

E-Trading Application for Rice Farmers Using Waterfall Model Development: Basis for ICT Adoption by Filipino Farmers

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Abstract: The study focused on evaluating the developed E-Trading Application for Rice Farmers in the Province of Oriental Mindoro, which aimed to improve the quality of selling the products in the market. The evaluation was based on ISO 25010 in determining the performance of the E-Trading Application for Rice Farmers in the Province of Oriental Mindoro, using the five (5) criteria, which are functional suitability, performance efficiency, usability, reliability, and security. The development phase used the developed E-Trading Application for Rice Farmers in the Province of Oriental Mindoro. The Waterfall Software Development Life Cycle Model involves gathering requirements, analysis, design, code, test, and user acceptance. The respondents evaluated the performance of the E-Trading Application for Rice Farmers as Effective. The results, using a t-test, showed that there is no significant difference between the evaluation of the rice farmers and IT practitioners in the performance of the E-Trading Application for Rice Farmers. The E-Trading Application for Rice Farmers was developed using the different stages in the Waterfall methodology. No significant difference exists in the evaluation between the rice farmers and IT practitioners on the developed E-trading Application as to functional suitability, performance efficiency, usability, reliability, and security. The E-Trading Application was recommended to the entire region of MIMAROPA for implementation to cater to more farmers and consider the respondents' suggestions to further improve the application.

Keywords: e-trading, rice farmers, ICT adoption, quality of selling products.

INTRODUCTION

The Philippines lacks an accessible online agriculture information system like rice. One of the leading causes of farmers' distress is ignorance and lack of benefit from government agricultural projects. In the Philippines, where agriculture is vital to economic growth and feeding growing people, an Opportunistic Conceptual Framework occurs in most less-developed nations due to a lack of or insufficient knowledge on the extent and quantity of traded commodities and their pricing. The conceptual framework's significant concepts determine an objective's approach. Enter dealers and cash lenders. The input phase establishes the process's components, including a licensed Operating System and a Database. This covers knowledge, hardware, and software needs. Processor, RAM, and disk space are required for the created system to run well. Agricultural commodity and input markets, hence small farmers' involvement in these markets, suffer from a lack of knowledge. Smallholder farmers make up the bulk of farmers in Benin. They also have a slight surplus and are geographically spread. Market access is one of the most critical elements affecting the success of smallholder agriculture in developing and least developed nations. Online consumer

shopping, according to Singh (2019). Travel services, apparel, gadgets, books, music and video, health and beauty, home and garden, flowers and presents, sports and fitness equipment, and toys are all purchased online. The internet allows e-marketers to target a wide variety of demographics.

Develop an E-trading app for rice producers. Despite the Philippines being a primarily agricultural nation, smallholder farmers are among the country's poorest. Smallholders confront similar challenges such as lack of finance, inputs, pests, diseases, post-harvest facilities, and poor product prices. Mysql is a management system. Following the data collection phase, the E-Trading Application for Rice Farmers Using Waterfall Model Development: Basis for ICT Adoption by Filipino Farmers is evaluated using a survey questionnaire based on ISO 25010 and administered to determine the proposed system's performance, analysis, and interpretation of data. Because agriculture plays a vital role in the development of the economy in Oriental Mindoro, some problems are still associated with agriculture production. The farmer's attitude towards Selling crops, little did they know about new technology modern farming online trading. Most farmers are still stuck in their old ways due to the crude selling of Agricultural

products in farming. Cultural consciousness had made some farmers willing object to the use of farming trading techniques because of some cultural belief that if the modern system is applied, this will lead to low productivity for income. Matveev claims M. (2021).

Stated It is suggested to formalize supply and demand as language variables. A membership function building algorithm based on individual customer desire is presented. A second investigation verifies the usage of formalized generalized demand to attain good offer choice. The study is one of the few to identify and prioritize wholesale electronic trading platform adoption determinants in agriculture marketing. Supracharya, S., et al. (2021). The study reviewed academic papers in two rounds and generated a prediction function between identified predictors and adoption. This study aims to rank the elements impacting e-Trading in Indian agriculture. The rating system is a first in agricultural e-trading. Trust, Cost, Perceived Ease of Use, and Facilitating Conditions are the top factors. E-Trading Application for Rice Farmers Using Waterfall Model Development: Basis for ICT Adoption by Filipino Farmers.

METHODOLOGY

In this study, the researcher used developmental research and descriptive research methods. Developmental research is the study of developing, designing, and evaluating instructional processes, programs, and products. This type has a set of criteria that also meets internal effectiveness and consistency. To gather the data needed for this research, a survey was conducted through sets of questions, and at the same time, an observation was conducted to help the researcher identify the extent of ICT usage in the farming business. The researcher believes that these methods were appropriate to the present study since descriptive research is a process of collecting data needed for the study and considering that the program and functions of the developed system are identified and described. Paller-Calmorin et al., (2007), stated that descriptive research design focuses on the present condition and the current terms presented. The purpose is to find new truths that may have different forms, such as the increased quantity of knowledge, increased insight into operating factors, the discovery of a new causal relationship, and a more accurate formulation of the problem. The population for this research includes the rice farmers and IT personnel in Oriental Mindoro. A total of three-hundred seventy (370) respondents composed of, Three-hundred fifty-five (355) farmers and fifteen (15) IT practitioners evaluated the E-Trading Application for Rice Farmers Using Waterfall Model Development: Basis for ICT Adoption by Filipino Farmers. Purposive sampling was used in the conduct of the study since the researcher focused on the rice farmers in the Province of Mindoro. Purposive sampling is a non-probability sampling where the participants are selected based on the characteristics of a population and the study's objective. Purposive sampling is also known as judgmental, selective, or subjective sampling. This type of sampling can be beneficial when you need to reach a targeted sample quickly and where sampling for proportionality is not the primary concern.

The study respondents consisted of rice farmers and IT practitioners from the 2nd district of Oriental Mindoro, particularly in Band. The two types of respondents evaluated the performance of the developed E-Trading Application for Rice Farmers Using

Waterfall Model Development: Basis for ICT Adoption by Filipino Farmers. in terms of the criteria set in the ISO 25010. The researcher used two sets of instruments in gathering the necessary data. These are composed of an adapted questionnaire checklist based on ISO 25010 and an interview guide questionnaire. The researcher used the adapted questionnaire checklist based on ISO 25010 to evaluate the developed E-Trading Application for Rice Farmers Using Waterfall Model Development: Basis for ICT Adoption by Filipino Farmers. They used the five criteria as functional suitability, usability, reliability, and security. An interview guide questionnaire was also used to determine the challenges encountered by the respondents during the evaluation and other comments and suggestions for the improvement of the system.

For the interpretation of data, a four-point scale was used with the verbal interpretation shown below:

Table 1: Scale and interpretation

Scale	Rating	Verbal Interpretation
3.50 – 4.00	4	Very Effective
2.50 – 3.49	3	Effective
1.50 – 2.49	2	Moderately Effective
1.00 – 1.49	1	Not Effective

Initially, the researcher requested the approval of the Dean of the Graduate School to conduct the study. Next, the gathering of relevant information from different data sources about the study. The data were gathered from the respondents, such as the rice farmers of the Province of Oriental Mindoro and the IT practitioners who evaluated the developed E-Trading Application for Rice Farmers Using Waterfall Model Development: Basis for ICT Adoption by Filipino Farmers. Regular consultations with the researcher's adviser and authorities in the Province of Mindoro were sought to enhance and complete the system. The researcher pursued the data gathering after the permission to conduct the study. By collecting the data, such as selling and buying the product of another rice crop, the researcher conducted unstructured interviews with the different offices and departments of Agriculture. The adapted, modified questionnaire checklist was validated. Prior to that, the researcher was given access to the participants to evaluate the developed E-Trading Application for Rice Farmers. The questionnaire checklist was personally distributed to the respondents by the researcher himself. The respondents were also briefed on how to fill up the said instrument. The questionnaires were then collected, and the responses were tallied and tabulated. Lastly, the data were subjected to statistical treatment for analysis and interpretation to develop sound conclusions and recommendations.

To find answers to the research questions, the following statistical tools were used:

1. Weighted Mean was used to determine the respondents' assessment of the performance of the developed E-Trading application.

Formula
$$Wx = \frac{Tw}{Tr}$$

Where: Wx – weighted mean
Tw – total weight
Tr – total respondents

2. **T-test** was used to test if there are significant differences between the two means as reflected in the weighted means generated by the responses of the rice farmers and IT practitioners.

Formula:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S_{\bar{x}_1 - \bar{x}_2}}$$

where: $\bar{x}_1$ = the sample mean for group 1
 $\bar{x}_2$ = the sample mean for group 2
 $S_{\bar{x}_1 - \bar{x}_2}$ = the estimated standard error of the difference in the means

RESULTS AND DISCUSSIONS

E-Trading Application for Rice Farmers Using Waterfall Model Development: Basis for ICT Adoption by Filipino Farmers. The data gathered are presented in textual and tabular forms with statistical treatment for the analyses and interpretation purposes. The presentation of data is sequenced according to the order of statement of the problem in Chapter 1. This chapter presents the results, analyses, and interpretation of data. Stages Undertaken in the Development of E-Trading Application for Rice Farmers Using Waterfall Model Development: Basis for ICT Adoption by Filipino Farmers Waterfall software development methodology is a process for developing a software model which illustrates the software development process in a linear sequential flow. In the waterfall model, typically, the outcome of one-stage acts as the input for the next stage. This means that any stage in the development process begins only if the previous stage is completed.

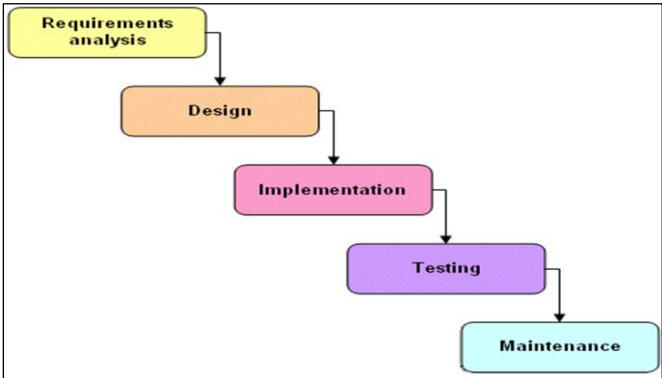


Figure 1. The waterfall Methodology in System Development

The researcher collected and examined the needs of rice farmers in Oriental Mindoro. The researcher also defined the database needs and functional requirements. The researcher first designed the system, then built it. The design was coded using PHP and MySQL. After the Application was created, the system was tested. The last step is User Acceptance, the final test to validate beneficiary increment.

The respondents' evaluation of the E-Trading Application for Rice Farmers Using Waterfall Model Development: Basis for ICT Adoption by Filipino Farmers using the criteria based on ISO 25010 was based on an assessment of the Application's ability to comply with international standards.

Table 1 summarizes the weighted means of the five (5) criteria evaluated by the rice farmers and IT practitioners.

Table 1
Summary of the Respondents' Evaluation on the Performance of the E-Trading Application for Rice Farmers Using Waterfall Model Development: Basis for ICT Adoption by Filipino Farmers

CRITERIA	Rice Farmers		IT Practitioners		Over-all mean	
	WM	VI	WM	VI	WM	VI
Functional Suitability	3.57	VE	3.45	E	3.51	VE
Performance Efficiency	3.59	VE	3.47	E	3.53	VE
Usability	3.60	VE	3.38	E	3.49	E
Reliability	3.54	VE	3.42	E	3.48	E
Security	3.58	VE	3.60	VE	3.59	VE
Over-all Mean	3.58	VE	3.47	E	3.52	VE

The table further shows that the IT practitioners rated the E-Trading Application for Rice Farmers Using Waterfall Model Development: Basis for ICT Adoption by Filipino Farmers. This is probably attributed to the fact that IT practitioners are more particular with the quality of the system in terms of its technical aspects and characteristics. However, an overall weighted mean of 3.54 showed that the system was Very Effective. Challenges Encountered on the Use of the Developed E-Trading Application for Rice Farmers Table 3 shows the challenges Encountered by the respondents in using the E-Trading Application for Rice Farmers.

Table 2
T-Test Results of the Difference in the

Criteria	Type of Group	Mean	Computed Value	Tabulated Value	Interpretation at 0.05	Decision
Functional Suitability	Rice farmers	3.57	1.01	3.182	Not Significant	Accept H_0
	IT practitioners	3.45				
Performance Efficiency	Rice farmers	3.59	0.91	3.182	Not Significant	Accept H_0
	IT practitioners	3.47				
Usability	Rice farmers	3.60	2.21	3.182	Not Significant	Accept H_0
	IT practitioners	3.38				
Reliability	Rice farmers	3.54	1.16	3.182	Not Significant	Accept H_0
	IT practitioners	3.42				
Security	Rice farmers	3.58	1.12	3.182	Not Significant	Accept H_0
	IT practitioners	3.60				

Assessment of the Respondents on the Developed E-Trading Application for Rice Farmers

Using a t-test, the results show no significant differences between the evaluation of the rice farmers and IT practitioners on the developed E-Trading Application for Rice Farmers. The computed values are less than the tabulated values, confirming that the null hypothesis is accepted. Since the evaluation result proved to be Very Effective, it can be concluded that the developed Application will be very helpful or helpful for the rice farming community.

Table 3

E-Trading Application for Rice Farmers Using Waterfall Model Development: Basis for ICT Adoption by Filipino Farmers

Challenges Encountered	IT Practitioners	Rice Farmers
Different confidentiality settings for groups and individuals	0	2
Error Identification	5	0
Processing time is slow	2	0
Limited layout control	3	5

Based on the interview results, five (5) IT practitioners stated that *"The system has a limited layout control."* On the other hand, three (3) IT Practitioners revealed that *"The system lacks efficient and flexible customization possibilities."* Moreover, two (2) IT practitioners said that *"The system's processing time is slow."*

Conversely, during interviews with the rice farmers, 5 or 34 percent said that the system has *"Limited Layout Control."* 2 or 14 percent stated that *"The system has a slow process."* The E-Trading Application for Rice Farmers Using Waterfall Model Development: Basis for ICT Adoption by Filipino Farmers developed by the researcher is a software-based platform that provides infrastructure, framework, and tools to facilitate an online Trading System for Rice Farmers. E-Trading presents many advantages to the farmers as it manages several aspects of the Trading system process and provides essential services to host and deliver the selling product. However, despite the many good intentions of the researcher, E-Trading was also found to have disadvantages, as seen by the respondents. The respondents said that the E-Trading Application has a limited layout control, lacks efficient and flexible customization possibilities, the processing time is slow, and it is difficult to get used to it due to the complex system.

Recommendations of the Respondents in the Use of E-Trading Application for Rice Farmers Using Waterfall Model Development: Basis for ICT Adoption by Filipino Farmers The IT practitioners recommended that in order for the E-trading application to maximize its usage, a modification of the payment mode from cash basis to online payment be considered and studied; and deploy the e-trading application to the rice farmers to determine the extent of its implementation, as well as its limitations, for further enhancements, to serve its fundamental purpose. However, almost 90% of the rice farmers requested training on using the Application. Moreover, if the aforementioned e-trading application is approved for full implementation, assistance from the researcher and designated IT, students, to be available when needed, in an interview with an NFA personnel, he mentioned the roles of the Enforcement Officers. He assigned Monitoring Teams who regularly visit the markets to ensure that rice products are sold correctly. Thus, the developed E-Trading Application can also be a measure to encourage the public to help the government be informed of those individuals who are not selling their products at the correct prices. When the Application was presented to a National Food Authority official/supervisor, the said supervisor was happy to comment that the E-Trading Application will help the rice farmers cultivate and become entrepreneurs. Generally, this E-Trading Application "will be of great help to the Province of Oriental Mindoro and the whole country, as well." she quoted.

Conclusion

Based on the study's findings, the following conclusions are drawn: The E-Trading Application for Rice Farmers was developed using the different stages in Waterfall methodology. The respondents evaluated the performance of the E-Trading Application for Rice Farmers as Very Effective using the criteria based on ISO 25010 as to functional suitability, performance efficiency, usability, reliability, and security. No significant difference exists in the evaluation between the rice farmers and IT practitioners on the developed E-Trading Application for Rice Farmers as to functional suitability, performance efficiency, usability, reliability, and security. The two groups of respondents stated the challenges they encountered in using the E-Trading Application for Rice Farmers. The two groups of respondents proposed recommendations on using the E-Trading Application for Rice Farmers to improve the system. The researcher developed a

Recommendations

Based on the findings and conclusions of the study, the following recommendations are forwarded. The entire region of MIMAROPA may consider the implementation of the use of the E-Trading Application to cater to more rice farmers. The identified challenges by the respondents may be considered to improve further the performance of the E-Trading Application for Rice Farmer in areas of functional suitability, performance efficiency, usability, reliability, and security. The observations and suggestions forwarded by the respondents may be reviewed and incorporated in the stages involved using the waterfall model to improve the E-Trading Application for Rice Farmers in terms of payment mode online for easy and fast transactions. Strategies may be developed to address the recommendations forwarded on using the E-Trading Application for Rice Farmers to improve the system. Future research may be conducted to improve the developed E-Trading Application for Rice Farmers to be used by the rice farmers covering all transactions in selling different rice varieties.

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