Storage of grain: stored in the granary
- Marketing: fulfillment surrounding communities.
- Relationship : fostering trade relations with traders

c. Middle technology capability

- Harvesting of paddy: using a toothed sickle.
- Threshing grain: Using pedal thresher
- Drying grain: Grounded drying floor sheeting / plastic
- Storage of grain: storage use canned / burlap sacks / plastic bags stored in the warehouse
- Marketing: sell grain to traders.
- Relationship : members of the farmer groups (poktan) / farmer groups combined (gapoktan)

d. High technology capability

- Harvesting of paddy: *reaper*
- Threshing grain: *power thresher*

- Drying grain: *flat bed dryer/box dryer/vertical dryer*
  - Storage of grain: silo
  - Marketing: sell grain to rice milling industry
  - Relationship: members of the farmer groups (poktan) / farmer groups combined (gapoktan)
- e. Very high technology capability
- Harvesting of paddy: *combine harvester*
  - Threshing grain: *combine harvester*
  - Drying grain: *integrasi dryer dan silo*
  - Storage of grain: *in store dryer*
  - Marketing: processing paddy to rice and sell to the market
  - Relationship: members of the Farmer-Owned Enterprises

Hierarchical structure consisting of three (3) levels, namely:

a. First Level: Objective

The first hierarchy level describe objectives. The goal is to measure the ability of rice postharvest technologies to farmers.

b. Second Level: Factor

Factor used is the production capability (F1), the ability of investment (F2), the ability to hold a small change (F3), the ability to hold a large change (F4), marketing ability (F5), and the ability to create networks (F6).

c. Third Level: Sub Factor

Factor used is the production capability (F1), the ability of investment (F2), the ability to hold a small change (F3), the ability to hold a large change (F4), marketing ability (F5), and the ability to create networks (F6).

Tableu 1. Level of Technology Capability for Post-harvest

No.	Post-harvest Activity	Level of Technology Capability
1	Harvesting of paddy	middle
2	Threshing grain	middle
3	Drying grain	middle
4	Storage of grain	middle
5	Marketing	middle
6	Relationship	high

The result of the ability level of post-harvest technology in rice farming then validated by experts. Expert validation results showed that the compatibility between the results obtained with the knowledge possessed by experts. According to experts, the level of technological capabilities in the post-harvest rice farmers varies in each post-harvest activities. Most of the post-harvest activities have value M (Medium), except on activity relationships, the value of which is owned by H (High).

Rated level of technological capability M (Medium) on rice harvesting, threshing grain, grain drying, grain storage and marketing of grain indicate that farmers in Karawang has the following technological capabilities:

- Harvesting of paddy: using a toothed sickle.
- Threshing grain: Using pedal thresher
- Drying grain: Grounded drying floor sheeting / plastic
- Storage of grain: storage use canned / burlap sacks / plastic bags stored in the warehouse
- Marketing: sell grain to traders.
- Relationship : members of the farmer groups (poktan) / farmer groups combined (gapoktan)

While the technology has the ability to build relationships High value shows that farmers in Karawang district already has the ability to form cooperative Gapoktan.

Technological capability assessment results in accordance with the conditions of the existing technological capabilities in Karawang district as the study area. In general, the condition of the rice harvesting technology capabilities, threshing grain, grain drying and storage of grain in Karawang use:

- Harvesting of paddy: using between sickle until toothed sickle
- Threshing grain: threshing grain with a flail on a body or *pedal thresher*
- Drying grain: sun drying in the house / mats around the house / tarps
- Storage of grain: at home by entering into a tin / jute sacks / plastic bags
- Marketing: sell grain to traders.
- Relationship: members of the farmer groups (poktan) / farmer groups combined (gapoktan)

In general, the ability of rice postharvest technologies in Karawang is the technological capability to semi-manual mechanical. The ability of semi-mechanical technology only occurs in threshing grain, where the majority of farmers in Khanewal district has been able to use the pedal thresher to thresh grain was. While other

technological capabilities towards technological capabilities still manually.

**Gap Needs Farmers Postharvest Technology and Capabilities.**

Based on identification of post-harvest technology needs of farmers and farmers' post-harvest technology capability analysis, there is a gap between the needs of technology and technological capabilities of farmers. Postharvest technology needs of the farmer is the farmer has the technological capability mechanically. While the results of the analysis of post-harvest technology capabilities of farmers suggests that the ability of farmers postharvest technology leads to the ability of technology to semi-manual mechanical. The difference between needs and technology capabilities resulting in the need for increased capacity postharvest postharvest technology of farmers in order to increase technological capabilities according to the needs of the technology. Postharvest technology capabilities that lead to the technological capability to semi-mechanical manual is expected to increase to the ability of mechanical technology.

**BUMP Proposed Partnership To Boost Farmer Technology Capabilities**

BUMP partnership to improve the ability of farmers derived from the adoption of technology benchmarks partnership BUMP PT Padi Energi Proklamasi. BUMP partnership PT Padi Energi Proklamasi started in the year 2010 and till today this partnership is still going well. However, a partnership BUMP PT Padi Energi Proklamasi still focus on sales of grain and provision of agricultural infrastructure (sarprastan) such as seeds, fertilizers, and drugs. Improved technological capabilities many farmers are still not touched in this partnership. Learning of weakness partnership BUMP PT Padi Energi Nusantara in improving technological capabilities of farmers, made a new proposal BUMP partnership. This proposal consists of organizational structure, business processes, partnership programs, and implementation strategies BUMP partnership program. This proposal is expected to be an improvement to the existing partnership BUMP thus improving the welfare of farmers can be quickly implemented.

**PROPOSED ORGANIZATIONAL STRUCTURE PARTNERSHIP BUMP**

Advocacy role in the organizational structure is under the marketing division. This resulted in the role of advocacy is not optimal because the advocacy is given to support the company's marketing. Advocacy will focus on supporting the achievement of the target given by the company's marketing. Empowerment of farmers to improve the technology becomes not the main purpose BUMP partnership. The partnership will focus only on the effort associated with pemsasaan company, namely the sale of grain and provision of agricultural inputs such as seeds, fertilizers, and drugs. To be able to play a role in improving the technological capabilities of farmers, advocacy needs to be increased to advocacy division. Proposed structure BUMP that served to increase the technological capabilities of farmers can be seen in Figure 3.

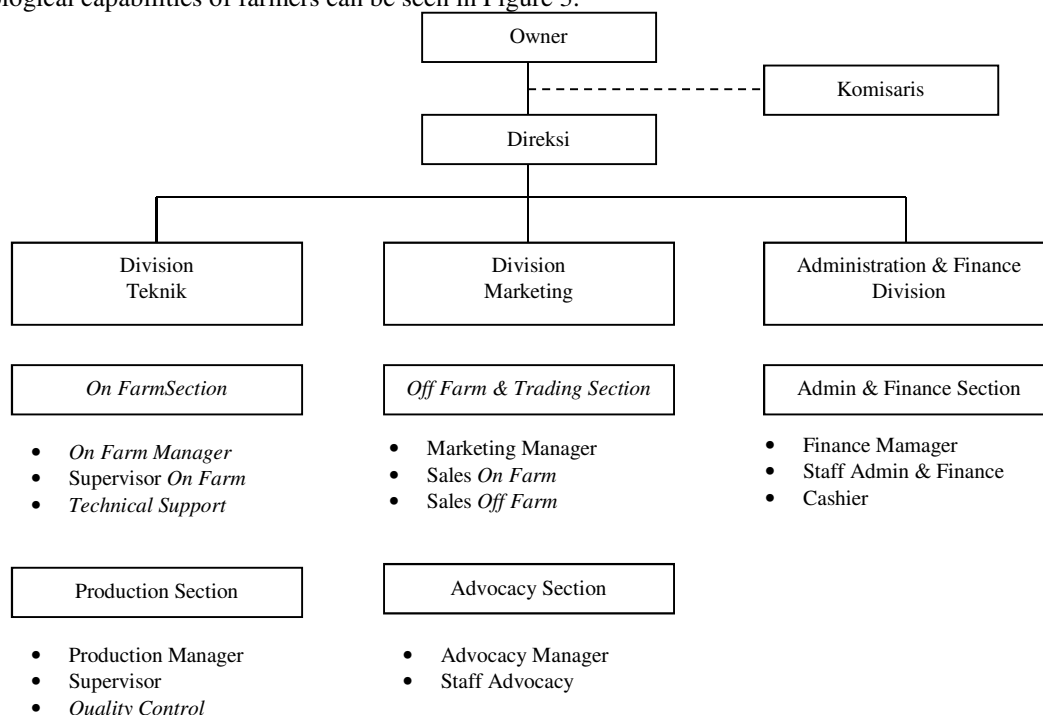


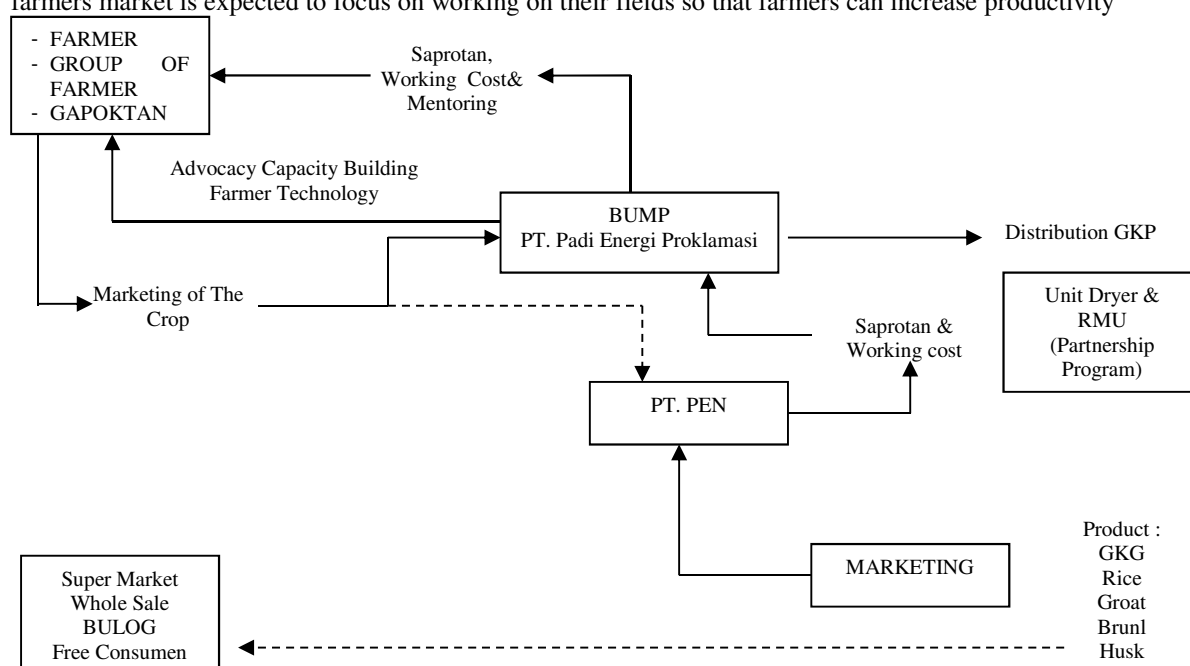
Figure 2. Proposed BMP Organization Structure



### Proposed Business Process Partnership BUMP

Business process PT Padi Energi Proklamasi as BUMP partnership starting from granting saprotan and cost of work on PT Padi Energi Nusantara community is spending development to BUMP PT Padi Energi Proklamasi. BUMP PT Padi Energi Proklamasi saprotan then provide assistance, the cost of playing with, and assistance to farmers, groups of farmers or farmer groups. Farmers harvest later Energy purchased BUMP PT Padi Energi Proklamasi in accordance with market prices. BUMP PT Padi Energi Proklamasi then drying grain farmers who bought and milled into his RMU. Rice, groats, bran, and husk which is then sold to PT Padi Energi.Nusantara Proposed business process partnerships BUMP.

BUMP partnership business process PT Padi Energi Proklamasi indicates that the focus of the business is a partnership BUMP guarantee grain for the farmers market, the availability saprotan, and the cost of working on the rice fields. Hope this BUMP partnership so that farmers can focus on working on their fields. Farmers do not have to worry about the cost to work on their fields because it has been supplied by the BUMP. In addition, farmers also do not have to worry about the availability saprotan and markets for grain produced. Saprotan been provided according to the needs of farmers. The market has also been secured by BUMP so that farmers are not confused to find a market for grain produced. Availability of working on cost, availability saprotan and certainty farmers market is expected to focus on working on their fields so that farmers can increase productivity



Gambar 3. Propose BUMP Bussines Process

The Partnership of BUMP PT Padi Energi Proklamasi if only guarantee the availability of working on cost, availability saprotan and market certainty, of course, can not be beneficial to enhance the technological capabilities of farmers. Surely there must be other additional business processes so that the role of technological capability of farmers can be seen in the partnership BUMP. The role that needs to be added is an advocate for farmers to improve its technological capabilities. Proposed business process BUMP partnership can be seen in Figure 3.

### PROPOSE BUMP PARTNERSHIP PROGRAM.

The proposals of BUMP partnership program to improve the technological capabilities of farmers is:

- Cooperation with agricultural extension, universities, Research and the Ministry of Agriculture, Department of Agriculture and the Karawang district to provide technical assistance, information dissemination and advocacy of technology upgrades farmers
- Support renting of agricultural machinery (Alsintan) to support agricultural mechanization program of the Directorate General of Food Crops and District Government Karawang
- Soft loans / grants to buy Alsintan which supports the agricultural mechanization program
- Guarantees for the use of donated Alsintan by Directorate General Plant Food, Agriculture district or other party for optimal use by farmers / poktan / gapoktan.

### STRATEGY FOR IMPLEMENTATION OF BUMP PARTNERSHIP PROGRAM.

Some of the strategies that need to be done so that the BUMP partnership programs can be well implemented ie:

- a. Constructing cooperation agreement (MCC) or MOU to agricultural extension, universities, Research and the Ministry of Agriculture, Department of Agriculture and the Karawang district to help provide technical assistance, information dissemination and advocacy of technology upgrades to farmers / poktan / gapoktan.
- b. Constructing cooperation with banks / other financial institutions to provide soft loans Alsintan procurement of agricultural mechanization program that can be implemented.
- c. Constructing cooperation agreement (MCC) or MOU to the parties that will provide grants to farmers Alsintan / poktan / gapoktan in Karawang district.
- d. Strengthening institutional BUMP in order to increase the role of farmers prosper
- e. Utilizing existing technology well, so that companies can reduce operating costs
- f. Improving quality through the establishment of managerial job descriptions are clear and focused

## CONCLUSION AND SUGGESTION

### CONCLUSION.

Rice postharvest technology needs of farmers in Karawang district in order to gain the support and assistance of the District Government Karawang and the Ministry of Agriculture should be made to have conformity with the vision, mission, and goals of development and the Ministry of Agriculture associated with the development of post-harvest technology of paddy. Rice postharvest technology needs of the farmers are on a mission 2, 1 policy direction that development efforts agribusiness agricultural food crops and horticulture through the provision of production facilities and infrastructure, institutional empowerment, innovation and application of agricultural technology, development of agricultural product processing industry.

Directorate General of Food Crops program that aims to enhance the technological capabilities of farmers are increasing production, productivity, and quality of food crops to achieve self-sufficiency and self-sustained. This program is translated into the production of chess strategy. Chess Directorate General Plant Food production strategy is then translated into programs and activities of the Directorate General of Food Crops 2012. Priority component of empowerment / strengthening the post-harvest handling of food crops is a means of post-harvest losses and survey results rice. Assistance in the form of postharvest rice reaper (scissors type rice harvester machine), mower paddy (rice harvester machine type clothing), serrated sickle, power threshers (rice thresher), pedal thresher motor (engine type rice harvester hold on), plastic sheeting postharvest, dryer flat body types, and the husk-fired furnace for flat-dryer combination type indicates that the focus of post-harvest handling of rice Directorate of Food Crop farmers are improving technological capabilities lead to the ability of mechanical technology.

Policy in Karawang district and the Ministry of Agriculture Directorate of Food Crops have in common is the mechanization of agriculture. This is evident from the focus of the revitalization of the agricultural sector in Karawang local government is facilitating technology and mechanization of agriculture and agricultural inputs support of the Directorate General of Food Crops which leads to the mechanization of agriculture. Based on the two policies can be specified requirement postharvest technology of paddy farmers in Karawang is a technology that supports the efforts of agricultural mechanization.

Technological capability assessment performed by five people representing the R & D experts, academics, and practitioners. Technological capability assessment results were processed using Multi Expert Multi Criteria Decision Making (ME-MCDM). The results of the fit of post-harvest technology of rice farmers in Karawang district is largely post-harvest activities have a value of M (Medium), except on activity relationships, the value of which is owned by H (High)

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In order to enhance the technological capabilities of farmers, partnership BUMP need to enhance the role of advocacy into advocacy division. BUMP partnership program proposals to improve the technological capabilities of farmers is:

- a. Cooperation with agricultural extension, universities, Research and the Ministry of Agriculture, Department of Agriculture and the Karawang district to provide technical assistance, information dissemination and advocacy of technology upgrades farmers
- b. Support renting of agricultural machinery (Alsintan) to support agricultural mechanization program of the Directorate General of Food Crops and District Government Karachi
- c. Soft loans / grants to buy Alsintan which supports the agricultural mechanization program
- d. Warrant the use of donated Alsintan Directorate General Plant Food, Agriculture Department Karawang district or other party for optimal use by farmers / poktan / gapoktan.

This partnership program proposal can be implemented using the following implementation strategy:

- a. Constructing cooperation agreement (MCC) or MOU to agricultural extension, universities, Research and the Ministry of Agriculture, Department of Agriculture and the Karawang district to help provide technical assistance, information dissemination and advocacy of technology upgrades to farmers / poktan / gapoktan.
- b. Constructing cooperation with banks / other financial institutions to provide soft loans Alsintan procurement of agricultural mechanization program that can be implemented.
- c. Constructing cooperation agreement (MCC) or MOU to the parties that will provide grants to farmers Alsintan / poktan / gapoktan in Khanewal district.
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- e. Utilizing existing technology well, so that companies can reduce operating costs
- f. Improving quality through the establishment of managerial job descriptions are clear and focused

## SUGGESTIONS.

Suggestion can be given based on the results of this study are:

1. Identify technology needs and technology capability analysis needs to be done by the farmer BUMP BUMP continuously in order to find out the gap between the needs of technology and technological capabilities of farmers.
2. The role of advocacy needs to be improved in partnership BUMP.
3. BUMP partnership program proposals to improve the ability of farmers suggested technologies included in the partnership program compiled BUMP.
4. BUMP partnership program implementation strategies suggested may be a reference to the current efforts to improve the ability of rice farmers postharvest technologies implemented

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