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Why Farmers Prefer to Use Warehouse Receipt System in Turkey: An Integrated Model Approach

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Abstract: The warehouse receipt system (WRS) in agriculture has been considered a solid tool to support the agricultural sector. In comparison to other nations, Turkey has initiated the adoption of WRS recently. Therefore, the attitudes, abilities, and perceptions of farmers regarding current practices are of great importance. This study identified the factors influencing farmers' intention to use WRS and categorized them based on these factors in Turkey. The conceptual framework of the study is constructed on the Theory of Planned Behavior, the Technology Acceptance Model, perceived cost, innovation openness, and organizational factors. Explanatory factor analyses were utilized to reveal reliability and sampling adequacy of the factors, and a cluster analysis was conducted to categorize the farmers based on the factors. The results showed that 38.40% of the farmers exhibited a high tendency towards using WRS in the future. These individuals demonstrated notably positive attitudes, social norms, and perceived behavioral ability, and they also held favorable perceptions towards WRS (perceived ease of use, perceived usefulness, perceived cost). This study could assist intermediaries, industrialists, and decision-makers in improving the system and developing action plans.

Keywords: warehouse receipt system; farmers; clustering analysis; Turkey

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1. Introduction

The warehouse receipt system (WRS) in agriculture has been recognized in many countries as a remarkable tool to empower and improve agricultural economics [1]. This system provides several benefits, such as maintaining the quality of products, price stability, and food safety and creating strategic stock or credit facilities for farmers, intermediates, industrialists, and government organizations [2,3]. Building a good warehouse receipt system has a remarkable contribution when the biological nature of products, seasonality of products, weather dependency, risk, and uncertainty in agriculture, especially in emerging economies, are taken into consideration [4,5].

This system requires a set of processes starting from licensing to risk management. Firstly, organizations authorized by governments enable licenses to warehouses satisfying certain quality standards on storage facilities, such as temperature and humidity control [3]. Then, agricultural products are accepted after they are controlled in terms of quality and quantity and stored under appropriate storage conditions. Finally, product owners release their products, completing the official requirements [5,6].

The United States of America (USA) and Canada are among the countries that give the most importance to this system in the world. Hence, in 2022, these countries had 3536 licensed warehouses [7]. In Turkey, the system in agriculture was introduced in a project supported by the Word Bank and the Ministry of Trade in 2003, and then the legislation on regulations (Law No. 5300 on licensed warehouses for agricultural products) was released in 2005 [8]. Compared to other countries, the system seems to have just been established, and it is very important to monitor and improve implications.

The literature includes some studies that enabled us to have a better understanding of demographics and factors affecting farmers' WRS preference [9–11], the role of WRS

on farmers' income level [5,12,13], small-scale farmers' access to financial resources [14], farmers' perceptions of the warehouse receipt system [1], and views of the warehouse receipt system and the expectations of olive oil farmers toward the warehouse receipt system [15]. However, no studies were found to have focused on the behavioral factors on preferences of farmers' warehouse receipt systems.

This study aims to reveal the factors influencing farmers' preferences for adopting WRS and the positions of similarity based on these factors. To reach the research goal, the Theory of Planned Behavior (attitude, social norms, and perceived behavioral control) and the Technology Acceptance Model (perceived usefulness, perceived ease of use) were integrated, and perceived cost, innovation openness, and organizational factors were added. This conceptual framework helps us to understand farmers' attitudes and subjective norms around them toward WRS, as well as perceptions of their ability to benefit from this system. The research questions of this study were as follows:

How are farmers grouped according to their attitudes toward using WRS?

How are farmers grouped according to subjective norms about WRS?

How are farmers grouped according to their perceptions of their ability to benefit from using WRS?

How are farmers grouped according to their innovation openness?

How are farmers grouped according to organizational factors?

The contribution of this study to the literature is two-fold. Firstly, an integrated model including the Theory of Planned Behavior, Technology Acceptance Model, perceived cost, innovation openness, and organizational factors was designed to have a better understanding of farmers' behavior toward WRS for the first time. This integrated model may suggest what factors are important in stimulating farmers' preferences to use WRS. Secondly, data obtained from this study may serve intermediates, industrialists, and government organizations to plan their actions and produce policy implications, which may create a more favorable environment for farmers toward WRS.

2. Literature Review

In this study, the Theory of Planned Behavior (TPB) and the Technology Acceptance Model (TAM) were integrated, and perceived cost, social innovation, and organizational factors were added to reveal factors affecting farmers' intentions to continue LDS in the future. TPB includes attitudes, social norms, and perceived behavioral control [16]; TAM consists of perceived usefulness and perceived ease of use [17]. These factors were derived from a deep review of the literature. The model is presented in Figure 1.

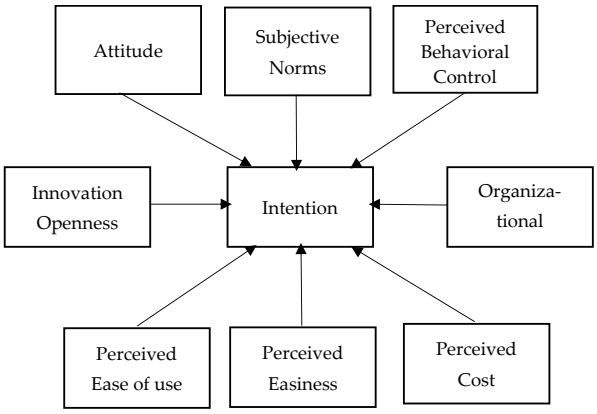

Figure 1. Factors affecting farmers' intentions to prefer WRS.

TPB is a socio–psychological model that attempts to understand an individual's behavior and evaluates how individuals' intentions convert to certain behaviors. The basic concepts of this model are explained below.

Intention: Intention is defined as an indicator of how hard people try to perform and how much effort they plan to make to perform a behavior [16]. In this context, intention is commonly taken into consideration instead of the actual behavior since it is accepted as the antecedent of the behavior [18]. Previous studies show that intention has a significant impact on farmers' behaviors in agriculture while using or adopting a system [19–21]. Considering the literature, intention is taken as the antecedent of the behavior in this study.

Attitude: This term is expressed as an individual's evaluation of any behavior as positive or negative. In other words, a person forms a belief in a behavior by associating it with other attributes. Hence, when attitude toward behavior exists, each belief leads behavior to a positive or negative result [16]. As Widodo and Sholichah [10] stated, attitudes toward behavior have positive effects on farmers' intention to prefer WRS. Some other studies also indicated that farmers who have a more positive attitude toward new systems in agriculture tend to adopt them more [22–24]. In this study, attitude is considered a factor in intention to use.

Subjective Norms: Subjective norms refer to the perceived social approval by salient referent individuals and groups to perform or not to perform a behavior [16]. It means that people who have positive perceptions of their social environment are more engaged with the behavior. Previous studies revealed that subjective norms can be a determinant in understanding farmers' intention to adopt new production systems or technologies [10,24]. There seems to be a need to investigate the presence of any associations between subjective norms and farmers' intention to use WRS in the future.

Perceived Behavioral Control: This term refers to people's perceptions of their ability or power to perform a certain behavior. In other words, perceived behavioral control involves individuals' willingness to perform a behavior and an evaluation of their ability to perform that behavior. People evaluate how difficult or easy it is to perform a behavior, and these perceptions can influence their behavior [16]. Perceived behavioral control has been proven to be a salient factor having an impact on farmers' intention or final behavior to use new methods [10,25,26]. In this regard, it is very important to reveal any relationships between this factor and farmers' intention to prefer WRS.

To sum up, it can be said that an individual's intention to perform the behavior under consideration is stronger when the attitude and subjective norm concerning behavior is favorable and the perceived behavioral control is high.

Perceived Ease of Use: According to Venkatesh and Davis [27], perceived ease of use is a salient issue to explain the user acceptance process and is defined as "the extent to which a person believes that using the system will be free of effort". Namely, it reflects the degree of difficulty or ease of using a system. Previous studies suggest that people are more willing to adopt a new system when they have a positive perception of easiness of use [28–30]. So, the positive perception of farmers may be a remarkable determinant of their use of WRS.

Perceived usefulness: Perceived usefulness is defined as the extent to which a person believes that using the system will enhance their job performance [27]. The use of a performance-enhancing system indicates that the individual makes a positive evaluation of using it. Some researchers reported that perceived usefulness should be taken into account to have a better understanding of the intention to use new systems [31–34]. In light of previous studies, perceived usefulness is included in the model to gain insight into farmers' intention to use WRS in the future.

Perceived Cost: Perceived cost is defined as the effort perceived by an individual to satisfy the requirements for using a new system. People generally tend to adopt new systems when they are persuaded that the new technologies can increase their incomes or reduce production costs [35]. A new technology adoption may require extra costs, such as documentation, registration, fixed costs of process change, and adaptation to new procedures in agriculture [36,37]. In this study, perceived cost can be defined as farmers' trade-off between the perceived benefits and cost of using WRS. As many previous studies stressed, the perceived cost can be a determinant of the behavior. It is included in the model to have a better explanation of the behavior.

Innovation Openness: Seçkin Halaç et al. [37] described this term as the willingness of individuals to try and adopt new technologies, systems, or approaches to obtain market opportunities. As previous studies implied, people with higher levels of innovation openness may tend to change current applications and adopt new technologies [38,39]. Some studies on the effect of innovation openness to adopt new systems, such as online shopping or agricultural green production technologies, revealed that innovation openness can be a driver of the final behavior [35,40,41]. Hence, this study considered this concept a factor affecting farmers' intention to use WRS.

Organizational Factors: The organization scheme for a warehouse receipt system has various units such as operational units, quality control and inspection, technology and information management, and marketing [3,5]. In an organization, the relationships between farmers and these units' staff are very important to provide users' willingness and loyalty to the system. Some previous studies proved that organizational factors have an impact on the adoption of a system, and people who have positive and satisfying relationships with the organization tend to prefer it in the future [42,43]. In this study, whether organizational factors affect farmers' intention to prefer WRS needs to be investigated.

3. Materials and Methods

Survey Design: The primary data were obtained through in-person interviews conducted with farmers who prefer WRS. Farmers favoring WRS were exclusively chosen because this system is regarded as a relatively novel application, and this particular group tends to possess a comparatively higher level of knowledge about it.

This study used a comprehensive structured questionnaire as the primary data collection instrument. The questionnaire is divided into three distinct sections. The first section is dedicated to eliciting information regarding the demographic characteristics of the farmers (gender, age, education, agricultural production experience, and duration of using WRS). In the second section, questions were asked to determine the farm structure (farm size, number of parcels). The third and final section is designed to explore factors affecting farmers' intention to adopt WRS (intention, attitudes, social norms, perceived behavioral control, perceived ease of use, perceived usefulness, perceived cost, innovation openness, and organizational factors).

In this study, the factors influencing farmers' intention to prefer WRS were compiled from scales in previous studies (Table 1). In the context of this study, the statements employed in these scales were translated into Turkish and subsequently submitted to experts for their evaluation. These scales were assessed using a five-point Likert scale (1. Strongly Disagree, 2. Disagree, 3. Neutral, 4. Agree, 5. Strongly Agree). The questionnaire form was given its final form after it was tested with a pilot survey involving 30 farmers. The survey was conducted in July and August 2021.

Table 1. Resources of scales and number of statements.

Scales	Number of Statements	References
Intention	4	[10–12]
Attitude	4	[10–12]
Subjective norms	5	[10–12]
Perceived behavioral control	5	[10,14,44]
Perceived ease of use	4	[1,45,46]
Perceived usefulness	3	[44–46]
Perceived cost	5	[1]
Innovation openness	3	[47,48]
Organizational factors	10	[1,48]

An official application was made to the Scientific Research and Publication Ethics Committee of Cukurova University, Institute of Natural Sciences before commencing the field study. The questionnaire underwent a comprehensive assessment by this committee, and all requisite permissions were accordingly secured, as indicated in the official letter dated 8 July 2021 (protocol code E.135855).

Sampling: Due to its possession of 19.42% of Turkey's licensed warehouse capacity, Konya province was chosen as the study area. According to the 2020 data provided by the Turkish Grain Board, the total number of farmers who selected WRS was 32,791 individuals in Turkey. Notably, among this cohort, 19.22% of them, constituting 6304 individuals, were situated within the boundaries of Konya province [49]. The number of farmers to whom the questionnaire would be administered was determined using the "Proportional Sampling Method". For a finite population, the sample size based on the known or estimated proportion of those possessing a certain characteristic was calculated [50]. Therefore, ensuring a 90% confidence interval and a 10% margin of error, surveying 113 farmers who were users of the licensed warehousing system was deemed appropriate. During the survey, a total of 125 farmers were interviewed to reach a better representative sample.

Demographic characteristics of the sample are given in Table 2. The majority of the respondents (98.40%) were male. Around 58.40% of them were aged 41–60 years, with an average age of 53.90 years. Further, 40.80% of the farmers graduated from high school. The sample had an average of 31.88 years of experience in agricultural production. In addition, the average duration of their preference for WRS was 2.42 years, with a range from 1 to 7 years.

Table 2. Demographic characteristics of the sample.

Characteristics	Frequency	Ratio (%)
Gender		
Woman	2	1.60
Man	123	98.40
Age		
20–40	18	14.40
41–60	73	58.40
61+	34	27.20
Average	53.90 years	
Education Level		
Primary School	42	33.60
Secondary School	15	12.00
High School	51	40.80
University	17	13.60
Experience in agricultural production	31.88 years	
The duration of farmers' preference for WRS	2.42 years	

Statistical Analysis: Initially, exploratory factor analysis was carried out to ascertain the reliability and sampling adequacy of the measurement scales. Following this, a cluster analysis was utilized to categorize farmers based on their contributions to the factors influencing their intention to adopt the Licensed Depo System (LDS).

The assessment of construct reliability and sampling adequacy was performed through explanatory factor analysis [51]. Factor analysis is a multivariate statistical technique employed for data reduction or dimensionality reduction, with the primary objective of amalgamating interrelated variables and identifying a smaller set of uncorrelated yet conceptually meaningful new variables, which are referred to as factors. In practice, factor analysis serves as an indicator of the structural sampling adequacy of the data derived from the measurement instrument [52,53].

In this study, nine scales were developed for measurement purposes to assess the factors influencing farmers' preferences for WRS. Subsequently, the data obtained from

the application of these scales were subjected to Principal Component Analysis (PCA), and through this method, the sub-scales and characteristics of the scales were determined. The interpretation of the outcomes was conducted considering the factors' cumulative variance explained, Cronbach's Alpha values, Kaiser–Meyer–Olkin (KMO) values, and Bartlett's test of sphericity results. The reliability of data was evaluated through Cronbach's Alpha values. KMO serves as a statistical tool indicating the adequacy of the sample. Additionally, Bartlett's test of sphericity was employed to assess the significance of relationships within the correlation matrix [51,54]. When conducting PCA, it is commonly advised to adhere to specific criteria. These criteria include ensuring that the cumulative variance explained by the components should not be less than 60%. Additionally, the reliability of the data should be established by having a Cronbach's Alpha value exceeding 0.70, and the suitability of the data for PCA should be confirmed with a Kaiser–Meyer–Olkin (KMO) value above 0.60. Further, Bartlett's test of sphericity must yield a statistical significance level below 0.05 [55].

The purpose of the factor analysis in this study was to statistically assess the factors influencing farmers' intention to prefer WRS and to prepare the scales for Two-Step Cluster analysis. Cluster analysis, a commonly used method in contemporary research, aims to categorize a population or objects (e.g., farmers, consumers, or products) within a dataset based on their shared attributes. The resultant clusters are expected to display homogeneity within each cluster while demonstrating heterogeneity between clusters [56]. In cluster analysis, two methods are commonly utilized as hierarchical (agglomerative) and non-hierarchical (divisive). The primary aim of both clustering methodologies is to optimize dissimilarity between clusters while enhancing the similarity within clusters [57,58]. It is noteworthy that the selection of clustering techniques may vary depending on the sample size [59].

In this study, the Two-Step Cluster method was employed as a hybrid clustering technique resulting from the combination of non-hierarchical clustering techniques, specifically "k-Means", and hierarchical techniques, notably "Ward's Minimum Variance". In comparison to classical clustering algorithms, the Two-Step Cluster method found applications across various disciplines due to its ability to provide more informative categories [60,61].

In the analysis of cluster quality or appropriateness, the Silhouette value serves as a crucial metric. This metric is bounded within the range of -1 to +1 and aids in quantifying the distances among the resultant clusters. When the cluster quality value approaches +1, it suggests reduced intra-cluster dissimilarity, indicating well-structured clusters. Conversely, a cluster quality value closer to -1 suggests increased intra-cluster dissimilarity, indicating suboptimal clustering [62].

In the context of the Two-Step Cluster analysis method employed in this study, a model was constructed with the objective of farmers' intention to prefer WRS. For this model, the mean values of each scale (intention, attitude, subjective norms, perceived behavioral control, perceived ease of use, perceived usefulness, perceived cost, innovation openness, and organizational factors) were calculated, and these arithmetic means were employed as input variables. Given that the sample size of 125 farmers was considered sufficient to obtain valid results, a minimum of 100 observations was deemed adequate for partitioning clusters to perform the analysis [56].

4. Results

Explanatory Factor Analysis: According to the results of EFA the explanatory power of the scales ranged from 64.20% (subjective norms) to 92.42% (innovation openness). Further, all Cronbach's Alpha coefficients exceeded the threshold of 0.70, and all Kaiser–Meyer–Olkin (KMO) values were above the 0.60 benchmark. These statistical metrics notably exceed the predefined threshold values. Additionally, all results of Bartlett's test of sphericity yield values below 0.05. Hence, it can be concluded that all the scales under investigation in this study satisfy the criteria for internal consistency and reliability (Table 3).

Table 3. Results of explanatory factor analysis.

Factors	Variance Explained (%)	Cronbach's Alpha Value	KMO Value	Bartlett's Sphericity Test
Intention	88.86	0.955	0.807	$p < 0.05$
Attitude	64.56	0.899	0.800	$p < 0.05$
Subjective norms	64.20	0.839	0.774	$p < 0.05$
Perceived behavioral control	81.04	0.939	0.817	$p < 0.05$
Perceived ease of use	77.37	0.894	0.724	$p < 0.05$
Perceived usefulness	70.76	0.825	0.582	$p < 0.05$
Perceived cost	79.39	0.945	0.712	$p < 0.05$
Innovation openness	92.42	0.956	0.737	$p < 0.05$
Organizational factors	79.99	0.969	0.910	$p < 0.05$

Cluster Analysis: The model summary for the Two-Stage Cluster analysis is illustrated in Figure 2. According to the model, the analysis incorporated nine factors, revealing a cluster count of three. The coefficient for cluster quality was determined to be 0.5, which can be considered acceptable within the context of this analysis.

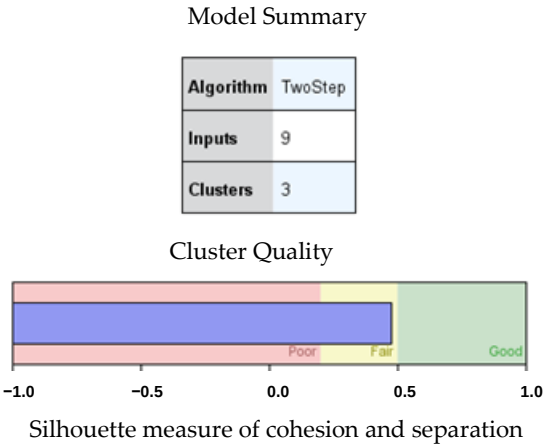

Figure 2. Model summary.

When the cluster sizes derived from the analysis were reviewed, it was found that the smallest cluster (decisive farmers) consisted of 34 farmers, which corresponds to 27.20% of the total farmers. On the other hand, the largest cluster (irresolute farmers) comprised 48 farmers, accounting for 38.40% of the total number of farmers. The final cluster (timid farmers) was composed of 43 farmers, representing 34.40% of the total number of farmers (Figure 3).

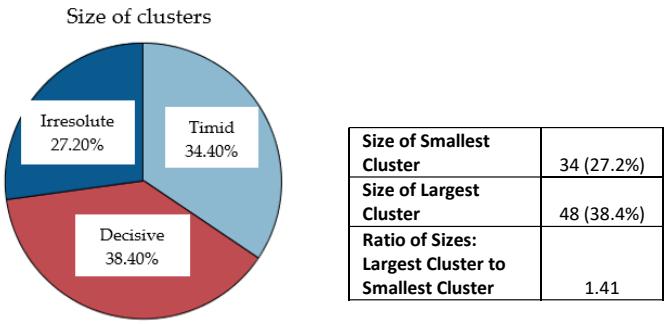

Figure 3. Size of clusters.

The cluster analysis results, considering the averages, are presented in Table 4. According to the findings of the analysis, with a score of 4.67 on the intention scale, de-

cisive farmers demonstrated the highest intention to use WRS in the future. These farmers exhibit a notably positive attitude towards WRS, with an attitude score of 4.07, and concurrently, they were influenced positively by their social environment (subjective norms: 4.29). Additionally, they expressed confidence in possessing the requisite knowledge and skills to effectively use WRS, as indicated by high scores in perceived behavioral control (4.93), perceived ease of use (4.96), and perceived usefulness (4.97). They also perceived the benefits of WRS to be substantial (perceived cost: 4.96).

Table 4. Two-Step Cluster analysis results (mean).

Factors	Timid (Cluster 1) (n = 43)	Irresolute (Cluster 2) (n = 34)	Decisive (Cluster 3) (n = 48)
Intention	3.25	4.21	4.67
Attitude	3.00	3.16	4.07
Subjective norms	3.48	3.84	4.29
Perceived behavioral control	3.21	4.69	4.93
Perceived ease of use	4.99	4.53	4.96
Perceived usefulness	3.99	4.24	4.97
Perceived cost	4.00	4.59	4.96
Innovation openness	5.00	3.69	4.99
Organizational factors	5.00	3.90	4.69

On the contrary, timid farmers represented the segment with the lowest inclination to utilize WRS in the future, as evidenced by their intention score of 3.25. These individuals exhibited a notably diminished positive attitude towards WRS (attitude: 3.00). They received comparatively lower levels of positive influence from their social environment (subjective norms: 3.48) and expressed reservations regarding the adequacy of their knowledge and skills for effectively employing WRS (perceived behavioral control: 3.21; perceived usefulness: 3.99). In addition, farmers within this group believed that the cost associated with using WRS (perceived cost: 4.00) would outweigh its benefits. Despite these predispositions, timid farmers were individuals who perceived the utilization of WRS as straightforward and displayed a willingness to embrace innovation (perceived ease of use: 4.99; innovation openness: 5.00; organizational factors: 5.00).

Concerning the irresolute farmers, the intention to sustain engagement with WRS was consistent between both groups, and they exhibited an average level across all factors.

5. Discussion

The warehouse receipt system in agriculture has become a solid tool to support and improve the agricultural sector. This system can help maintain the quality of products, price stability, and food safety for farmers, intermediates, industrialists, and government organizations. In Turkey, the legislation on regulations on the system (Law No. 5300 on licensed warehouses for agricultural products) was released in 2005. Compared to other countries, the system has just been established, so there is a need to monitor and improve the implications. This study aims to reveal the factors influencing farmers' preferences for adopting WRS and the positions of similarity based on these factors. As a conceptual framework of the study, the Theory of Planned Behavior (TPB), the Technology Acceptance Model (TAM), perceived cost, innovation openness, and organizational factors are integrated.

According to the results of the Two-Step Cluster analysis, farmers are divided into three clusters concerning their intention to use WRS. The clusters showed that decisive farmers, who tended to use the system more, had higher attitudes and positive subjective pressure around them. They also had a higher positive perception of their ability to benefit from the system. Previous studies also confirm the results of the current study that positive attitudes [45,63], subjective norms [29,45,63], and perceived behavioral control [1,2] affect

using intention to adopt the new system in agriculture. Moreover, these farmers perceive higher easiness, higher usefulness, and less cost to use compared to other marketing channels. Other studies also confirm the same tendency concerning perceived ease of use [1,2,64], perceived usefulness [28,64,65], and perceived cost [66–68]. However, our findings about innovation openness [47] and organizational factors [35,69] are not consistent with previous studies. This can be explained by the effect of attitudes, social norms, perceived behavioral control, perceived ease of use, perceived usefulness, and perceived cost. In other words, timid farmers had low intentions, which might result from having a less positive attitude toward WRS, receiving more negative social pressure about the system, and perceiving that their ability to use it is not enough. They also perceive that the system is difficult to use, is less useful, and costs more. These clusters allow for having a better understanding of the farmers' needs to have higher intention to use WRS. The findings suggest that if the timid and irresolute farmers are informed about the benefits and procedure of using the system to create a higher positive attitude and perception, they might possibly prefer to use it more. Further, a better social environment eventually affects farmers positively.

6. Conclusions, Practical Implications, Limitations, and Future Directions

The warehouse receipt system (WRS) has been considered a remarkable tool to stimulate the quality of products, price stability, and food safety, creating strategic stock or credit facilities for the marketing systems in agriculture. This study aims to provide an integrated conceptual framework including TPB, TAM, perceived cost, innovation openness, and organizational factors. Farmers were divided into three clusters regarding these factors. According to the findings, the farmers who are willing to prefer WRS have a higher attitude toward the system. These people receive higher positive social pressure from their families, friends, and governmental organizations. Farmers in this group also believe that they have a higher ability to benefit from this system. Moreover, these farmers perceive that the system is easier to use, is more useful, and costs less compared to other marketing channels.

This study has some limitations. Firstly, the data were collected from the province where the capacity of WRS and the number of WRS users were the highest. Even though the study area makes great contributions to the system, this may result in a bias in the findings. While the data are representative of Turkey, future studies can be conducted in different provinces or regions to increase representativeness and enable comparisons. Secondly, the data for this study are based on farmers' self-assessments. It should be noted that this method of data collection may introduce bias, a concern commonly discussed in self-assessment studies. Thirdly, when compared to the global scale, WRS in Turkey is still a relatively nascent system, and it can be argued that some farmers may not yet possess the knowledge to provide assessments about the system. Therefore, this study collected data only from individuals who had previously benefited from WRS. Future research may collect data from both groups. This study focused on grouping farmers concerning their attitudes and perceptions toward WRS by using cluster analysis. Further research may add demographic or operational characteristics to the model. Also, structural equational modeling may be conducted to reveal relationships among the variables.

This study contributes to the literature in terms of the conceptual framework employed. This integrated model has been used for the first time to have a better understanding of farmers' behavior toward WRS. This study is believed to provide benefits to intermediaries, industries, and decision-makers by assisting them in directing farmers toward WRS and supplying the necessary resources for supporting farmers. Furthermore, it is believed to aid decision-makers in developing action plans and fostering a more favorable attitude among farmers towards WRS.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

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Conflicts of Interest: The authors declare no conflict of interest.

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