Farmers' Behavior Towards the Use of Certified Rice Seeds in Rainfed Fields

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Abstract. Certified rice seeds can increase productivity, but only 53% of farmers use them in Indonesia. Rainfed paddy fields with certified seeds have the potential to increase productivity and develop into production centers. The research aimed to describe farmers' knowledge of certified rice seeds, analyze their suitability in terms of performance and importance, and analyze farmers' satisfaction with certified rice seeds. The research was carried out in 2021 in Banjarejo Village, Bayan District, Purworejo Regency, Central Java Province. Sampling was carried out by a purposive random sample of 31 farmers. The sampling techniques were carried out using purposive random sampling. The Customer Satisfaction Index (CSI) and Importance Performance Analysis (IPA) were analyzed descriptively and quantitatively. The results showed that most farmers use certified rice seeds after 3-4 planting seasons. Internal factors and economic factors affect the use of certified rice seeds. Farmers' CSI value of seed attributes amounted to 71.05%. The use of certified rice seeds in rainfed paddy fields must be increased using a persuasive seed-independent village area approach.

1 Introduction

One of the potential lands to be developed into rice production centers is rainfed paddy fields. The area of rainfed paddy fields in Indonesia reached 3.41 million ha. Rainfed paddy fields that have been intensively developed are 34.8% in Java (1.1 million ha) and 65.2% outside Java (2.0 million ha). The largest rainfed paddy field in Java is in Central Java Province (278,608 ha) [1].

Rice productivity in rainfed paddy fields can be increased by applying quality agro-inputs, such as certified rice seeds [2]. The importance of certified rice seeds is a priority of agricultural development policy for 2020-2024 [3]. Given the importance of seeds in agricultural businesses, the existence of seeds receives special attention, particularly in terms of quality and quality, according to MOA No.12/PERMENTAN/TP.020/4/2018 about the production, Certification, and Distribution of Plant Seeds, specifically "Seeds that will be

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distributed must go through certification and meet the quality standards set by the Government."

However, implementing the seed certification policy could improve some things. Research results [4] show that farmers have different ways of choosing the seeds they use on their farms. Certification policies cannot be used globally because of complex rules and requirements for farming communities. Data show that the use of certified superior rice seeds reached 50.88% of the total seed requirement of 349,540 tons in 2015 [5]. The target for the benefit of certified rice seeds in 2024 is 80%; however, the target set in 2020 of 60% has yet to be met, and the use of certified rice seeds in 2020 is still at 53% [6].

This condition raises the question of why not all farmers use certified rice seeds. Several research findings indicate that the use of certified rice seeds is more profitable than the use of non-certified rice seeds [7]. According to the findings from research [8], the adoption of technological innovations in developing countries still needs to grow.

Every individual's decision-making is different and variable because it is based on fundamental values that have a powerful influence on their behavior. [9] These values represent every human action's essential and fundamental rationality [10;11]. Based on the preceding information, this paper will investigate the farmers' attitudes toward certified rice seeds in terms of their importance and performance, as well as their level of satisfaction.

2 Research Method

In 2021, the research was conducted in Banjarejo Village, Bayan District, Purworejo Regency, Central Java Province. The data collection method used a survey. Sampling was carried out by a purposive random sample of 31 farmers. Purposive random sampling was used as the method of sampling. Data were analyzed descriptively, and quantitative analysis included validity and reliability tests, Importance Performance Analysis (IPA), and Customer Satisfaction Index (CSI). Dimensions of certified rice seed attributes measured include performance, features, reliability, conformance to specification, durability, serviceability, aesthetics, and perceived quality [12]. Assessment of the level of importance and performance of certified rice seed attributes using a Linkert scale with scores as presented in Table 1. [13;14]

Table 1. Likert Scale of importance and performance attributes on certified rice seeds

Scale	Performance	Importance
1	Very Dissatisfied	Very Unimportance
2	Dissatisfied	Unimportance
3	Neutral	Neutral
4	Satisfied	Importance
5	Very Satisfied	Very Importance

The farmer satisfaction index on the attributes of certified rice seeds is presented in Table 2 [15;16].

Table 2. Satisfaction Level Assessment Score

CSI Score (%)	CSI Criteria
0-20	Very dissatisfied
21-40	Dissatisfied
41-60	Quite satisfied
61-80	Satisfied
81-100	Very satisfied

The Importance Performance Analysis (IPA) and Customer Satisfaction Index (CSI) were processed using Microsoft Excel 2019 for data tabulation and SPSS version 25.0 for Windows validity and reliability tests.

3 Results and Discussion

3.1 Overview of Certified Rice Seeds

Farmers initially save and trade seeds and then develop them following local environmental conditions. Free seed exchange/barter among farmers has been a tradition, custom, and culture passed down through generations of farmers [17]. Farmers have the right to save, breed, and exchange seeds and unrestricted access to various non-patentable and non-genetically modified seed sources [18]. According to the Sanitary and Phytosanitary Agreement of the World Trade Organization (WTO) [19], all seeds in Indonesia must be registered and certified in the Crop Information System for quality, productivity, management, and plant disease prevention.

In Indonesia, certified rice seeds were pioneered in 1972 and continued to be refined until 2018 (Table 3). Certified seeds are seeds whose production process applies specific methods and requirements following the provisions of seed certification. Seed certification aims to preserve the purity of seed quality and provide farmers with it continuously. The benefits of using certified seeds are as follows: a) seed descent is known; b) seed quality is guaranteed; c) genetic purity is known; d) more efficient use of seeds; e) seeds grow uniformly.; f) simultaneous cooking and harvesting; and g) high production [20].

Table 3. History of seed certification in Indonesia

Year	Description
1912	The seed procurement process was initiated, followed by the establishment of seed barns.
1920	"Seed selection gardens" were established to multiply and distribute superior seeds to farmers.
1952	Indonesia joined FAO and implemented a more targeted pattern of seed production and distribution by categorizing seeds as foundation seed (FS), stock seed (SS), and extension seed (ES).
1969	A seed system that guarantees quality seeds has been continuously developed.
1971	The National Seed Agency was established following Presidential Decree No. 72 of 1971 to assist the Minister of Agriculture in planning and formulating seed-related policies.
1975	Based on Decree No. 190/kpts/org/5/1975 of the Minister of Agriculture regarding the organizational structure of the Ministry of Agriculture, a technical implementation unit of the Seed Monitoring and Certification Center was established.
2018	Certification regulations based on Minister of Agriculture regulation No. 12/PERMENTAN/TP.020/4/2018 regarding plant seeds' production, certification, and distribution.

3.2 Characteristics of farmers using certified rice seeds

Age is one of the internal factors that affect farmers' decision-making when conducting an activity; the older the farmers, the more conservative and resistant to change they will be [21]. According to the criteria established by the Ministry of Health of the Republic of Indonesia (2009), the majority of respondent farmers (77.43%) are classified as elderly (early-late). In contrast, the WHO classifies them as middle-aged and elderly. As much as

29.03% of farmers have a high school diploma or less. The experience of farmers in conducting rice farming activities (84%) for more than 20 years, internal factors are an indication of the capacity of farmers to accept and respond to change [22].

The majority of farmers' land holdings are less than 0.5 hectares (65%), and they are primarily cultivator owners (42%) and cultivators (58%). The annual household income of farmers is less than IDR 20,000,000, while the District Minimum Wage (UMK) for Purworejo is IDR 2,043,902.33 per month [23], which indicates that farmers earn below the minimum wage. More than 75% of the income comes from rice farming (Table 4).

Table 4. Characteristic of respondent

No.	Characteristic Respondent	Percentage
	Age (year)	
1	- <40	6
	- 40-50	16
	- 51-60	42
	- > 60	36
2	Education level	
	- SD	29
	- SLTP	16
	- SLTA	55
3	Farming Experience (year)	
	- < 10	6
	- 10-20	10
	- > 20 t	84
4	Land tenure size (ha)	
	- < 0.5	65
	- 0.5-1	29
	- > 1	6
5	Land ownership status	
	- Cultivar owner	42
	- Cultivator	58
6	Income (IDR)	
	- < 6,000,000	32
	- 6,000,000-12,000,000	32
	- 12,000,000-18,000,000	16
	- 18,000,000-24,000,000	13
	- > 24,000,000	7
7	Contribution of rice farming (%)	
	- < 50	16
	- 50-70	23
	>75	61

3.3 Farmers' Behavior Towards Certified Rice Seeds

According to the preceding section, the certified rice seed is divided into four classes: Breeder Seed (BS)/Yellow Label, Foundation Seed (FS)/White Label, Stock Seed (SS)/Purple Label, and Extension Seed (ES)/Blue Label. A plant breeder or their institution is in charge of producing and monitoring breeder seed. This seed is used to propagate BS, while FS is the first offspring of BS produced by an institute designated by the Directorate General of Food Crops, and its production is certified by the Seed Monitoring and Certification Center. Most certified seeds farmers use are SS and ES, which must be certified by the Seed Monitoring and Certification Center and are produced following established quality standards.

Seed certification requires a series of inspections, including (1) a preliminary inspection, (2) an inspection I (vegetative phase), (3) an inspection II (the flowering phase), (4) an inspection III (the ripening phase), (5) a post-harvest inspection, and (6) laboratory testing of seed candidates. Laboratory testing is performed to determine the quality of the seeds, including a) genetic quality, which refers to the appearance of pure seeds of particular species or varieties that display the genetic identity of the parent plant; b). Physiological quality is the ability to survive (viability), including germination and seed growth strength, so that it is resistant to storage and free of seed pests and diseases; c). The physical quality of seeds is their physical appearance (uniformity, pithiness, absence of other seed mixtures, weed seeds, and other contaminants); d). Seed health refers to the risk of infectious diseases transmitted by seeds. The advantages of seed health tests include seed improvement, seed trade, and plant protection. The maximum moisture content of 13% is a requirement for seed quality in the laboratory; a Minimum of 99 % pure seed for BS and FS seed classes and a maximum of 98 % for SS and ES seed classes; a maximum of 1 % impurities for BS and FS seed classes and maximum 2 % for SS and ES seed classes.

The number of farmers who always use certified rice seeds is 6% because planting uniformity and yield are more excellent with certified seeds than with uncertified ones. In contrast, 81 % of farmers only use certified seeds after 3 to 4 planting seasons, when rice plants are no longer observed growing simultaneously. Farmers who never use certified rice seeds (13%) cite the high cost of seeds and the belief that the results will be similar due to the small land size as justifications for their decision. In addition, the relatively low productivity of land in rainfed paddy fields is one of the reasons for the everyday use of certified rice seeds in rainfed paddy fields, so they consider it a loss to use certified seeds that must be purchased at a high price.

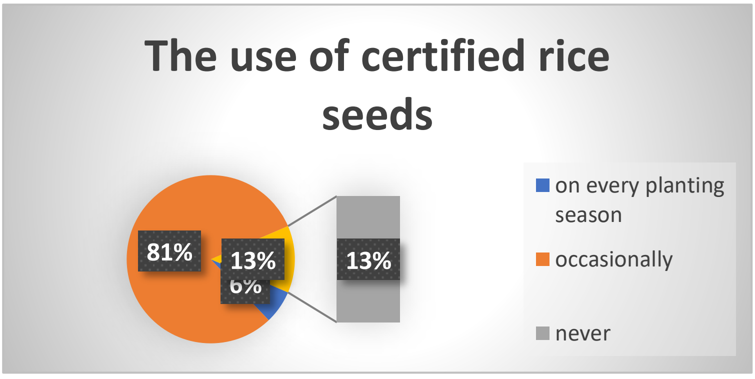

Fig. 1. Percentage of certified rice seed use in rainfed paddy fields

The certified rice seeds are then packaged at a rate of 5 kg/zak, and the packaging includes a label with information about the variety, growth rate, moisture content, and expiration date. Regarding the significance and performance of these attributes, farmers have different behaviors. Table 5 presents the responses of farmers to the eight dimensions measured. The performance quality dimension is the primary dimension of the certified rice seed attribute, namely production. An additional feature of the seed attribute is the plant's uniformity. The dimension of reliability is the capacity for growth, and the dimension of durability is the length of time certified rice seeds can be used or before they expire. The color of the grain indicates the conformance to specification. The serviceability expected by farmers is the availability of seeds. Aesthetics refers to the packaging of seeds, whereas perceived quality refers to the farmer's perception of the product's quality or superiority.

Table 5. Farmers' behavior towards certified rice seed attributes is based on the level of importance and level of performance.

Variables	Average Score	
	Level of importance	Performance Level
Performance	3.87	3.81
Features	3.77	3.67
Reliability	3.96	3.58
Conformance to specification	3.22	3.37
Durability	3.81	3.84
Serviceability	3.48	3.32
Aesthetics	3.16	3.45
Perceived quality	3.48	3.32

3.3.1 Customer satisfaction index (CSI)

The calculation of the CSI is based on the average score of the performance level and the importance level of each attribute. CSI was calculated to be 71.05% (Table 6). The index of farmer satisfaction with the use of certified rice seeds is in the range of 60% - 80%, showing "satisfied" criteria. Still, 28.95% of farmers are dissatisfied with the qualities of certified rice seeds. Unsatisfied farmers only sometimes or never use certified rice seeds.

Table 6. Customer satisfaction index (CSI)

Variable	MIS	WF	MSS	WS
Performance	3.87	0.1345	3.81	0.5124
Features	3.77	0.1310	3.67	0.4807
Reliability	3.96	0.1376	3.58	0.4926
Conformance to specification	3.22	0.1119	3.37	0.3771
Durability	3.81	0.1324	3.84	0.5084
Serviceability	3.48	01209	3.32	0.4013
Aesthetics	3.16	0.1098	3.45	0.3788
Perceived quality	3.48	0.1209	3.32	0.4013
Total	28.77			
WT				3.5526
CSI (%)				71.05

Description:
MIS: Mean Importance Score
WF: Weighting Factor
MSS: Mean Satisfaction Score
WS: Weight Value
WT: Total Weight

3.3.2 Importance and performance analysis

Every business has attributes that affect customer satisfaction and must be improved or maintained. Based on customer satisfaction results that are still below 100%, businesses must continue to improve customer satisfaction. The value of the Customer Satisfaction Index (CSI) indicates customer satisfaction. Increasing the level of importance and performance can bring customer satisfaction closer to 100 %. Attributes that need to be prioritized are those that consumers place a high level of importance on but for which the level of performance is considered inadequate.

Utilizing Importance Performance Analysis (IPA) is one way to improve the importance and performance levels. This method displays the priority of the performance level of each attribute using a cartesian diagram divided into four quadrants; the location of an attribute is determined by summing the average values of its level of importance and performance.

Results Importance Performance Analysis (Figure 2) demonstrates that no factors affect farmer satisfaction and that performance has not been as expected by farmers (Quadrant A).

Quadrant B contains factors that are thought to affect farmer satisfaction and have already been successfully implemented, resulting in a relatively higher level of satisfaction. This quadrant's dimensions must be preserved because they enhance farmers' perceptions of the superiority of the certified rice seed product. Farmer satisfaction can be affected by certified rice seed production, plant uniformity, germination rate, and expiration date, proven by the fact that farmers use certified rice seeds when rice plants begin to grow unevenly.

Areas that contain factors that are considered less critical make their performance considered less essential and less satisfactory. Due to its negligible impact on the perceived benefits by farmers, it is possible to reconsider improving the performance of the dimensions included in this quadrant (Quadrant C). According to the analysis results, the availability of seeds does not affect farmer satisfaction, as farmers can obtain the required seeds (typically varieties) by asking for or purchasing them from their neighbors' yields.

For farmers to always have access to the seeds they need and for the use of certified rice seeds to increase, it is necessary to approach the seed-independent village area. Farmer groups can produce seeds that correspond to the needs of local farmers. This is because each region has distinct rice varieties based on perceptions, land suitability, and water availability.

Highly satisfactory regions contain factors that farmers consider to be less significant. The variables included in this quadrant can be reduced so that the company can save costs (Quadrant D).

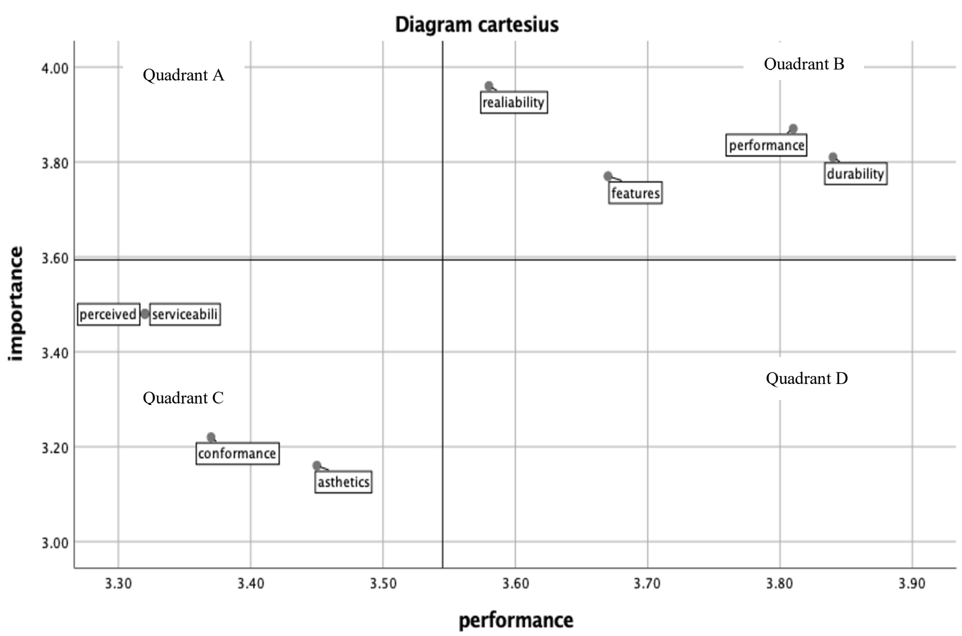

Fig. 2. Cartesius diagram of Importance Performance Analysis of certified rice seeds

4 Conclusions and Suggestions

Most farmers (81%) use certified rice seeds after 3-4 planting seasons. Internal factors and economic factors affect the use of certified rice seeds. The farmers' CSI value of the seed attribute is 71.05%. The use of certified rice seeds in rainfed paddy fields must be increased using a persuasive independent seed village area approach.

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