


## Article

# Farmers' Perceptions of the Warehouse Receipt System in Indonesia

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**Abstract:** This study assessed farmers' perceptions of the warehouse receipt system (WRS) in the West Java Province in Indonesia. Primary data were collected from 500 farmers through questionnaire administration. The results of the weighted average index revealed that there was a *strong* perception that the WRS is not well known, provides easy access to credit, and limited access for smallholder farmers. Moreover, there was a *weak* perception that the WRS has complicated regulations and slowed delivery of warehouse receipts. The main problems include lack of awareness, lack of facilities and limited access for smallholders. The implications for improving the implementation of the WRS are presented.

**Keywords:** farmers' perception; Indonesia; paddy rice farmers; warehouse receipt system

## 1. Introduction

Currently, the focus of developing and emerging economies is economic growth and food security. However, society is worried about the difficulties resulting from the depletion of natural resources, environmental issues, and social injustice [1,2]. To overcome these challenges, the concept of sustainable agriculture has been introduced. Sustainability in agricultural systems encompasses both resilience and persistence, and addresses many wider economic, social and environmental concerns. Sustainable agricultural practices include farmers' adoption of good agricultural practices that minimize the effects on the environment, and lead to increases in food productivity [2]. The level of agricultural sustainability varies across different regions, countries, and in different periods [3]. In general, farmers have a positive attitude toward sustainable agriculture practices that enhance agricultural productivity and are environmentally friendly [2,4]. Studies in Turkey and Ethiopia revealed that socio-economic status, frequent contact with extension services, education, ownership of land, and access to information were factors influencing farmers' adoption of sustainable agriculture practices [5,6].

Despite the adoption of sustainable agricultural practices that enhance farmers' productivity and improve the environment, there is still a lack of supply of food to the world's population [7–9]. The adoption of sustainable food value chains for the food supply system involves a shift from traditional practices to institutional mechanisms that lead to more equitable distribution of the increased value added [8,9]. A food system is a chain of activities from production to consumption, with particular emphasis on production, processing and marketing and the multiple transformations of the food that these entail [10–13]. A sustainable food supply chain comprises the logistics of food, successive value-adding activities, transformation into particular food products, and sale to final consumers. The adoption of the concept of sustainable food supply chains has a wide benefit for society and does not permanently deplete natural resources [9]. The three dimensions underpinning

sustainable food systems are: economic, social and environmental sustainability [14]. These principles are interconnected to create inclusive growth, green growth, and eco-social progress in society. The dynamic factors influencing the sustainability of food systems are fourfold as follows: changes in the food production and distribution; changes in economic development; changes in household consumption patterns; and changes in technologies [15–17]. In developing and emerging economies, the food system provides a flexible framework to address many of the challenges hindering the development of the food system [9].

In developing and emerging economies, the food supply chains have an important role to address global poverty and increase food security [18,19]. Generally, smallholder farmers are confronted with marketing and financial problems [20]. The sustainable food supply chains seek to adopt measures to ensure the functioning of the food commodity markets, facilitate access to market information, and ensure there are food reserves to help limit extreme food price volatility [1]. The problem of fluctuating food supply leads to food price volatility in agricultural markets, impacting negatively on poor, vulnerable and smallholder farmers, and increasing food imports in low-income countries [21]. Food trade mechanisms such as a floor price, crop insurance and futures markets have been employed to manage the price risk, nevertheless, these strategies have not proven effective [22]. Governments in some African countries have also been unable to successfully intervene on the issue of food distribution and price instability [23].

To minimize food price volatility, farmers could use the warehouse receipt system by depositing the commodities in a warehouse after harvesting, and selling them at a later time at relatively more profitable prices [22]. The warehouse receipt system creates a buffer against uncertainties in supply and demand, and takes advantage of economies of scale, and lower purchasing and transportation costs [18,19]. The following developing countries have successfully implemented the WRS: Romania, Hungary, South Africa, Zambia, Ghana, Russia, Slovakia, Bulgaria, Chechnya, Poland, Kazakhstan, Turkey, and Mexico [20]. Currently, Bulgaria, Kazakhstan, Hungary, Slovakia, Lithuania, and Moldova are the countries using the WRS for agricultural commodities in Europe [24]. In Sub-Saharan Africa, WRS has been implemented for agricultural commodities in Uganda, Ghana, and Tanzania [25]. One of the Asian countries that applied to the WRS was India [26]. Nevertheless, the implementation of the WRS in numerous countries including India, Indonesia, Tanzania and Ghana is confronted by problems such as a lack of awareness, limited warehouses facilities, lack of human resources, lack of storage facilities, issues relating to the legal and regulatory environment, scarcity of basic skills, weak market institutions, and smallholder farmers' access to finance [25–31].

The basic function of the warehouse is for storage of goods, protection, risk-bearing, financing and stock of raw materials [32]. The WRS is one of the public–private approaches in agricultural development to support food supply chains. In Sub-Saharan Africa, the public–private partnership has been an effective approach in the sustainable food distribution system [33,34]. The WRS supported the sustainability of the food supply chains in economic and social dimensions by providing the raw materials and enabling smallholders' access to profitable markets, thereby providing universal benefit for the society [9]. In Tanzania, the implementation of the WRS lead to reductions in transaction costs and reinforced the capacities of domestic and regional markets [25,35]. In other developing nations in Africa and Asia, the implementation of the WRS increased agricultural inventory, and economic turnover, and sustained the supply of raw materials. The WRS is an alternative mechanism for financing agricultural activities and service providers in food supply chains. Furthermore, the WRS leads to an improvement in product quality and standardization, which are crucial for success in competitive domestic and international markets [22,23,27,36,37].

The phenomenon of price volatility for agricultural commodities has driven the government of Indonesia to issue a WRS based on Law No. 9/2006. The policy was seen as essential to assist farmers in overcoming product marketing issues, and help them access credit from financial institutions [38]. The WRS is a strategy to substitute the minimum support price scheme and cash transfers with a more targeted public distribution system for poor households [39]. The WRS creates a better and more

efficient agricultural commodity marketing system that is accessible by the smallholders and provides value addition [31].

The WRS policy in Indonesia was designed to help farmers by using a delay mechanism to obtain relatively more profitable prices. The mechanism also helped the government to control price fluctuations associated with the seasonality of agricultural commodities [30]. The WRS offered credit collateral, storage space and market information until the market stabilized and prices increased [40]. The system grades commodities and rates warehouses according to their size, reputation, and integrity [26]. The WRS contributes to the sustainability of the food supply chains by enhancing marketing and facilitating smallholders' access to finance [20].

The development of the WRS in Indonesia has continued to progress in terms of the number of operators, institutions, and spread of implementation areas. As of 2017, warehouse receipts have been issued in 83 districts/cities in 21 provinces [31]. However, the intended acceleration of the WRS implementation by the construction of 121 public warehouses in 105 districts/cities in 25 provinces from 2009 to 2017 has not been fully achieved. Only 89 warehouses have been active, while the remaining 32 warehouses are still inactive at present. In addition to the warehouses built by the government, Commodity Future Trading Regulation Agency (CoFTRA) has so far granted approvals to 59 private warehouses [31].

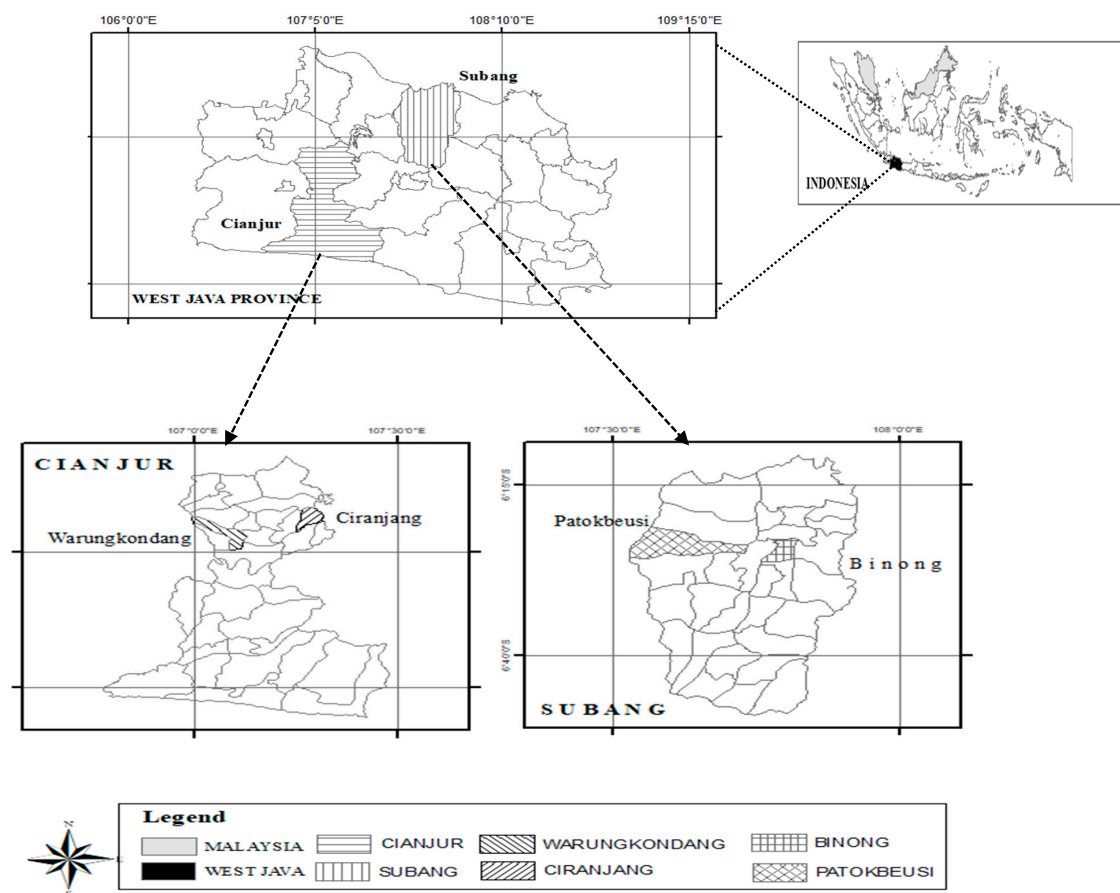
Implementation of the WRS in Indonesia has been slow since its launch in 2006. As a new financing system, the WRS was not well known and not fully understood by stakeholders [30]. On the other hand, the WRS only covered particular commodities, the main users were traders, there were only a limited number of warehouses, and there was limited support from the local government [41]. Consequently, the WRS has been under-utilized by farmers who are reluctant to use it. In several areas, the warehouses have remained empty or stocked well under their capacity due to competition with middlemen. Some warehouses also have a limited human resources capacity, particularly regarding managerial staff. This raises the questions; what are the farmers' perceptions regarding the WRS, and what are the problems and constraints of the WRS in Indonesia?

Therefore, the objectives of this study were to assess the farmers' perceptions of the WRS and to identify the main problems and constraints of implementation of the WRS in the Subang and Cianjur districts in the West Java Province in Indonesia. Farmers' perceptions can be categorized across three main factors, namely institutional, marketing and technical factors [42]. This study provides information regarding the performance and main problems of the WRS from the perspectives of users and non-users, considering the use of private and public warehouses. By unearthing the farmers' perceptions, challenges and constraints, this study provides directions for the operation of the WRS in Indonesia to ensure not only its sustainability, but also the sustainability of food production systems. The remainder of the manuscript is structured as follows: Section 2 presents the materials and methods, Section 3 presents the results, Section 4 presents the discussion, and Section 5 provides the conclusions.

## 2. Materials and Methods

### 2.1. Study Area

The study was conducted in two districts in the West Java Province in Indonesia, namely Subang and Cianjur. Both districts have a special characteristic in terms of the benefits received from government programs, including the provision of infrastructure, agricultural input and machinery facilities. Actually, the West Java province has 14 public warehouses, and 13 private warehouses, however only 10 of the public warehouses are active [31]. From Subang district, the location of the private warehouse is the Patokbeusi subdistrict and that of the public warehouse is the Binong subdistrict, whereas in the Cianjur district, the location of the private warehouse is the Ciranjang subdistrict and that of the public warehouse is the Warungkondang subdistrict (Figure 1).



**Figure 1.** Research locations in the Subang and Cianjur districts, West Java Province.

Both districts are centers of paddy rice production. In 2016, the West Java province contributed approximately 15% of the total production of paddy rice in Indonesia. The Subang and Cianjur districts contributed approximately 9% and 7%, respectively, out of the total paddy rice produced in the West Java province. Total production of paddy rice in Subang is 1.01 million tons, and in Cianjur it is 772,700 tons. Compared with secondary crops such as corn and soybean, the total production of paddy rice in the West Java Province is approximately 91% rice, 8.05% corn and 0.83% soybean [43]. From this data, it can be concluded that the majority of farmers in both districts are paddy rice farmers.

The location of the research was chosen purposively based on the following criteria: (1) this was the center of paddy rice production; (2) there is high price volatility of paddy rice in the area, and (3) there is a functioning warehouse receipt system. The districts, Subang and Cianjur, have private and public warehouses.

## 2.2. Sampling Methods, Population and Sample Size Determination

The respondents were the paddy rice farmers that were classified as users and non-users of the WRS, and for the users, they were classified by type of warehouse: public warehouse and private warehouses. This study employed a multistage sampling procedure as follows. First, purposive sampling was used to select the two districts in the West Java Province due to the reasons provided previously. Second, stratified sampling was employed to select farmers who use the WRS and those that do not [44]. Third, proportional simple random sampling was employed to select the respondent farmers based on the number of farmers in each district according to those who use public warehouses vis-à-vis those who use private warehouses. Finally, simple random sampling was used to select 100 farmers who do not use the WRS in two districts as the control sample (i.e., 50 farmers from each district) (Tables 1 and 2). The data was obtained through the administration of a structured questionnaire

to the respondents. The questions in the questionnaire relating to the farmers' perceptions were based on a five point Likert scale as follows: 5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, 1 = strongly disagree. Similarly, the questions in the questionnaire relating to the farmers' problems and constraints were based on a five point Likert scale as follows: 5 = very high, 4 = high, 3 = moderate, 2 = low, 1 = very low.

**Table 1.** Population of the paddy rice farmers that use WRS in the Subang and Cianjur districts.

Province	District	Number of WRS Users'		
		Public	Private	Total
West Java	Cianjur	229	171	400
	Subang	243	157	400
	<b>Total</b>	<b>472</b>	<b>328</b>	<b>800</b>

Source: Authors' survey, 2017.

**Table 2.** Sample paddy rice farmers from the Subang and Cianjur districts.

Province	District	Users		Total Users	Non-Users	Total Respondent
		Public	Private			
West Java	Cianjur	105	78	183	50	233
	Subang	132	85	217	50	267
	<b>Total</b>	<b>237</b>	<b>163</b>	<b>400</b>	<b>100</b>	<b>500</b>

Source: Authors' calculation, 2017.

The total population of paddy rice farmers in the Subang and Cianjur districts was 324,558, comprising 148,485 in the Cianjur district and 176,073 in the Subang district. Table 1 shows the population of farmers that use the WRS (i.e., public and private warehouses), and Table 2 shows the sample size of the respondents in the Subang and Cianjur districts.

The sample size was determined based on the total population of the paddy rice farmers in two districts following [45].

$$n = \frac{N}{(1 + N e^2)} \quad (1)$$

where  $N$  denotes the total population number of farmers in the two districts (i.e., 324,558);  $e$  denotes the margin of error from the sample 0.05 (95% confidence level), and  $n$  denotes sample size.

$$n = \frac{N}{(1 + N e^2)} = \frac{324,558}{1 + 324,558 (0.05^2)}$$

$$n = 399.5 \approx 400$$

Primary data were collected from respondents through face-to-face interviews guided by a semi-structured questionnaire using a five-point Linkert scale on the farmers' perception of the use of WRS. Secondary data were collected from relevant sources including the Ministry of Trade, Ministry of Agriculture, Central Bureau of Statistics (BPS), Bank Jabar, local governments, warehouse operators and farmer associations.

### 2.3. Methods of Analysis

Data analysis used quantitative and qualitative methods. The weighted average index (WAI) was employed to assess the farmers' perceptions about the WRS for agricultural commodities in Indonesia. The WAI formula followed [46].

$$WAI = \sum \frac{S_i F_i}{N} \quad (2)$$

where, the WAI is ( $0 \leq WAI \leq 1$ ),  $F_i$  is the frequency of response;  $S_i$  is the scale value assigned at  $i$  priority, and  $N$  is the total number of responses. The level of perception was measured on a five-point scale with varying weights. The degree was weighed as 1 for "Very Strong" (VS), 0.75 for "Strong" (S), 0.5 for "Medium" (M), 0.25 for "Weak" (W), and 0 for "Very Weak" (VW). Numerous studies have used this approach to examine farmers' perceptions and associated decision-making [47–49].

The variables measured by the WAI were: (1) the sustainability of the WRS program, (2) the lack of human resource management, (3) the lack of facilities, (4) provides easy access to credit/finance, (5) high cost of warehouse rental, (6) high cost of transportation, (7) high cost of processing, (8) high cost of insurance, (9) expanding the market access, (10) gaining a higher selling price, (11) access to market information, (12) limited access for smallholder farmers, (13) slow issuing of warehouse receipts, (14) complicated regulation, and (15) WRS not well known by the farmers. Regarding the qualitative analysis, descriptive statistics, Chi-square test, and Student's  $t$ -test were applied to assess the socio-economic characteristics of the respondents.

## 3. Results

### 3.1. Socio-Economic Characteristics of the Respondents

#### 3.1.1. Characteristic of WRS Users and Non-Users

Table 3 shows the socio-economic characteristics of the WRS users and non-users. The mean age for users was 50.59, which was higher than the non-users (47.94). There was a significant difference between the mean ages of the users and non-users based on the student's  $t$ -test, but they were still within their economically-active age group. Among both groups, more than 95% of respondents were male, with an educational level higher than primary school, and more than 70% of the land ownership was self-ownership. More than 80% of users had an education level higher than primary school. Regarding the land ownership, there were significant differences between the users and non-users.

**Table 3.** Socio-economic characteristics of the WRS users and non-users in the Subang and Cianjur districts, Indonesia.

Socio-Economic Characteristics	User ( <i>n</i> = 400)		Non-User ( <i>n</i> = 100)		<i>p</i> -Value
	Mean	SD	Mean	SD	
<i>Demographic characteristics</i>					
Age of farmers (years)	50.59	10.28	47.94	9.77	0.017 **
Gender of farmers (%):					0.445
Male	95.2%		97.0%		
Female	4.8%		3.0%		
Educational level of farmers (%):					0.072
Primary school and below	19.80%		12.0%		
Higher than primary school	80.20%		88.0%		
Land ownership:					0.009 ***
Self-owned	70.4%		85.0%		
Rented	21.8%		9.0%		
Other	7.8%		6.0%		
<i>Economic characteristics</i>					
Land size (ha)	1.52	2.50	1.41	0.85	0.647
Farm revenue (USD/ha)	2121	6.20	2273	7.75	0.012 **
Farm profit (USD/ha)	1513	6.33	1676	7.54	0.006 ***

(\*\*\*), and (\*\*) indicate statistical significant difference at 1%, and 5% levels, respectively.



Chi-square test was used to test the significant differences for gender, educational level, marital status, and land ownership; whereas the Student's *t*-test was used to test the significant differences for age, land size, farming system revenue, and farm profit. Exchange rate: USD \$1 = 14,000 IDR during the period of data collection in May 2018–June 2018.

The WRS users had an average revenue of USD 2121 from their farm operations, which was lower than that of the non-users (USD 2273). There was a significant difference in farm revenue between the users and non-users. Similarly, there was a significant difference in farm profits between users and non-users.

### 3.1.2. Characteristics of Public and Private Warehouse Users

Table 4 shows the socio-economic characteristics of the private and public warehouse users. Among the 400 users that were interviewed, 163 respondents (40.75%) used a private warehouse, and 237 respondents (59.25%) used a public warehouse. The mean age of private warehouse users was 49.95, which was not significantly different from the public warehouse users (51.02). More than 90% of WRS users were male. Approximately 83% of private warehouse users and 78.4% of public warehouse users had an education level higher than primary school. In terms of land ownership, 69.20% of warehouse users owned the land on which they undertook the farming activities, 21.40% rented land and 9.40% had other forms of land ownership. Approximately 71% of public warehouse users owned land and 22% rented land, which was slightly higher than the private warehouse users. In terms of economic characteristics, the average size of landholding for the private warehouse users was 1.88 ha, compared to 1.28 ha for the public warehouse users. There was a significant difference in land holding between public and private warehouses users.

**Table 4.** Socio-economic characteristics of the private and public warehouse respondents in the Subang and Cianjur districts, Indonesia.

Socio-Economic Characteristics	Private Warehouse ( <i>n</i> = 163)		Public Warehouse ( <i>n</i> = 237)		<i>p</i> -Value
	Mean	SD	Mean	SD	
<i>Demographic characteristics</i>					
Age of farmers (years)	49.95	9.79	51.02	10.58	0.303
Gender of farmers (%):					0.220
Male	96.90%		94.20%		
Female	3.10%		5.80%		
Educational level of farmers (%):					0.259
Primary school and below	17.0%		21.60%		
Higher than primary school	83.0%		78.40%		
Land ownership (%):					0.592
Self-owned	69.20%		71.4%		
Rented	21.40%		22.0%		
Other	9.40%		6.6%		
<i>Economic characteristics</i>					
Land size (ha)	1.88	3.60	1.28	1.30	0.044 **
Farm revenue (USD/ha)	2114	6.32	2125	6.13	0.816
Farm profit (USD/ha)	1524	6.36	1506	6.33	0.704

(\*\*) indicates statistical significant difference at 5% level.

Chi-square test was used to test the significant differences for gender, educational level, land ownership and marital status; whereas the Student's *t*-test was used to test the significant differences for age, land size, farm revenue, farm cost and farm profit. Exchange rate: USD 1 = 14,000 IDR during the period of data collection in May 2018–June 2018.

### 3.2. Farmers' Perceptions the Warehouse Receipt System

#### 3.2.1. Farmers' Perception of Using the WRS

Table 5 shows the farmers' perceptions relating to the use of the WRS. From the total number of respondents, the WAI was considered *strong* for the factors of the lack of human resources management, a lack of facilities, providing easy access to credit, high costs of transportation, higher selling price, limited access for smallholders, and that the WRS not well known. The highest ranked factors for the WAI were the WRS had limited access for smallholder farmers (0.74), the lack of facilities (0.73), higher selling price (0.73), and WRS not well known (0.73).

**Table 5.** Farmers' perceptions of using the WRS in the Subang and Cianjur districts, Indonesia.

No	Factor	User (n = 400)		Non-User (n = 100)		Total (n = 500)	
		WAI	I	WAI	I	WAI	I
1	The sustainability of WRS program	0.63	S	0.43	M	0.59	M
2	The lack of human resources management	0.67	S	0.68	S	0.68	S
3	The lack of facilities	0.73	S	0.73	S	0.73	S
4	Providing easy access credit/finance	0.71	S	0.78	S	0.72	S
5	High cost of warehouse rental	0.53	M	0.68	S	0.56	M
6	High cost of transportation	0.65	S	0.72	S	0.67	S
7	High cost of processing	0.42	M	0.46	M	0.43	M
8	High cost of insurance	0.42	M	0.64	S	0.46	M
9	Expanding market access	0.46	M	0.47	M	0.46	M
10	Gain higher selling price	0.75	S	0.64	S	0.73	S
11	Access to market information	0.42	M	0.45	M	0.42	M
12	Limited access for smallholder farmers	0.74	S	0.73	S	0.74	S
13	Slow issuing of warehouse receipts	0.37	W	0.59	M	0.41	M
14	Complicated regulations	0.37	W	0.57	M	0.41	M
15	WRS not well known	0.74	S	0.72	S	0.73	S

(I) Interpretation: (S) Strong, (M) Medium, (W) Weak.

The results comparing users and non-users revealed that both groups had a *strong* WAI for the variables of lack of human resources management, lack of facilities, easy access for credit, high cost for transportation, gain higher selling price, limited access for smallholders, and not well known. On the other hand, both groups had a *medium* WAI for the variables of high cost for processing, expanding market access, and improved access for market information.

Users had *weak* perceptions that the WRS regulations were complicated and slow to issue the warehouse receipts. This means that farmers using the WRS were satisfied with the WRS regulations and the time taken to issue receipts. This corresponds with the fact that it generally takes only one week for warehouse receipts to be issued.

#### 3.2.2. Farmers' Perceptions of the Public and Private Warehouses Users

Table 6 shows the farmers' perceptions of using the private and public warehouses. From the total respondents, there was a *strong* perception of WRS sustainability, lack of human resources capacity, lack of facilities, easy access to credit, high cost of transportation, higher selling price, limited access for smallholders, and WRS not well known. The highest WAI rankings were for higher selling price (0.75), limited access for smallholders (0.74), WRS not well known (0.74) and easy access to credit (0.71).



**Table 6.** Farmers' perceptions of the private and public warehouses in the WRS in the Subang and Cianjur districts, Indonesia.

No	Factor	Private (n = 163)		Public (n = 237)		Total (n = 400)	
		WAI	I	WAI	I	WAI	I
1	The sustainability of WRS program	0.60	M	0.65	S	0.63	S
2	The lack of human resources management	0.74	S	0.63	S	0.67	S
3	The lack of facilities	0.77	S	0.71	S	0.73	S
4	Providing easy access credit/finance	0.72	S	0.70	S	0.71	S
5	High cost of warehouse rental	0.52	M	0.53	M	0.53	M
6	High cost of transportation	0.75	S	0.59	S	0.65	S
7	High cost of processing	0.40	W	0.43	M	0.42	M
8	High cost of insurance	0.39	W	0.44	M	0.42	M
9	Expanding the market access	0.44	M	0.48	M	0.46	M
10	Gain higher selling price	0.77	S	0.73	S	0.75	S
11	Access to market information	0.38	W	0.44	W	0.42	M
12	Limited access for smallholder farmers	0.74	S	0.74	S	0.74	S
13	Slow issuing of warehouse receipts	0.34	W	0.39	W	0.37	W
14	Complicated regulations	0.34	W	0.39	W	0.37	W
15	WRS not well known	0.77	S	0.71	S	0.74	S

(I) Interpretation: (S) Strong, (M) Medium, (W) Weak.

### 3.3. The Problems and Constraints Associated with Using the WRS

#### 3.3.1. The Problems and Constrains of the WRS Users and Non-Users

Problems and constraints associated with using the WRS were categorized into two parts: problems and constraints according to the users and non-users' perceptions, and according to the users' perceptions of public and private warehouses. There were 13 problem variables: lack of management, lack of facilities, complicated regulations, slow time for the issuance of warehouse receipts, high cost of warehouse rental, high cost of insurance, low selling price, delayed payment time, few available markets, no training, insufficient skilled labor, limited access for smallholder farmers, and lack of awareness.

Table 7 shows the problems and constraints associated with the WRS from the perspectives of users and non-users. From the total respondents, the main problems were the lack of awareness (0.76), lack of facilities (0.72), no training (0.70) and limited access for smallholders (0.70).

**Table 7.** Problems and constraints associated with the WRS in the Subang and Cianjur districts, Indonesia.

No	Problem and Constraints	User (n = 400)		Non-User (n = 100)		Total (n = 500)	
		WAI	I	WAI	I	WAI	I
1	Lack of management	0.69	S	0.68	S	0.68	S
2	Lack of WRS facilities	0.71	S	0.76	S	0.72	S
3	Complicated regulations	0.41	M	0.49	M	0.42	M
4	Slow time for the issuance of receipts	0.37	W	0.48	M	0.39	W
5	The high cost of warehouse fees	0.52	M	0.63	S	0.54	M
6	High cost of insurance	0.38	W	0.40	W	0.38	W
7	Low selling price	0.41	M	0.41	M	0.41	M
8	Delayed payment time	0.34	W	0.50	M	0.37	W
9	Few available markets	0.55	M	0.51	M	0.54	M
10	No training program	0.69	S	0.74	S	0.70	S
11	Insufficient skilled labour	0.66	S	0.72	S	0.67	S
12	Limited access for smallholder farmers	0.70	S	0.70	S	0.70	S
13	Lack of awareness	0.76	S	0.73	S	0.76	S

(I) Interpretation: (S) Strong, (M) Medium, (W) Weak.

### 3.3.2. The Problems and Constrains of the Public and Private Warehouse Users

Table 8 shows the WRS users' perceptions of the problems and constraints associated with the program's private and public warehouses. From the total respondents, the highest WAI rankings were lack of awareness (0.76), lack of facilities (0.71), and limited access for smallholder farmers (0.70). On the other hand, WRS users had *weak* perceptions regarding the following factors: time for issuance of warehouse receipts, high cost of insurance, and delayed payments time.

**Table 8.** WRS users' perceptions of the problems and constraints associated with the program's private and public warehouses in the Subang and Cianjur districts, Indonesia.

No	Problem and Constraints	Private (n = 163)		Public (n = 237)		Total (n = 400)	
		WAI	I	WAI	I	WAI	I
1	Lack of management	0.72	S	0.66	S	0.69	S
2	Lack of WRS facilities	0.71	S	0.71	S	0.71	S
3	Complicated regulations	0.39	W	0.41	M	0.41	M
4	Slow time for issuance of receipts	0.35	W	0.38	W	0.37	W
5	The high cost of warehouse fees	0.55	M	0.50	M	0.52	M
6	High cost of insurance	0.38	W	0.38	W	0.38	W
7	Low selling price	0.45	M	0.38	W	0.41	M
8	Delayed payment time	0.33	W	0.34	W	0.34	W
9	Few available markets	0.54	M	0.55	M	0.55	M
10	No training program	0.73	S	0.67	S	0.69	S
11	Insufficient skilled labour	0.69	S	0.63	S	0.66	S
12	Limited access for smallholder farmers	0.70	S	0.71	S	0.70	S
13	Lack of awareness	0.80	S	0.74	S	0.76	S

(I) Interpretation: (S) Strong, (M) Medium, (W) Weak.

## 4. Discussion

Demographic and economic characteristics have been used to examine the factors driving the adoption of an agricultural innovation decision, such as the WRS. In general, the factors influencing farmers' adoption of the agricultural technology include the farmers' characteristics, socio-economic and institutional characteristics, characteristics of the technology, a perception of need, and the households' risk-bearing capacity [48,50,51]. More specifically, previous research revealed that the factors influencing farmers' adoption of an agricultural technology package and mechanization in Ghana were age, gender, land size, farmers experiences, access to extension, credit availability, and availability of technology [51–54].

### 4.1. Characteristics of Respondents

The respondents were firstly divided into two groups, namely WRS users and non-users. The users were then also divided into users of a private or public warehouse. The total number of user respondents was 400 farmers, while there were 100 non-user farmers. Among the WRS users, 163 farmers used private warehouses and 237 used public warehouses.

#### 4.1.1. Characteristics of the WRS Users and Non-Users

The characteristics of the WRS users and non-users were significantly different in the variable of age, land ownership, farm revenue and farm profit. However, the characteristics of the WRS users and non-users were quite similar. Gender is expected to capture the differences in understanding the benefit of an agricultural innovation program such as the WRS. The results of this study revealed that the male paddy rice farmers (approximately 95%) who use the WRS were more common than the female paddy rice farmers (approximately 5%). This result is consistent with a previous study that showed that male farmers have a higher tendency to participate in agricultural innovation programs [55]. However, this

contradicts other previous findings that in the rural setting, users and non-users of the WRS were similar, irrespective of the educational level and gender of the individual concerned [37].

There was a significant age difference between users and non-users (Table 3). Age influences the experience and availability of the resources of the farmers. Older farmers prefer to use the WRS because they may have more resources and experience regarding the benefit of the WRS. This result is consistent with the fact that the average age of users was higher than non-users. Indeed, age has been shown to have a positive influence on the decision to participate in innovative programs such as the WRS and other agribusiness platforms [55,56].

Education could have a positive or negative effect on the WRS program. Education will increase the tendency to co-operate with other people and participate in group activities such as the WRS. However, it is also possible that education could increase the chances of the household obtaining a non-farm income, and reduce its dependency on the agricultural sector [56]. This study revealed that the educational level of non-users was higher than that of users of the WRS, albeit not statistically significant. A previous study also revealed that low levels of education were a barrier to marketing management skills and understanding information from government agencies [57].

The new finding in this study revealed that, the average annual profit for users (USD1513) was lower than that of non-users (USD1676). These results may be attributed to the current challenges of the implementation of the WRS, including high transportation and warehouse rental costs as revealed by the results presented in the section of the farmers' perceptions of the use of the WRS (see Table 5). Nevertheless, it may also be that the non-users are engaged in the production of some other agricultural products that yield relatively higher level of revenues and profits than the crops being produced by the users. This contradicts previous research that revealed that paddy rice farmers who participated in the WRS had higher incomes compared to non-WRS farmers [30,36].

#### 4.1.2. Characteristics of Public and Private Warehouse Users

Users of the WRS were categorized into two groups, namely users of private or public warehouses. Public warehouses are those that are licensed by the government, used by small and large firms/cooperatives/stated-owned enterprises, and provide storage and physical distribution services on a rental basis. These warehouses are organized to provide storage facilities for traders, manufacturers and agriculturists in return for a storage charge. Government warehouses are those that are owned, managed and controlled by central, state or local government authorities. In Indonesia, this type of warehouse is used by the Indonesia Logistic Bureau (Bulog) to store strategic commodities such as milled and paddy rice. Private warehouses are those owned, managed and operated by a company/group for shipping and storing its own products. Commonly, they are constructed near the fields, wholesalers, and retailers that are near their business centers and manufacturers that are near their factories. These companies have stable inventory levels and long-run expectations [58].

Public and private warehouses in Indonesia have similar specifications in terms of their technical requirements, as stated in the rule governing the Commodity Futures Trading Regulation Agency (CoFTRA) No. 4/2016. These technical requirements include the availability of fire extinguishers, loading and unloading facilities, pallets and security alarms, size of the storage area, and location near main roads. Feasibility assessments of the warehouses were undertaken by Bhandha Ghara Rekha Ltd. (PT BGR), as an independent supervisor for warehouse management. These guidelines contradict the results of previous research that public warehousing did not imply public ownership, but referred to a company storing goods for the public on behalf of whoever wished to deposit in the warehouse, and that receipts were issued to the respective depositors who could then use those receipts for trading purposes or as collateral for raising finance [26].

From the demographic and socio-economic characteristics, there was a significant difference in landholding between private and public warehouse users based on the student's *t*-test. The farm revenue and farm profit variables did not have a significant difference between the two groups. This means that the private and public warehouse users typically have similar characteristics. There were

no identifiable criteria to indicate whether the WRS users would use the private or public warehouses. Factors such as the warehouse location and distance from the farm are likely determinants of the farmers' choice.

#### 4.2. Farmers' Perceptions of the Warehouse Receipt System

##### 4.2.1. Farmers' Perceptions of Using the WRS

There were differences in perceptions between the users and non-users for the factors of WRS sustainability, warehouse rental cost, insurance cost, time for warehouse receipts to be issued and complicated regulations. Users had *strong* perceptions that the WRS will be sustainable and help them in their farm businesses in the long-term, but non-users had *moderate* perceptions. The warehouse receipt system users believed that the program would work well, particularly given the institutional and funding support from the Commodity Futures Trading Regulation Agency (CoFTRA). Users of the WRS were confident in the program given that it has been declared a national program since 2006 and has been supported by local governments. Non-users argued that the program worked properly only because of the support from the government with a top-down approach. However, they doubt the continuity of the WRS if assistance from the government ceased.

The agency managing the WRS in Indonesia—CoFTRA, under the Ministry of Trade in the Republic of Indonesia—was established as a body for stakeholders in the agricultural and commodities sector with the introduction of Commodity Futures Trading (CFT), the WRS and the Commodity Auction Market (CAM). At present, these three trading schemes have been soundly synergized and integrated, thereby facilitating a surge in agricultural productivity and sustainability. The major tasks and functions of CoFTRA are to develop, manage, expand and supervise the CFT, CAM and WRS. The WRS is operated by several institutions: (1) Supervisory Board, (2) Warehouse Manager, (3) Assessment Institution Body, and (4) Registration Centre [59]. With this established structure, the WRS may be sustained for the long-term. The experience from several developing countries is that in order to work well, warehouse receipts need to be recognized by law [60].

Both the user and non-user groups had the same *strong* perception that the WRS had a lack of human resources management. Although each warehouse already had the appropriate management structure, some did not qualify for warehouse management. For instance, one staff member was often required to do everything from the transport of produce to preparing the quality commodity test. Some warehouse staff also had no access to management training because of limited warehouse operation budgets. The success of the WRS depends on the effort of warehouse management to efficiently service the farmers. The WRS businesses develop not only based on trust, but also on the professionalism of the staff.

Users and non-users also had the same *strong* perception regarding the lack of WRS facilities, with a WAI value of 0.73. Some warehouses did have the specifications stated in the feasibility documents, including security facilities, location near the main road, pallets, drying facilities and transportation facilities. However, one warehouse was also used for mixed commodities, with paddy rice, milled rice and maize being stored together. This situation increases the risk of products being contaminated with pests. Previous research has revealed that the WRS in Africa lacked suitable storage infrastructure, had legal and regulatory issues, a lack of requisite skills among warehouse managers and weak complementary market institutions that reduced the program's attractiveness among key stakeholders [25]. However, the WRS facilities had many indirect benefits, including helping to tackle the issues underlying post-harvest losses [61].

One of the important benefits of the WRS was access to credit/finance. By depositing paddy rice in the warehouse, farmers could use their warehouse receipts as collateral to obtain cash from the banks. The variable of providing easy access to credit had WAI values of 0.71 for users and 0.78 for non-users. The WAI value for non-users was higher than users, because they had high expectations of the concept underpinning the WRS. The government has also provided loan interest subsidies

for WRS users, so that the loan interest rate was only 6% per year, which is very low compared to the normal commercial rate of 10.5–12%. Traders' decisions on whether to access credit were mainly determined by social capital variables (i.e., trust index, decision-making index, labour contribution, meeting attendance index and heterogeneity index) and credit variables (i.e., interest rate, and payback period) [62]. If warehouse receipts could be used as a guarantee for credit, farmers were more willing to participate in the WRS. Indeed, both groups had a *strong* perception that the WRS enabled easy access to credit. The WRS has made a great contribution to improving smallholder farmers' access to financial services, but limited awareness of the benefits of the warehouse receipts and activity in informal financial markets limits the use of the warehouse receipt as a financial instrument [40]. A WRS and other guarantee systems in Tanzania had a high impact on farmers' income generation and access to markets, and their preferences for savings [63]. The advanced information technology support and financial attractiveness of the WRS are two indispensable enablers for agricultural finance initiatives in China, and collaboration with other entities is necessary in adopting agricultural supply chain finance [64].

In terms of funding, the WRS was an alternative means of agricultural financing and had support from the banking sector [27]. Transportation costs in the WRS were charged to the farmers using the warehouse and were generally around Rp 100/kg, depending on the distance between the warehouse and the farm. Both the users and non-users provided *strong* indications that this cost was expensive, with a WAI value among users of 0.65 and 0.72 among non-users. The transportation cost will therefore burden the farmers who use the WRS, and these farmers expressed a need for lower transportation costs. If the transportation cost is considered too expensive, the WRS users will not want to continue using the warehouse. High transportation costs are expected to have a negative relationship on the use of the warehouse [65].

There were differences in WAI values between users and non-users for the variable relating to warehouse rental costs. The users had a *medium* WAI value of 0.53, while the non-user had a *strong* value of 0.68. Non-user farmers assumed that the cost of warehouse rental was expensive and they perceived no other benefits from using the warehouse. The warehouse rental cost negatively influenced farmers' profit. If the warehouse rental rate was cheaper, farmers would be more willing to participate in the WRS [29].

Both the user and non-user groups also had a *medium* WAI value for the cost of processing in the warehouse, expanding market access, and access to market information. The cost for paddy rice processing was Rp 100/kg and insurance costs approximately Rp 1 per ton. These costs were not considered a burden to farmers because they gained other benefits from the WRS. For both the market access and market information access variables, the farmers perceived that they did not benefit as a result of participating in the WRS. The WRS is one of the market risk management instruments to reduce unstable prices, and it is consistent with long-term market development [66]. Futures contracts are another price risk management instrument for actors in food marketing channels [67–72].

The participants of the WRS included both farmers and traders, so that the farmers directly sold the paddy rice to the traders. Sometimes, farmers deposited the paddy rice directly to the traders because the WRS requires a minimum of 10 tons (individually) to be stored in the WRS. As a market institution, the WRS can reduce transaction costs and strengthen the capacity of local and regional markets to absorb surpluses to cope with increases in outputs and avoid precipitous price plunges, which dampen producer incentives [25]. Previous research in Uganda revealed that while the market structure and conduct of the pilot WRS was implemented as theorized, it faced various barriers that led to poor market performance [73].

Both the user and non-user groups had a *strong* perception that the WRS provided limited access for smallholders. In the Cianjur and Subang districts, the dominant users of the WRS were traders and middlemen. Smallholder farmers find it difficult to deposit their commodities, because the minimum requirement for paddy rice stored in the warehouse was 10 tons. Previous research found that warehouse finance was often unavailable to rural producers, especially smallholders in Africa,



with the warehouses being mainly used by a few large borrowers, usually importers, under expensive collateral management agreements involving international inspection companies [20]. Models targeting smallholder farmer groups and funded by donors/non-government organizations (NGOs) have often failed because of scale economies and disabling government policy. Due to low outputs, no smallholder farmer targeted by the WRS in Africa had been issued with a tradable certified warehouse receipt to serve as collateral to potential lenders [73]. In fact, warehouse receipt financing has generally not been embraced by smallholders in developing countries in which it has been available. This is supported by previous research that revealed that the problems associated with smallholder warehouse receipt financing are complex and require a deeper understanding of the transaction costs and risks that undermine its value to smallholders [74]. Smallholder growers were often reluctant to venture into risky entrepreneurial activities in the absence of effective mitigation measures [75].

#### 4.2.2. Farmers' Perception of the Public and Private Warehouse Users

Public and private warehouses users had a *weak* perception level for the following variables; time taken for warehouse receipts to be issued, complicated regulations, and access to market information. This means that the issuing time for warehouse receipts, the WRS regulations, and market information access were not a problem for private and public warehouse users. Both the public and private warehouses users had a *strong* perception that the WRS provides a relatively higher selling price, limited access for smallholders, and that the WRS is not popular. These results were similar for WRS users and non-users.

Public and private warehouses are categorized based on ownership. In the Subang district, the public warehouse was built by the central government and is now managed by the “Annisa” cooperative. The Annisa cooperative is involved in many activities, including supplying inputs, savings and loans, rice processing, and marketing. In contrast, the private warehouse in the Subang district was independently established and is managed by the farmer group “Mitra Tani Sejahtera”, due to it being located close to the production center.

In the Cianjur district, the public warehouse was built by the central government and is now managed by the “Niaga Mukti” cooperative. The management of this cooperative was very active in running the WRS as a business activity and it received full support from the local government, including the assistance of two trucks for transportation, WRS operational costs assistance (i.e., electricity and staff salary), and the procurement of rice processing machines. The business development (except for the warehouse rental in the WRS) includes rice processing, rice marketing, loans and savings, and production input supply. With the business development, many farmers in the Cianjur district were interested in using the WRS. This is consistent with the results of a previous study that found the use of warehouse receipts as a financial instrument had positive effects on factors such as awareness of the benefits of the WRS, availability of licensed and supervised public warehouses, availability of financial packages, and government policies [40]. In the WRS in India, increasing demand for use of the warehouse depends on the selling price, and the retailers' offer of a partial trade credit option to his customers [76].

#### 4.3. The Problems and Constraints Associated with Using the WRS

##### 4.3.1. The Problems and Constrains of the WRS Users and Non-Users

The Indonesian Government had been promoting the WRS since 2008, but these efforts have been less than optimal. The promotion has mainly been undertaken by the Ministry of Trade, while the WRS program is a national program that involves several stakeholders including the Ministry of Agriculture, Ministry of Cooperatives, SMEs, the Bank of Indonesia and local governments. It is necessary to also involve regional and government agencies such as agricultural extension workers, so that information about the WRS could be better disseminated to the farmers.



The main problems of the using of WRS were the lack of awareness, lack of facilities, no training program, and limited access for smallholders. This result is consistent with previous research that the proposed WRS in the Barito Kuala District, South Kalimantan Province, is yet to be implemented due to these challenges [29].

Both users and non-users complained about the lack of facilities in the WRS such as security, processing and post-harvest, and transportation facilities. For the public warehouses, the government built the warehouses and provided other equipment such as drying floors and office buildings, but other facilities must be managed by warehouse management and local governments. Local governments had funding constraints that limited WRS activities, so the creativity of the warehouse manager is needed to find a new income source for the WRS.

An important problem regarding the implementation of the WRS is the limited access for smallholder farmers. Users of the WRS in Indonesia are dominated by large-scale traders because they have large amounts of paddy rice to trade. One of the requirements to store paddy rice in the warehouse relates to minimum quantities, with at least 10 tons required for individuals and 50 tons for groups. Smallholder farmers often have difficulties in meeting these requirements. To meet the minimum requirement of 50 tons, smallholder farmers will have to cooperate with other farmers to store their grain as a farmer group. In the Subang and Cianjur districts, an average farmer group can deposit 50 tons of paddy rice.

#### 4.3.2. The Problems and Constrains of the Public and Private Warehouse Users

The main problems and constrains of the public and private warehouses users were lack of awareness, lack of facilities, and limited access for smallholder farmers. These results were similar from the perspective of WRS users and non-users, and consistent with previous research that the prospective benefits of the WRS were facilitating trade, enhancing market efficiency, creating easier access to rural finance, mitigating price risks, and enabling cost-effective management of public food reserves [20]. Warehouse receipts are an important and effective tool for creating liquidity and easier access to credit. Such schemes also offer additional benefits such as smoothing the supply and prices in the market, improving grower incomes, and reducing food losses [77]. The WRS could enhance the value of farmers' products as collateral and play an essential role in agricultural marketing. The receipts are bankable, and can be traded, sold, swapped or used for collateral against a derivative instrument such as a futures contract [35].

The WRS is a platform to increase farmers' income through a delayed sale system, where farmers can store their products during harvest time, and sell them later at higher prices in times of higher demand. The WRS is also a source of financing, based on the principle that warehouse receipts could be pledged to the bank as collateral for financing, thereby providing farmers with access to money for their next farming investment. The WRS has benefits in creating a more efficient and modern marketing system [78].

The WRS also encourages the improvement of product quality and standardization, where producers/farmers are motivated to standardize their products. This is very important in the midst of stiff competition in the market due to globalization and market liberalization. The WRS can encourage a warehousing revolution, through the development of a warehousing system that is an important part of supporting modern marketing patterns. Hence, it should be designed as best as possible to efficiently store products or commodities. Consistent with previous research in Uganda, for the best-practice implementation of the WRS, governments should spearhead the promotion of standards, improvements in smallholder productivity, capacity strengthening of collective actions, and the importance of increased awareness and understanding of all aspects of the WRS [73].

In theory, warehouse receipt financing permits smallholders to store their surplus produce safely in a modern warehouse and sell at a later date when prices will be higher. It also allows them to use the stored commodity as collateral, to secure a loan and finance household consumption and investment needs in the interim. However, in practice, warehouse receipt financing generally has not been

embraced by smallholder farmers in developing countries where it has been available [74]. However, using warehouse receipts as a financial instrument has had positive effects such as raising awareness of the benefits of the WRS, increased availability of licensed and supervised public warehouses and financial packages [40,78].

Another problem for the implementation of the WRS is coordination and cooperation among institutions. In conducting the WRS program, institutional cooperation is confronted with various challenges, such as farmer socio-economic empowerment through the WRS, warehouse empowerment through the use of receipts as an alternative finance mechanism, finance instruments and agricultural marketing. However, the implementation of the WRS requires coordination among government departments, farmers, regional bodies, and financial institutions [79].

## 5. Conclusions and Recommendations

The WRS in Indonesia provides sustainability of the food system by an economic link with the farming system to enhance the marketing of agricultural commodities and support the financing of agricultural activities. The WRS policy was promulgated in 2006, and the implementation began in 2008. The implementation of the program was slow and not widely adopted as the farmers were reluctant to use the WRS. Thus, this study sought to develop a deeper understanding of the WRS' role and performance from the perspectives of the farmers.

The results show that the socio-economic characteristics of WRS users and non-users, and of users who engaged with either private or public warehouses, were quite similar. However, there were significant differences in age, land ownership, farming system revenue, and profit, with non-users having higher WAI values than users for all of these variables.

The results of the weighted average index on the perceptions of the WRS revealed that there was a *strong* perception that the WRS is not well known, provides easy access to credit, and limited access for smallholder farmers. Moreover, there was a *weak* perception that the WRS has complicated regulations and slow delivery of warehouse receipts. The main problems with implementation of the WRS in Indonesia were the lack of awareness, lack of facilities and limited access for smallholders.

This study provides the following policy recommendations. First, the Indonesian Government, and especially the Ministry of Trade, should improve farmers' awareness and understanding of the WRS through agricultural extension undertaken by the Ministry of Agriculture and the Extension Services embedded in the functions of the local governments. In fact, implementation of the WRS should be better supported by the Ministry of Trade, and each ministry of the government should have greater engagement with farmers.

Second, CoFTRA should build a public warehouse near the main production centers with support from each center's local government. Public warehouses near production centers will reduce transportation costs.

Third, the government should provide adequate assistance and training for warehouse management, because the main potential factor that may influence the sustainability and success of the WRS is the creativity of the warehouse staff to be proactive in the business development. The WRS is a business and needs to make a profit, and so the management staff need to increase their efforts to promote the program to farmers and other stakeholders to increase WRS participation.

Fourth, it is imperative that the government provide financial support for the high transportation and warehouse rental costs to attract farmers to use the WRS, thereby generating needed benefits, including relatively higher farm revenues and profits compared to those of non-users. Currently, it appears that the non-users obtain higher farm revenues and profits than the users of the WRS.

Lastly, it is essential that smallholder farmers have full access to the WRS and that the current minimum paddy rice deposit level be reconsidered to cater for the growers. More than 85% of farmers in Indonesia are smallholders who typically operate farms of less than 0.5 ha and find it difficult to satisfy the 10 ton requirement of the WRS. These smallholder farmers need improved access to the WRS to help them market their commodities and access financial services.

This study provides an empirical contribution to the existing literature. In terms of methods of analysis, previous studies used purely qualitative and descriptive methods, whereas this study employed the weighted average index, student's *t*-test, and chi-square analyses. In addition, whereas previous studies explored the WRS in general, this study explored the farmers' perceptions and challenges of public and private warehouses. Finally, the finding that the average annual profit of non-users was significantly higher than that of the users of the WRS is striking, and this could be attributed to the current challenges of the implementation of the WRS, including high transportation and warehouse rental costs.

It is important to note this study's limitations. The limitations of the study are related to the research location, type of commodities and type of warehouses examined. The research location was restricted to two districts (i.e., Subang and Cianjur) in the West Java Province in Indonesia, and paddy rice commodities. Also, this study assessed only two types of warehouses; private and public warehouses, without examining the cost-benefit analysis of using the WRS. Therefore, extending the research area to other regions within Indonesia covering other commodities and other types of warehouses (i.e., government and co-operative warehouses) to provide more general conclusions is an excellent opportunity for future research.

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