Economic analysis of captivity maize hybrid supporting food self-sufficiency in South Sulawesi

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Abstract. Strategies adopted in the effort to achieve food self-sufficiency is through the provision of quality seeds of new high-yielding varieties in accordance with farmers’ preferences. The availability of quality seeds in sufficient quantities, on time and easily obtained by farmers plays an important role. Farmers often experience significant losses, both in terms of cost and time, due to the use of low quality seeds. Therefore, although plant growth and production is greatly influenced by climatic conditions and farming practices, it is important to remember the importance of quality selection seeds to be used. Propagation of corn starts from the provision of seed types 1) Breeder Seed (BS) 2) Foundation seed (FS), 3) Stock seed (SS) dan 4) Extension seed (ES). Continuity of the seed multiplication plot is very influential on the availability of seed sources in accordance with needs seed producers / breeders and determine the process of seed dispersal production. The smooth flow of seed propagation also greatly determines the speed of spread of new high yielding varieties. In a financial analysis study on corn breeding farming that has been carried out in Bantaeng Regency, South Sulawesi, it shows that farming in one planting season can get a profit of IRD 37,975,000,00. Circumstances where deep farming operation does not make a profit and does not suffer losses if it is able to produce seed as much as 678 kg While the payback period for investment / PBP (Pay Back Period) is 0,95. Therefore, hybrid maize farming is said to be very feasible where each using a cost of IRD. 1, - or one rupiah can get a benefit of IRD. 2,54

1. Introduction
South Sulawesi Province is one of the centers of national corn development in Eastern Indonesia. Corn (Zea mays L.) and has a agroecosystem and rainfed lowland as a potential for corn development. Nationally, the development of corn in dry land agroecosystem is 60-70% and in rain-fed rice fields is 20-30% [1]. Seed is one of the factors that determine the success of crop cultivation and its role cannot be replaced by other factors, because seed as a plant material and as a carrier of genetic potential, especially for superior varieties. The superiority of varieties can be enjoyed by consumers if the seeds are planted with quality [2]. The superiority of varieties and seed quality is the main justification for building a certified seed production system [3]. According to [4], the quality of a seed can be seen from factors such as the correctness of varieties, seed purity, vitality (germination power and growing strength), free from pests and diseases. [5] argued that in modern agriculture, seed acts as a delivery mechanism that delivers technological superiority to clients (farmers and other consumers). Then produce high quality agricultural products must begin with planting high quality seeds, ie seeds that display superior characteristics of the varieties they represent. In the procurement and distribution
system, the quality of a seed can be determined by several factors including: (1) the production system, (2) processing of results, (3) storing of results, and (4) handling during seed distribution.

One of the strategies adopted in the effort to achieve self-sufficiency is through the provision of quality seeds of new superior varieties that are in accordance with farmers’ preferences. The availability of quality seeds in sufficient quantities, on time and easily obtained by farmers plays an important role and the contribution of seed breeders is quite large [6]. Farmers often experience significant losses, both in terms of cost and time, due to the use of low quality seeds. Therefore, although plant growth and production is greatly influenced by climatic conditions and farming methods, it must be kept in mind the importance of selecting seed quality [4].

According to [7], the use of healthy, quality and pure seeds can increase yields by up to 25%. Unhealthy seeds have a less optimal vigor and germination capacity which can cause yield reduction of up to 20%. The purity of a variety is one of the factors that determines the quality of seeds and has a significant effect on crop yields [7]. Farmers’ participation in the production of certified seeds can be fostered in the form of mutually beneficial cooperation with seed producers / companies [8].

Propagation of corn seeds starts from the provision of seed types (BS) by the Research Institute for commodities, as a source for multiplication of basic seeds (FS), then staple seeds (SS), and scatter seeds (ES). The continuity of the seed multiplication channel is very influential on the availability of seed sources in accordance with the needs of producers / seed breeders and determines the seed dispersal production process. The smooth flow of seed propagation also greatly determines the speed of spread of new high yielding varieties to farmers [6].

Although the availability of new high yielding varieties of high yielding corn plants that have been released is quite a lot, but their breeding efforts to support the availability of seeds are still very limited, especially in maize production centers. To overcome this problem, propagation activities through the breeding of superior seeds of corn plants by involving farmer groups to encourage the emergence of new seed breeders is very necessary, in order to support the availability of new high-yielding varieties seeds in a series of sustainable food self-sufficiency programs.

The main problem of national seedling is a classic problem that occurs every year, namely the problem of not meeting the right 6 (right variety, right quality, right amount, right target, and right price). This problem has arisen for a long time every year. Therefore, it is time to think about solutions to these problems. Some thoughts need to be discussed, among others: 1) It is time to review the current seed system, why the 6 problems cannot be fulfilled and become a problem every year, 2) in every region, it is time for a breeder to be able to produce minimal seeds to meet their own needs, 3) in general farmers are able to produce seeds to meet their own needs, but the quality of their seeds is still low because the source seeds are from a variety that is planted repeatedly.

In South Sulawesi, the use of quality seeds has increased. Based on data from the Indonesian Food Crops and Horticultural Seed Certification Supervisory Agency, this is mainly due to government policies with the help of free seeds, both for the development of rice, soybeans and corn. Some of the advantages of using quality seeds include: a) saves the use of broad unity seeds; b) response to fertilization and the effects of other agronomic treatments; c) high productivity due to high yield potential; d) the quality of the yield will be guaranteed both through good post-harvest; e) has a resistance to pests and diseases, age and other characteristics are clear; and f) the harvest time is easier to determine because the cooking is simultaneous [9].

Demand for corn will continue to grow along with the level of consumption that has been growing to this day. This is because corn is a good source of carbohydrates, protein, fiber, and fat for growth [10]. Maize farm productivity using labeled seeds is 10-30% higher. This is the main driver for farmers to use labeled seeds even though they are expensive. To encourage the production and use of higher quality and labeled seeds, the following steps need to be taken: (a) providing direct subsidies to farmers in the framework of the concept of integrated subsidies, (b) encouraging seed production both by Soes and the private sector with investment facilities especially for seed processing and (c) tightening the system of supervision and certification of seeds to provide certainty of seed quality for farmers [10]. The use of quality seeds can reduce the number of seeds and replanting and have high
germination and growth so that the crop looks uniform. Yields between 5-20% [11]. This study aims to 1) Analyze the level of financial feasibility of breeding hybrid corn seed farming. 2) Knowing the minimum sales volume so that the corn breeding farm does not suffer losses, but also has not yet made a profit which, in other words, profits equal zero. 3) Analyze the time period of the return of investment that has been issued, through the benefits derived from a planned project.

2. Research Methodology

2.1. Place and time
This research was conducted in Gantarangkeke Village, Gantarangkeke District, Bantaeng Regency, South Sulawesi Province. This area is one of the corn production centers in the South Sulawesi region and is a regional development center for the corn seed independent region. The research time was carried out in January - December 2016.

2.2. Scope of Activities
The scope of this research activity includes: a). breeders who have an entrepreneurial talents, b) Seed source from Iceri Maros, c) Assistance / guidance on corn seed production techniques including rouging and post-harvest handling and handling of seed processing, d) Seed Certification, e) The data collected was analyzed with input-output analysis to determine the level of profits obtained in seed business. And qualitative data are tabulated and presented in tabular form. The number of respondents interviewed was 30 people.

Model of seed production system
A. Land preparation
B. Seedling and Planting Preparation
C. Fertilizing
D. Roguing, the activity of identifying and removing deviant plants [12].
E. Detaselling
   Detaselling can determine the purity of seed pollination. Ineffective pollination results in low quality cob [13]
F. Harvesting of Seeds
G. Processing Harvest Results
H. Seed Care (Coating)
I. Packaging and Labeling
J. Storage
K. Distribution

2.3. Data analysis
Acceptance of maize breeding farms is the value of production produced and expressed in terms of money. The period of receipt of maize breeding farms is expressed within one planting season. Expenditures of maize breeding farms are the value of all fixed and non-permanent inputs released in the production process. The difference between revenue and expenditure is the advantage of corn farm farming to determine the level of farm efficiency.
2.4. Analysis of B / C Ratio.
This analysis is used to see the extent of the comparison between the value of benefits against the value of costs if seen in the current value conditions.
The formula used to do the calculation is:

\[
\text{BC Ratio} = \frac{\text{T R (Total Revenue)}}{\text{T C (Total Cost)}}
\]

The measure of the assessment of a business feasibility undertaken is:
• If the BCR value > 1, then the farm can be said to be feasible to try
• If the BCR value <1, then the farm can be said to be unfit for business

BEP (Break even point).
BEP can be interpreted as a condition in which farming operations do not make a profit and do not suffer losses (income which is assessed using total costs). This analysis is used to see the break-even point (no profit and no loss) of a farm. The formula used is as follows

\[
\text{BEP} = \frac{\text{Total Cost}}{\text{Selling Price}}
\]

2.5. Breakeven Point of Production and Price.
One technique in studying the relationship between cost, revenue and production volume is by analyzing the break-even point of production and prices. The formula is presented in Figure 1.

2.6. PBP (Pay Back Period).
The payback period method can be easily and simply calculated to determine the length of time for an investment return. Provide information about the length of the break even project. Can be used as a risk consideration tool because the shorter the payback period, the shorter the risk of loss. Can be used to compare two projects that have the same risk and rate of return by looking at the payback period if the payback period is shorter for a farm. The formula used is as follows:

\[
\text{PBP} = \frac{\text{Investment Value}}{\text{Advantages Of Each Production Process}}
\]
3. Result and Discussion

To support the achievement of high quality seeds, operational standards are needed in managing seeds in the form of technological components. The components of corn seed production technology include:

1. Selection of new superior varieties of agricultural research and development in accordance with farmers' preferences, both hybrid and composite types or free-range.
2. Seed quality (germination capacity > 95%), given seed treatment (seed treatment) with 2 gram metalaxyl (product material) for each kg seed. The need for seeds is 15-20 kilograms per hectare.
3. Determination of location: Isolation and Distance
4. Land preparation, land management is carried out if the soil is textured heavy and without tillage if the soil is light textured.
5. Plant population is around 66,600 plants per hectare, plant spacing 75 cm x 40 cm with two plants per hole or 75 cm x 20 cm with one plant per hole.
6. Fertilization of nitrogen (N) based on the stage of plant growth and observations of leaves using a chart leaf color
7. Fertilization of P and K as needed based on soil nutrient status from the results of laboratory analysis.
8. Organic matter (manure 1.5-2.0 tons / ha) is given as
9. cover the seeds in the planting hole.
10. Making drainage channels (specifically for planting on land
11. Dry flat in the rainy season).
12. Provision of water through irrigation channels, as needed (specifically for Planting in paddy fields in the dry season).
13. Weed control in an integrated manner.
14. Roguing
15. Detaselling
16. Integrated pest and disease control.
17. Harvest on time and process manually or with tools and machines.

The availability of quality seeds in sufficient quantities, on time, and easily obtained by farmers plays an important role, and this is inseparable from the role of large seed breeders [14]. In order to establish sustainable continuity between producers and users of technology, especially corn varieties, the provision of sustainable source seeds is one of the most important activities and this is the first step to developing varieties.

3.1. Analysis of hybrid corn seed farming

[15] say that taking the decision of farmers who dare to bear the risk to allocate the factors of production on his farm. It is said [16] the increase in production can be done through population engineering. In the farming of hybrid corn seed production is done twice the planting season in one year. Broadly speaking, the calculation calculations of hybrid corn farming are the costs that must be incurred as well as the benefits obtained in running a hybrid corn farming business in Bantaeng Regency. The standard assumptions in financial analysis are in the following:
Table 1. Assumptions in financial analysis of hybrid corn farming in the district Bantaeng 2016.

| No. | Assumption                             | Unit          | Value  |
|-----|----------------------------------------|---------------|--------|
| 1   | Production period                       | Month         | 8      |
| 2   | Projection period                       | Year          | 1      |
| 3   | Growing season                          | times / year  | 2      |
| 4   | Duration per planting season            | Month         | 4      |
| 5   | Land area                               | Ha            | 1      |
| 6   | Productivity                            | kg / ha       | 2,500  |
| 7   | Fixed price                             | Month         |        |
|     | Seed source                             | Rp / kg       | 125,000|
|     | Selling hybrid corn seeds               | Rp / kg       | 25,000 |
|     | Used alone                              | Rp / kg       | 0      |
|     | Increase in selling price of hybrid corn| Percent / year| 0%     |
| 8   | Used alone                              | Persen        | 1.0%   |
| 9   | Interest rate per year (flat)           | Persen        | 15%    |
| 10  | Credit period                           |               |        |
|     | Investment credit                       | Month         | 12     |
|     | Working capital credit                  | Month         | 12     |
| 11  | Proportion of working capital           | Persen        |        |
|     | Private capital                         | Persen        | 30%    |
|     | Kredit                                 | Persen        | 70%    |
| 12  | Proportion of venture capital           | Persen        |        |
|     | Private capital                         | Persen        | 30%    |
|     | Kredit                                 | Persen        | 70%    |
| 13  | Discount Factor                         | Persen        | 15%    |
| 14  | Loan payments                           | Month         | 4      |

Source: Primary Data

The calculation of the costs of the prices prevailing at the time of the study is contained in the following table. The costs used are fixed costs and variable costs contained in Tables 2 and 3.

Table 2. Investment costs and Depreciation

| No. | Cost component          | Volume | Unit price Rp | Total (Rp) | Economic age (Year) | Depreciation Value Year (Rp) |
|-----|-------------------------|--------|---------------|------------|---------------------|-------------------------------|
| 1   | Tractor engine          | 1 unit | 26.000.000    | 26.000.000 | 8                   | 3.250.000                     |
| 2   | Diesel engine water pump| 2 unit | 1.500.000     | 3.000.000  | 4                   | 750.000                       |
| 3   | Hand sprayer            | 3 unit | 800.000       | 2.400.000  | 4                   | 600.000                       |
|     | Total Investment Cost   |        | 31.400.000    |           |                     | 4.600.000                     |

Source: Primary Data
### Table 3. Analysis of Farmers’ Hybrid Corn Farmer Business in Bantaeng Regency 2016

| No | Items                                      | Volume | Unit cost (Rp) | Total (Rp) |
|----|--------------------------------------------|--------|----------------|------------|
| I  | Fixed cost                                 |        |                |            |
| A  | Depreciation tool costs                    | 1 season| 2,300,000      | 2,300,000  |
| B  | Land Tax / ha                              | 1 season| 425,000        | 425,000    |
| C  | Rent (Rp.)                                 | 1 season| 2,500,000      |            |
|    | - Rent a drying floor, warehouse etc.      | 1 Package| 1,500,000      | 1,500,000  |
|    | - Rent others                              | 1 Package| 1,000,000      | 1,000,000  |
| II | Variable Cost                              |        |                |            |
| A  | Fee Of Production Facilities               |        |                |            |
|    | Seed Cost (Rp.)                            | 20 Kg  | 125,000        | 2,500,000  |
|    | Fertilizer:                                |        |                |            |
|    | - UREA (Rp.)                               | 1,000 Kg | 1,800          | 1,800,000  |
|    | - NPK (Rp.)                                | 400 Kg  | 2,300          | 920,000    |
|    | - ZA (Rp.)                                 | 200 Kg  | 1,400          | 280,000    |
|    | Insecticide (Rp.)                          | 5 Ltr   | 150,000        | 750,000    |
| B  | Labor Wages (Rp./org/day)                  |        |                | 3,300,000  |
|    | - Land preparation                         | 4 OH    | 50,000         | 200,000    |
|    | - planting                                 | 10 OH   | 50,000         | 500,000    |
|    | - Maintenance & irrigation                 | 10 OH   | 50,000         | 500,000    |
|    | - Rouging                                  | 4 OH    | 50,000         | 200,000    |
|    | - detaselling                              | 14 OH   | 50,000         | 700,000    |
|    | - Fertilizing                              | 4 OH    | 50,000         | 200,000    |
|    | - Harvest                                  | 4 OH    | 50,000         | 200,000    |
|    | - Transportation                           | 4 OH    | 50,000         | 200,000    |
|    | - Drying                                   | 4 OH    | 50,000         | 200,000    |
|    | - Sorting                                  | 4 OH    | 50,000         | 200,000    |
|    | - packaging                                | 4 OH    | 50,000         | 200,000    |
| C  | Message Fees                               |        |                |            |
|    | - Purchase of seed packaging               | 2,500 Sheet | 3,000         | 7,500,000  |
|    | - Print packaging                          | 2,500 Sheet | 500         | 1,250,000  |
| D  | Supervision and certification costs        | 2500 Kg |                | 1,000,000  |
|    | Total production costs (I + II)            |        |                | 24,525,000 |

Source: Primary Data

The production cost that must be required to finance 1 ha of land is around Rp. 24,520,000 while in table 4, the production of corn obtained is 2,500 kg per season with a selling price range of Rp. 25,000 / kg, so the total amount is Rp. 62,500,000 and the profit obtained by farmers can reach Rp. 37,975,000. If in one season farmers get an average profit of Rp. 37,975,000,- in one year (two seasons) farmers can get a profit of 75,950,000, - or if the average monthly income of farmers is Rp. 6,329,166,67. This is in line with [17], research that in the Philippines corn farming has comparative and competitive advantages. [18], economic analysis of farming and financial feasibility is said to be beneficial if the r / c obtained is more than 1, The following is the result of the feasibility analysis of a hybrid corn seed breeding farm.
Table 4. Breeding production of hybrid corn seeds, Bantaeng, South Sulawesi 2016

| Production (tons) | 2.500 | Kg       | 62.500.000 |
|------------------|-------|----------|------------|
| Reception        | 2.500 | Kg       | 25.000     |
| Advantage        |       | 37.975.000 |
| R/C Ratio        |       | 2.54     |

3.2. **BEP (Break Even Point)**

Break even analysis according to [19] is a way or a technique used by an officer or manager of a company to find out the volume (amount) of sales and production volume whether the company concerned does not suffer losses and also does not make a profit. The definition of break even analysis according to [20] break-even analysis is a management tool that can help restaurant managers to see the relationship between various costs, revenues and sales volume. Through break-even analysis, managers can also determine the amount of income needed at a desired level of profit achievement which is also commonly called Cost-Volume-Profit Analysis.

3.3. **Benefits of Break Even Point Analysis.**

To find out the benefits of BEP (Break Even Point) analysis according to [21], break-even analysis or Break Even Point analysis is very useful for management in explaining some important operational decisions in three different but still related ways, namely: a) Consideration of new products in determining what level of sales must be achieved so that the company makes a profit. b) As a basic framework of research the effect of expansion on the operational level. c) Assist management in analyzing the consequences of shifting variable costs to fixed costs due to the automation of the mechanism of work with sophisticated equipment. [22] also explain some of the benefits of break even analysis for management, namely:

a. Help control through the budget.
b. Increase and balance sales.
c. Analyze the impact of volume changes.
d. Analyze selling prices and the impact of changes in costs.
e. Negotiate wages.
f. Analyze the product mix.
g. Receive further capitalization and expansion decisions.
h. Analyze the margin of safety.

Break Even Point analysis has several benefits [19], including: a) As a basis for planning operational activities in an effort to achieve certain profits. b) As a basis or basis for controlling ongoing activities. c) As a material consideration in determining the selling price. d) As material or basis for consideration in decision making.

**Basic Assumptions of Break Even Point Analysis:**

The basic assumptions in the BEP (break even point) analysis used in this study are several assumptions that have an effect on break analysis as follows [23]:

a. Cost variability is considered to be close to the predicted behavior pattern.
b. The selling price of the product is considered to be constant at various levels of activity.
c. Factory production capacity is considered relatively constant.
d. The prices of the factors of production are considered unchanged.
e. Production efficiency is considered unchanged.
f. Changes in the amount of initial and final inventory are considered insignificant.
g. The composition of the products sold is considered unchanged.

h. Volume is the only factor affecting costs.

BEP can be interpreted as a condition in which farming operations do not make a profit and do not suffer losses (income which is assessed using total costs). The BEP equation is as follows:

\[
\text{BEP} = \frac{\text{TOTAL PRODUCTION COST}}{\text{SELLING PRICE}}
\]

\[
\text{BEP} = \frac{17,175.000}{25.000} = 687 \text{ Kg}
\]

The BEP analysis is not merely to find out whether the company reaches the BEP point, but the BEP analysis is able to provide information to farm loans on various levels of sales volume, as well as its relationship with the possibility of making a profit according to the level of sales concerned, following the BEP chart [24].

![Figure 2. Graph of Break even point](image)

The results above show that corn breeding farms break even (no profit and no loss) if they reach 687 kg of production.

3.4. PBP (Pay Back Period)

Payback Period is the period or number of years needed to return the investment value that has been issued. The Payback Period in Indonesian can also be referred to as the payback period. Investors or Entrepreneurs often use the Payback Period (PP) as the deciding factor in making investment decisions, the decisions that determine whether to invest their capital in a project or not. A project with a very long payback period is certainly less attractive to most investors.

According to [24] the payback period can be interpreted as the time period for the return of investments that have been issued, through the benefits obtained from a planned project. Meanwhile, according to [25] the payback period is a period that is needed to be able to recoup investment expenditure by using proceeds or net cash flow (net cash flows).
BP = INVESTMENT VALUE
ADVANTAGES OF EACH PRODUCTION PROCESS

$$BP = \frac{31.400.000}{37.975.000}$$

What if all investments are loans with 15% interest per year then (15% x 31.400.000) = 4.710.000 then the investment plus interest is equal to Rp 36.110.000

$$PBP = \frac{36.110.000}{37.975.000} = 0.95$$

If in 1 period equals 4 months, then the investment capital can be returned within 0.95 or 3.76 months if the income assumption is divided per 4 months.

4. Conclusion
1. The strategy adopted in the effort to achieve self-sufficiency in maize is through the provision of quality seeds of new superior varieties that are in accordance with farmers' preferences. The availability of quality seeds in sufficient quantities, on time and easily obtained by farmers plays an important role in increasing the productivity of corn which at the same time can affect the welfare of farmers. In this case the contribution of seed breeders to support self-sufficiency in corn is also quite large.
2. In this research, the financial feasibility analysis of hybrid corn breeding is very profitable, where the R/C reaches 2.54, this illustrates that the farm is very feasible to be developed.
3. Farming of hybrid corn seed breeding farms break even (no profit not loss on production achievements of 687 kg.
4. The results of the analysis that have been issued amounted to 0.95 or 3.76 months if the income assumption is divided per quarter or per season.
5. corn seed breeding business is very profitable for farmers so it is feasible to be cultivated in a sustainable manner.

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