Effect of App utilization on the agricultural efficiency of rural communities

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Abstract. Agricultural efficiency is a key contributor to agricultural productivity growth and the efficient allocation of resources in the economy. Studies in agricultural efficiency literature have focused on determining if farmers have been using resources more efficiently by applying the best technological and managerial practices from existing stock of knowledge. Meanwhile, the calculation of Agricultural efficiency is rather complicated and not easy for common people. The paper describes how to design and build a mobile-based app for farmers who would exhaustively help them in the calculation of agricultural efficiency and then studies the effect on rural communities. The aim of study are: 1) To design and develop an android app which can analyze agricultural efficiency; 2) Analyzing the results of trials and evaluating the android app that has been made to horticultural farming on rural communities. The method to build this mobile app is prototyping consist of 4 steps: 1) to identify the user’s basic requirements; 2) to develop an initial prototype; 3) to use the prototype; 4) to revise and enhance the prototype. The app is socialized and used on rural communities. The conclusion are: the efficiency app can be one of the solutions to facilitate policy-making in farming activities, and make forecasting profit of farming; android app is proven to produce an agricultural app program that is mobile and has an attractive interface; the loss in agricultural field can be avoided; the app helps farmers to determine the fixed and variable cost of farming.

1. Introduction

One of the important issues facing agriculture is cost reduction. But keeping the use of resources such as agricultural chemicals and fertilizers to a minimum, and operating agricultural machinery efficiently will not only improve cost competitiveness, it will also help reduce the burden on the environment. In developing countries, efficiency augmentation in the farm sector is imperative for overall economic development [1].

Agricultural efficiency is a key contributor to agricultural productivity growth and the efficient allocation of resources in the economy. Studies in the agricultural efficiency literature have focused on determining if farmers have been using resources more efficiently by applying best technological and
managerial practices from the existing stock of knowledge (technical efficiency)[2][3]. Technical efficiency can be measured by using an input-based method or output-based method. The input-based method identifies technical efficiency as a proportional reduction in the quantity of input use without causing a change in the quantity of output [4]. The low efficiency is related to the use of capital (energy, fixed capital, plant protection, insecticides, and pesticides), the existence of numerous workforce used in agriculture and a large number of farms which mostly practice subsistence agriculture [5].

However, the calculation of Agricultural efficiency is complicated and not easy for common people, especially farmers. But technology can make it easy. The paper describes how to design and build a mobile-based app for farmers who would exhaustively help them in the calculation of agricultural efficiency. The research is aimed to design an automatic calculation system with the Android platform, and then we studied the effect of the app mobile to the farming of the farmers. Therefore, the specific objective of the research is (1) to design and develop an android app which can analyze agricultural efficiency (2) to analyze the results of trials and evaluating the android app that has been made to horticultural farmers.

2. Methods
The research was conducted in Kapontori Subdistrict of Buton Regency as a field of data collection and Computer Laboratory of Universitas Muhammadiyah Buton as a place of making an android app. The app is developed by Android Studio [6]. The method of the mobile app is built by prototyping. The steps in prototyping is showed in Figure 1.

![Figure 1. Steps in prototyping [7]](image)

Figure 1 shows a four-step model of the prototyping process, which consists of the following: the first step is identifying the user’s basic requirements. The system designer works with the user only long enough to capture the user’s basic information needs. The second step is developing an initial prototype. The system designer creates a working prototype quickly, using tools for rapidly generating software. The next step is using the prototype. The user is encouraged to work with the system to determine how well the prototype meets his or her needs and to make suggestions for improving the prototype. And the last step is revising the prototype. The system builder notes all changes the user requests and refines the prototype accordingly. After the prototype has been revised, the cycle returns
to Step 3. Steps 3 and 4 are repeated until the user is satisfied. When no more iterations are required, the approved prototype then becomes an operational prototype that furnishes the final specifications for the app [7].

The efficiency calculation in-app uses the technical efficiency and allocative efficiency algorithm [8]. The final calculation shows the forecasting the cost to develop farming and the suggesting to farmers how to manage their cost [9].

3. Results and Discussion

It is important to note that farmers and other people who are non-experts find it difficult to know how to make the cost of their farms more efficiency. The non-experts are dependent on experts for the right information about it. The proposed agricultural app has been developed to provide a solution on how to calculate an efficiency value in farming, so they can know where parts of their farming must be reduced or increase to get more efficiency. Besides that, the expert can know the efficiency value of farm easier; he does not need a heavy device like a laptop, just using a smartphone.

The app is used by users to collect and input farming profile data, farmer profile data, seed cost data, fertilizer cost data, pesticide cost data, labor cost data, tax cost data, and cost depreciation data. From all these data the system will process and display the recapitulation data of cost, income, R / C ratio, Cobb Douglas equation, and farm efficiency value. All these inputs and processed data can then be exported by the user into the excel file format (*.xlsx) so that the data can be shared out of the Android device by the user. The proposed agricultural app is an android app. The app allows farmers, farming extensions, and other farming experts to get all the information regarding the agricultural efficiency calculation. Figure 2 and figure 3 showed the interfaces of agricultural efficiency app.

![Figure 2. (a) Screen of recapitulation of farm costs; (b) Farm income Screen](image-url)
User feedback retrieval is done using usability testing. The user directly performs testing on the app without being tested. User feedback retrieval is based on five scales [10]. The result showed in table 1.

| Scales (the assessed of the app) | Response                                                                 |
|----------------------------------|--------------------------------------------------------------------------|
| App Design                       | Easy to use, informative, use signifiers correctly and attractive         |
| Reliability                      | Keep personal information security, and the calculation is appropriate.  |
| Responsiveness                   | Response time is short                                                   |
| Trust                            | The information is always true because of app calculation itself.        |
| Personalization                  | Easy to use and understand                                               |

Testing was done by 20 respondents who have tried the app. Respondents are 10 farmers, 3 extension workers, and 7 students of agriculture faculty of Universitas Muhammadiyah Buton. Based on testing of mobile app functionality and user feedback that has been done, the results obtained are as follows: (1) All functions tested on the system work properly. Each input data entered can be received well, and successfully provide the expected output; (2) System inputting, data processing and calculation results that have been made to run well according to the expectations of authors and users; (3) Android apps that have been created have an attractive and easy to understand by the users.

After they used the app in two weeks in their farming, the effects of using the app for farmer are good; almost respondents like to use the app because of easy to use and informative. And the loss of agriculture field can be avoided. The interesting result is when we ask them to pay for using or the app displays ads. None of them choose paying the app; they do not care if the app display ads. Also, they want facilities to customize the skin of the app because of some of them unlike the skin of the app.
Some of the farmers are confused with the use of the app. So, to increase the success of using this app, it is necessary to educate the farmers. Farmers’ education is quantitatively important in determining the agricultural performance [11]. The result may perhaps enable farmers to take full advantage of the app and attain the best possible level of efficiency in farm production. However, for app project to continue effectively and sustainably, there are several challenges to overcome, including the uncertainty over its long-term financial support, the lack of appropriate human resources and the lack of a balanced representation of all the stakeholders at various decision-making levels. During the app project, financial insecurity interfered with the timely implementation of activities and limited the engagement of non-agriculture-related stakeholders [12].

4. Conclusion
Some principal findings are: 1) the efficiency app can be one solution to facilitate policy-making in farming activities, and make forecasting profit of farming; 2) Android app is proven to produce an agricultural app program that is mobile and has an attractive interface; 3) the app helps farmers to determine the fixed and variable cost of farming; 4) the loss in agricultural field can be avoided. Therefore, the app can help farmers to forecast farming cost if they want to develop their farming. The important thing in this paper, the cost for developing and maintenance app can be gotten from ads in the app. We recommended the government should place prime importance on the adoption of new technologies and facilitating the farmers to have sound acquaintance with the advanced technologies in advance adoption of new technologies. This can be accomplished by organizing technology-related programs for the farmers.

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