

Mobile phones for enhancing performance of agribusiness management and empowering farmers in Indonesia

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Abstract

Vegetables provide a good chance for agribusiness in Indonesia. This paper analyses the roles of mobile phones in agribusiness management based on vegetable production. As vegetable-intensive vegetable farming is a risky business, being a risk averter is one of the serious factors for the success of agribusiness. The potential risk is exaggerated with evidence that vegetable products are perishable, which is directly associated with post-harvest handlings. Farmers as the main players involve information accessed using mobile phones for planning agribusiness. This study selected farmers as the subject of agribusiness based on intensive vegetable farming. This study collected field data available at the agricultural institution in 2022 and applied structural equation modeling (SEM) to recognize the effects of multiple dependent variables in simultaneous regressions. The analysis shows that mobile phones served some significant roles in agribusiness management. It increased agribusiness's profit by mediating sales, volume, and price of vegetables. The mobile phones empowered the farmers because they could acquire market information, credit and customers and improve agronomic technology. Despite available and affordable mobile phones, the adoption in agribusiness activities was far below the expected level. The farmers need encouragement to use the device. The training targeted explicitly on the use of mobile phones is one of the best alternatives to familiarise farmers with mobile phones.

Keywords: vegetable agribusiness, information and communication technology, structural equation modelling, sales and profit.

1. Introduction

Vegetable sector plays an important role in the bio-economy of Indonesia. Indonesia gained US\$17.15 million from seasonal vegetables. However, Indonesia also imports several vegetables. The balance of payment was still deficit, which indicated that the monetary value of imported vegetables exceeds the exported ones. The deficit doubled that value of export in 2015 [1]. Along with economic benefits, vegetables also provide health benefits since they provide nutritious diets [2,3].

Overall, chili dominates the land cultivated to vegetables as well as the production. Figure 1 shows the dynamics of top-five vegetables in Indonesia during the last three year. In agribusiness, timely decision making on preparing land, planting crops, irrigating field, weeding, spraying pesticides, harvesting products, storing harvests, and sending to market become central agribusiness management. Information and communication technology especially mobile phones can accelerate the actions were farmers in remote areas exchange and analyses essential information.

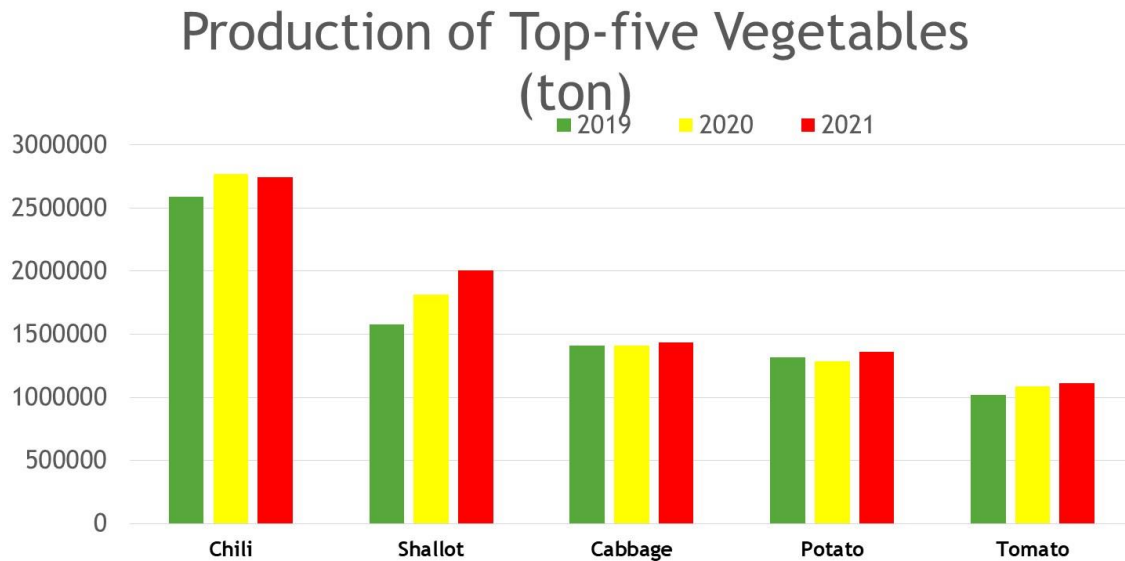


Figure 1. Current trend of top-five vegetables in Indonesia

The phones enable farmers interact with markets in urban communities. Innovations that incorporate the information and communication technology (ICT) into the broadcasting of agricultural data to farmers have established at local, regional and national levels. The ICT is increasingly empowering farmers to concentrate, seek and separate useful and updated information related to market and technology. There is a potential of upgrading old rural farming problem by encouraging among farming communities. This study arises goals by analysing the potential roles of mobile phones and the contributions to Indonesian agricultural-rural development continuum. This study specifically analyses the usage of mobile phones in agribusiness management, and assess its impact on agribusiness performance.

2. Research Methodology

The fundamental concept of this study is a hypothesis that an introduction of mobile-phone, as a part of hand phone, can potentially affect business performance. In this case, the usage of hand phone indirectly affect profit through mediation of sales and price of the products. Following a concept of supply response, the volume of sales is affected by the price of product. Simultaneously, the use of hand phone is dependent on the producers' human capital, which characterized by age, education, experience and training. This concept is formulated in a multi-path analysis, commonly called a model of multiple simultaneous equations. Structural equation modelling is used to estimate the model. Variables in this study are defined and measured in Table 1.

Table 1. Definition, measurement, and summary of selected variables

Variables	Explanation	Unit
Endogenous variables:		
Mobile phone	Mobile phones applied in agribusiness management	dummy: 1=yes; 0=no
Price	Current prices of vegetables apparent to farmers	dummy 1= low; 3=high
Sales	Percentage vegetables sold for commercial to total harvest	percentage
Profit	Income gained from farming of one hectare basis	million IDR
Exogenous variables:		
Age	Age of farmer	year
Education	Formal education gained by farmer	year
Experience	Experience on vegetable farming system	year
Training	Agricultural training program participation	dummy: 1=yes; 0=no

Source: field surveys

The proposed model is expressed in Figure 2.

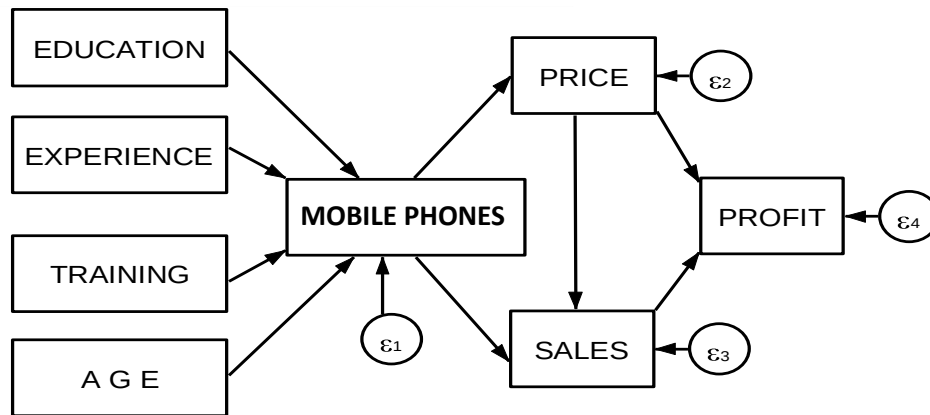


Figure 2. Proposed model of analysis

The null hypothesis is proposed that every path has no statistical effect on the matching variables. Alternatively, at least one path is hypothesized to be statistically affects the respective variables. At least 90% confidence interval applied to hypothesis tests. The model was estimated using STATA ver. 13. The results were presented in standardized form such that the impact of each factor is comparable to others.

This study is based on a complied cross-section data set from a series of field surveys at farm household level in the major vegetable-producing regions of Indonesia. The surveys were guided using a structured questionnaire. The samples of farmers were selected using a purposive stratified random sampling method. The data were provided by Assessment Institute for Agricultural Technology of the Ministry of Agriculture, set in 2022.

This study considered that SEM is more suitable than other usual approaches because SEM is able to diminish bias and multicollinearity issues [4]. This tool executes multiple endogenous variables and very powerful multivariate technique and enables scientists to quantify indirect, direct and total effects of variables on other ones in just one step [5].

3. Result and discussion

The result of estimation is presented in Figure 3. All paths are statistically significant except the path of price to profit. The R-squared is 0.85, and χ^2 is 1850.64 which is very significant. The usage of hand phone in agribusiness was significantly affected by farmers' characteristics. The older ones were less likely to use hand phone. It is logical that older players faced a difficulty of a modern device like mobile-phone. Skill, education and training resulted in positive effect on the use mobile phones. This means that advanced human capital makes acceptance to advanced technology as well as mobile phones. There is the same case in some Africa such as Kenya where farmer youths get more exposed to advanced technology and they are more prospective to make calls directly buyers using phones or they browse the websites to find new markets or to comprehend the current market information. As well, education makes farmers become more probable to use ICT [6]. Similar to the case in Ethiopia, educated young household heads have higher probability of possessing hand phones than uneducated old household heads [7].

The sales of agribusiness were positively steered by the hand phone usage and prices gained by the producers. Theoretically, this specific finding is understandable and logical. The mobile phones brought about high sales as the farmers could take many actions to increase the production and sales eventually by utilizing mobile phones. The producers potentially access modern agronomic technologies leading to a high performance of chili cultivation. This study also shows that the usage of hand phone directly and indirectly improves sales via mediation of price. High price has led to high sales matches supply theory. The producers made responses to the high prices by increasing production level. Profit generated from agribusiness was only significantly determined by sales of vegetables. The finding suggests that high sales led to high profit.

This occurrence is economically understandable. The price did not directly generate contributions to the profit, but it indirectly gave an impact on profit through sales.

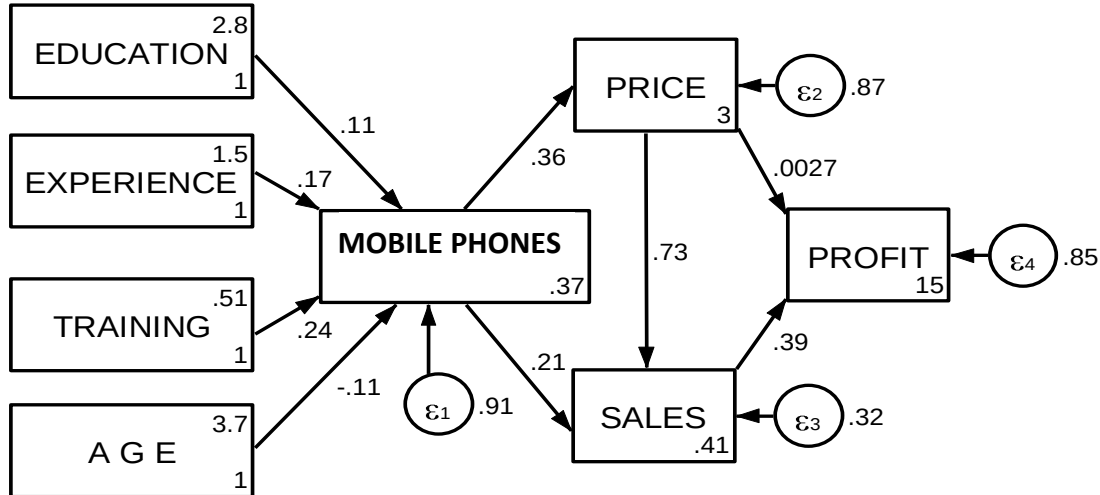


Figure 3. Estimated result of analysis

Some studies correspond to this finding, where the use of mobile phones can potentially give an effect on households' wealth, their agricultural outcomes and happiness in many circumstances [8,9,10]. Firstly, mobile phones could reduce potential farmers' search costs, thus obtain price information in many markets and send the products to the markets with the best prices and cut the transport costs. Secondly, in the absenteeism of marketing in different places, better-quality access to information could improve potentially farmer bargaining power against buyers, so allowing negotiation for a high price. Thirdly, mobile phones enable potentially farmers to accomplish a sale, and this reduce uncertainty and risks associated distant market. Lastly, should information technology upsurge the prices that farmers receive, and elastic prices of agricultural production, this conditions potentially increase the production in the future for long run operation.

Vegetable-based agribusiness has been able generated profit through farm management. Based on a study of the profit per hectare basis of eggplant, chili, tomato and yard-long bean was superior to those of other cereal crops [11]. Big chili and eggplant contributed an almost identical portion of profit, which accounted for around 45%. This means that both vegetables were relatively superior compared to other vegetable crops. Yard-long bean had the most inferior in terms of net return, which accounted for 15%. Tomato and small chili gave similar portion of profit, which accounted for about 30%. Note that the main component of material input was agrochemicals that have been introduced a long time ago in the era of the Green Revolution. Currently, the application of agrochemicals needs wise decisions because it can potentially lead to health and environmental problem. Introduction improved technology can reduce the use of agrochemicals without reducing the production [12]. It is also important that market infrastructures and credit facilities should be provided to encourage farmers engage agribusiness, based on vegetable farming [13].

4. Conclusion and policy implications

This study shows that the ability of agribusiness players can improve the business performance by utilizing hand phone. The agribusiness performance increased because of better price and higher sales of product compared to those who did not use hand phone. Furthermore, the high price received by the producers led to high sales. This is consistent to the law of supply stating that producers will respond high price by increasing production to sell. By utilizing hand phone, the producers can potentially access agronomic technology, networks, markets and institutions necessary to improve production. The eventual impact of hand phone usage was high profit. In this case, the increase in profit is considered indirect impact through the mediations of price and sales.

Policy implications are drawn for up-scaling and making it more affordable for the end users. Strengthen producers' capacities to undertake sustainable rural transformation processes by accessing all useful market information and agronomy through hand phone innovations in agricultural research and development in developing countries. Increase access to mobile phones for producers and strengthen the knowledge and leverage the use of mobile phones will support agribusiness productivity in Indonesia, and other developing countries in general.

With the growing importance of information technology for agribusiness, the government through the ministry of agriculture carries out policies in the use of information technology to improve the results of agriculture and the welfare of farmers. One of its policies is that the agricultural department in cooperation with private sectors needs to provide agricultural commodity price information services that can be accessed via cellular phone in the form of content. Through this cooperation, farmers can obtain information more quickly and easily and get content that is useful for agriculture.

AUTHORS' CONTRIBUTIONS

Joko Mariyono contributed to the paper in terms of preparing manuscript, data analysis and interpretation, final check and submission. Kadhung Prayoga, Agus Subhan Prasetyo, Wulan Sumekar, and Siwi Gayatri provided significant contributions to this paper in terms of discussions on the analysis, socio-economic and technical aspects as well as policy implications.

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