Buletin Peternakan 48 (2): 153-161, May 2024

ISSTAP
Indonesian Society for Sustainable Tropical Animal Production

Bulletin of Animal Science

ISSN-0126-4400/E-ISSN-2407-876X Accredited: 230/E/KPT/2022
http://buletinpeternakan.fapet.ugm.ac.id/

Doi: 10.21059/buletinpeternak.v48i2.92075

Technological Acceptance of Cattle Farmers in Mobile Applications for Livestock Digital Marketing

Agung Triatmojo[1,2*], Nguyen Hoang Qui[3], Yasser Basstawy El Sayed[4], Mujtahidah Anggriani Ummul Muzayyanah[1], Suci Paramitasari Syahlani[1], and Budi Guntoro[1]

[1]Department of Livestock Socio-economics, Faculty of Animal Science, Universitas Gadjah Mada, Yogyakarta, 55281, Indonesia
[2]Faculty of Agricultural, Environmental, and Food Sciences, Free University of Bozen-Bolzano, Bolzano, 39100, Italy
[3]Department of Animal Science and Veterinary Medicine, School of Agriculture and Aquaculture, Tra Vinh University, Tra Vinh, 87000, Vietnam
[4]Faculty of Economics and Management, Free University of Bozen-Bolzano, Bolzano, 39100, Italy

Article history
Submitted: 17 December 2023
Accepted: 14 March 2024

* Corresponding author:
E-mail: agungtriatmojo@ugm.ac.id

ABSTRACT

The farmers have encountered challenges in conducting livestock trade due to the absence of dealer activity caused by Anthrax and Foot Mouth Disease (FMD) epidemics. In this context, it is crucial to utilize technology in livestock marketing to obtain current market information from distant marketplaces and reduce the risk of contagion. To meet these purposes, a mobile phone application has been developed in order to be used by cattle farmers; after that, market testing has been conducted to gain feedback and determine the segmentation. Thus, the study aimed to examine the differences in the perceived ease of use, perceived usefulness, and social impact amongst farmers who are willing and unwilling to embrace a mobile phone application for digital marketing. A total of 968 cattle farmers were surveyed with stratified random sampling techniques in the Special Region of Yogyakarta. The data obtained were analyzed using mean difference inferential analysis. The result showed that farmers with various categories of age, education, farm revenue, farmers group, farmer experience, cattle ownership, and regions have significantly different ($p<0.01$) perceived usefulness (PU), perceived ease of use (PE), and social influence (SI) on mobile applications for livestock digital marketing. Furthermore, farmers willing to adopt mobile application have significantly higher ($p<0.01$) PU, PE, and SI factors. This study recommends mobile app developers evaluate potential user needs and background factors that may influence farmers' interest.

Keywords: Consumer behavior, Digital marketing, FMD, Technological acceptance, Willingness to adopt

Introduction

Beef cattle raising is an economically sustainable industry that offers employment possibilities to rural communities and meets the dietary requirements of the population. Indonesia is currently facing a growing problem with Anthrax and FMD, as the number of cattle fatalities caused by these diseases continues to rise. Anthrax and FMD are currently among the most significant animal diseases, causing substantial economic losses in susceptible cloven-hoofed animals (OIE, 2018). Due to disease control measures, it becomes challenging to market livestock during these epidemics.

The status of diseases such as Anthrax and FMD affects cattle marketing not only in Indonesia but all over the world. According to Kappes *et al.* (2023), the presence of animal diseases in production impacts markets, which is evident through the implementation of trade bans and restrictions. It is imperative to restrict the movement of animals and humans across farms since they can serve as potential disease vectors to mitigate the spread of diseases (Sieng *et al.*, 2022). Due to dealer activity's absence, farmers have encountered challenges in conducting livestock trade. The marketing of beef cattle takes place at numerous livestock markets, which are located in rural areas. Farmers travel great distances with their cattle to these markets, often without any knowledge of the prevailing prices (Girma and Kelil, 2021). Therefore, it is crucial to utilize mobile phones in livestock marketing to establish a link between farmers' livestock output and the markets and obtain up-to-date market information from distant marketplaces (Girma and Kelil, 2021). According to Abdelsayed (2017), mobile

applications (mobile apps) can improve dairy farmer's decision-making and adoption. Insufficient information and inadequate extension services were a significant limitation due to the absence of extension facilities (Girma and Kelil, 2021). In addition, a majority of the farmers in the rural area lacked the proficiency to use their mobile phones and could not comprehend the content of text messages received by extension agents and fellow farmers (Girma and Kelil, 2021).

Furthermore, Davis (1989) provides additional insights into technological innovation by examining the concepts of perceived ease of use and utility within the Technology Acceptance Model (TAM) framework. The widespread acceptance of the TAM is based on its strong theoretical foundation and practical effectiveness. Since its inception, the TAM has undergone numerous revisions, extensions, critiques, and tests to assess its internal and external consistency (Enu-Kwesi and Opoku, 2020). Nevertheless, each person possesses a subjective assessment of the utility and ease of integrating technological advancements (Baaziz and Quoniam, 2014). In order to effectively adapt to technology, persons must acquire operational perception, possess a technical knowledge and psychological adoption of the significance of behavioral control (Roberts *et al.*, 2021).

To elucidate the method by how individuals employ new technologies, several models and frameworks have been devised. These models, including the Technology Acceptance Model, incorporate variables that may influence user acceptance (Davis, 1986), Theory of Planned Behavior (Ajzen, 1991) and Diffusion of Innovation theory (Rogers, 2003), Theory of Reasoned Action (Ajzen and Fishbein, 1975), Unified Theory of Acceptance and Use of Technology (Venkatesh *et al.*, 2003). However, this study employed the TAM theory in considering the research context, which was one in which farmers were unfamiliar with the use of digital marketing for livestock via mobile applications. In addressing research objectives, the application of basic theory is considered to be more reliable. Moreover, the constructs proposed by the questioners are readily comprehensible to the respondents.

Authors have extended the TAM framework by identifying additional social influences (He *et al.*, 2018). As previously stated, the traditional TAM focuses solely on two key factors: “ease of use” and “usefulness”. However, research on technology adoption needs to consider the impact of social and cultural context on technology acceptance (Scherer *et al.*, 2019), even in the technology field (Graf-Vlachy *et al.*, 2018). Individuals tend to adopt certain behaviors because of external factors (Shah and Asghar, 2023). In the agricultural context, farmers are influenced by peers to adopt new technologies (Niu *et al.*, 2022). This can be inferred by the fact that the social context plays a pivotal role in shaping individuals’ perceptions, interpretations, and decisions regarding the adoption of a new technology. Introducing social influence as an additional element into the TAM provides a more comprehensive understanding of the dynamics that could be observed within the social environment.

The farmer's inclination to adopt new technology or applications may be influenced by various factors, including the farmers' subjective perceptions. Nevertheless, there is a dearth of research examining the differences between farmers who are eager to adopt and those who are unwilling to adopt in terms of mobile apps livestock digital marketing in Indonesia. Most of the studies (Abdelsayed, 2017; Michels *et al.*, 2019; Fabiyi *et al.*, 2022), conducted related to mobile apps for livestock production and health management. Despite the numerous studies and implementations of the TAM model, our research brings a new perspective by applying the model to a specific community (the farmers) with distinct economic and social characteristics (such as low skill levels, limited education, and a perception that innovation is not directly relevant to their work).

TAM has become one of the most frequently referenced models within the context of technology acceptability (Rahimi *et al.*, 2018). It has garnered considerable empirical support over the period of the previous decades. TAM's applicability is restricted to the workplace due to its failure to consider the social influence on technology adoption. Therefore, this study fulfilled the gap by added social influence on the model. Thus, the study aimed to examine the differences in the perceived ease of use, perceived usefulness, and social impact amongst farmers who are willing and unwilling to embrace a mobile application for digital marketing.

Materials and Methods

Total 968 cattle farmers were surveyed with stratified random sampling technique from four regencies of the Special Region of Yogyakarta (Sleman, Gunungkidul, Bantul, and Kulon Progo). The surveys were set to have a 98% confidence level with a margin of error of 3.73% of the measured value. For Yogyakarta's total cattle population of 319,060, divided by 5 heads per farmer, we obtained 63,812 farmers. To estimate the number of sample respondents, we used a sample size calculator available at www.calculator.net. Therefore, a minimum sample size of 961 respondents would be required for the aforementioned case. Proportions were calculated based on the cattle population in each region and district using data from the Bureau Statistic of Yogyakarta (2023) from a total of 968 respondents. The selected districts were those with a concentration on central beef cattle production. The number of survey respondents was proportional to the population size of each district. Finally, we randomly selected the respondent by obtaining the data list from the local extension officer. This study has partnered with a surveying company to recruit trained enumerators for collecting valid sample data.

The province was chosen because this is one of the most dynamic areas for cattle raising and trading in Indonesia and also as one of the main centers of livestock movements in livestock production. The survey was conducted between September and October 2022. The respondents have provided permission and were adequately informed about the research objective. After expressing their desire to participate in the interview, participants were asked to provide their signature in the consent letter. The responders were assured that their information would be confidential and utilized solely for research purposes. This study involved individuals who are cattle farmers and have at least one mobile phone in their household with access to internet connectivity. Farmers were given a tutorial and instructed to familiarize themselves with mobile applications before their interviews. Then, a questionnaire survey was designed using the theory of TAM.

Farmers were explained and have been instructed to surf for one hour using one of the researcher-determined digital marketing applications available on mobile phones called Sobaternak^{R}. There are comparable applications available in Indonesia; however, they are now unavailable for download and lack any recent updates. Farmers were asked for information on their experience using the application related to perceived usefulness (effectiveness of selling livestock, ease of selling livestock, time efficiency, and usefulness of the application), perceived easiness (ease of using the application, application interface, and obtaining information), and social influence (influence of other farmers, influence of extension workers, and other information media). A Likert scale of 1 to 4 was used to measure farmers' perceptions of the acceptance of digital livestock marketing technology.

Data were analysed using inferential analysis for the purposes of this study. Discrete choice analysis was used for farmers' characteristics in non-parametric analysis, as the data were nominal. For technological acceptance, differences between farmers who adopted the app and those who did not were analysed using parametric analysis, including t-tests and analysis of variance (ANOVA) from a one-way randomized design, with analysis conducted using R Studio software. The Jarque-Bera test was conducted ($p > 0.05$) to each measured value to check the normal distribution.

Results and Discussion

Social characteristics of farmers

Table 1 shows that farmers from 40 to 60 years old accounted for approximately 50% and could access the market compared to other age segments. Younger farmers (<40 years old) tend to have easier access to market information, which can be obtained through information technology. However, novice farmers who have just entered the cattle business may face considerable obstacles in accessing the market because the system of buying and selling cattle, especially in the research area, is based on a long-established system of trust. The utilization of web-based tools and online sales by direct market producers may be comparatively correlated with particular socioeconomic and farm-level attributes (Pesci *et al.*, 2023). The younger farmers tend to embrace a greater array of technology. They may be more receptive to and proficient in utilizing new technologies than older farmers, as they find them more beneficial and practical (Rose *et al.*, 2016).

Table 1. Farmer's characteristic to market access

Variables	Freq.	%	Market access		Non-parametric Tests
			Yes	No	
All respondents	968	100	503	465	
Age (years)					*Pearson* X^2*=280.68***
18 – 40	131	13	128	3	
41 – 60	476	48	302	174	
>60	361	37	73	288	
Education (years)					*Fisher's Exact*=164.19**
Non-tertiary (1 – 12 years)	631	65	233	398	
Tertiary (> 13 years)	337	35	270	67	
Farming income (USD average per month)					*Fisher's Exact*=60.41**
<100	576	59	240	336	
>100	392	41	263	129	
Farmer group					*Fisher's Exact*=1.07^{NS}
Yes	564	58	301	263	
No	404	42	202	202	
Farming experience (years)					*Fisher's Exact=54.13***
1 – 15	396	41	262	134	
>15	572	59	241	331	
Cattle ownership (Tropical Livestock Unit)					*Fisher's Exact*=0.18^{NS}
0 – 1	246	25	125	121	
> 1	722	75	378	344	
Region					*Pearson* X^2*= 9.65**
Sleman	278	28	125	153	
Bantun	190	19	112	78	
Gunungkidul	393	40	211	182	
Kulon Progo	107	11	55	52	

*, **, ^{NS} The mean difference is significant at 0.05, 0.01, and non-significant.

Most of the farmers had non-tertiary education (65%) and were not able to access the market directly to sell their cattle to the end consumer (restaurant or meat shop) compared to the tertiary educated farmers (Table 1). Technical assistance and capacity building should be extended to farmers in order to foster the growth and progress of the traditional livestock industry. The capacity to access available market information and negotiate prices more effectively is enhanced through training. Promoting investment in cattle farming among individuals possessing higher levels of literacy has the potential to enhance both production and marketing standards (Kibona and Yuejie, 2021).

A total of 59% of farmers have more than 15 years of experience; surprisingly, they are less accessible to the direct market access (Table 1). Cattle farmers favoured indirect marketing channels facilitated by intermediaries or middlemen who acted as liaisons between farmers and slaughterhouses or inter-island merchants; as a result, they were deprived of direct market access for an extended period of time (Dewi *et al.*, 2021). Older farmers may tend to be more risk-averse and conservative in their attitudes (Abu *et al.*, 2014; Adeoti, 2014). Besides, the group of farmers did not change their ability to access the market. In contrast, Aku *et al.* (2018) reports that membership in a farmer's organisation tends to give producers convenient access to markets. Moreover, group membership facilitates communication between members, providing opportunities to obtain market information (Tolno *et al.*, 2015). Similarly, the ability of farmers to access the market did not increase when the number of cattle increased. This assumes that farmers rely solely on brokers to sell their livestock. Farmers tend to be price takers and have little bargaining power, while brokers act as price setters in the market for beef cattle (Adunea *et al.*, 2019).

Generally, there is an even split between respondents with and without market access. Farmers with certain demographic characteristics (Table 1) tend to have greater access to markets: in reference to the analyzed sample, for instance, it is noteworthy that 98% of farmers aged between 18 and 40 have market access. Conversely, this percentage decreases to 20% when considering those above the age of 60. An intermediate percentage is observed for those aged between 40 and 60, with a market access rate of 63%. Individuals with higher socioeconomic status are more likely to receive information first and therefore benefit the most from the application of new technologies (Rogers, 2003). Nevertheless, many farmers still face difficulties in selling their cattle. Hence, technology is needed to facilitate farmers in marketing and selling their livestock (Guntoro *et al.*, 2022). The threat of disease spread can occur at any time, which can potentially lead to losses. The mobile app for livestock marking is designed to assist farmers in marketing their livestock. However, it is necessary to know how farmers perceive the application before its commercial launch.

Mobile app technology acceptance based on farmers background

Mobile applications of digital livestock marketing can be defined as the promotion of livestock and other services related to farm management using digital technologies, notably the Internet, but also including mobile phones, display advertising, and any other digital medium, including computers or mobile phones (Wendy *et al.*, 2019). Nevertheless, not all farmers familiar with neither direct selling nor marketing technologies. Whereas, having an online presence was associated with increases in farm sales and profitability (Peng *et al.*, 2021; Ume, 2023). Many farmers relied on online outreach tools like social media to inform their customers that they were still open or update them on how they could buy their products (Pesci *et al.*, 2023), instead of specific mobile apps for selling livestock. Our study presents an empiric data on how farmers react as scholars introduced the spesific application for selling their livestock. A survey question asked farmers about their intend to adopt the mobile app on livestock digital marketing.

Table 2 showed that there were significant effects of age, education, farm revenue, farmers group, farmer experience, cattle ownership, and regions on PU, PE, and SI. Young farmers aged 18–40 had higher scores of PU, PE, and SI than those of other groups of farmers. Furthermore, participating in the farmer group also showed a higher PU, PE, and SI. Mobile apps act as a bridge between producers and consumers so that if these applications can be optimally utilised, it is expected to break the supply chain and get competitive prices. However, for older farmers who tend to lack digital literacy, the role of peer farmers groups as collective action is important in using the application (Ma *et al.*, 2023). Thus, peer farmers help to input livestock data into the application.

In particular, younger farmers (18-40 years old) gave higher ratings (PU, PE, and SI) regarding the application. On the one hand, higher PU and PE can be attributed to the influential role the overall social context of the studied environment. This demographic segment is believed to have a greater affinity for technology use, which leads to a higher propensity to innovate and adopt new technologies (Rose *et al.*, 2016). In addition to that, they tend to be more educated (Talukder *et al.*, 2019), and this familiarity with technology combined to the higher levels of education contribute to their favorable ratings. Other factors such as a greater ability to adapt to change, a receptiveness to modern farming practices and a potentially greater awareness of market trends may also affect their positive assessment.

On the other hand, the interplay of various factors in shaping their more positive evaluations is highlighted by the higher social influence (SI) score of 2.74 for the young farmers segment, compared to 2.49 for the 41-60 age group and 2.24 for the >60

Table 2. Cross tabulation of technological acceptance of mobile app between farmers demographics

Variables	Perceived usefulness	Perceived ease of use	Social influence
Age (years)			
18 – 30	2.74	2.84	2.74
41 – 60	2.51	2.7	2.49
>60	2.26	2.44	2.24
ANOVA	47.65**	31.18**	39.21**
Education (years)			
Non-tertiary (1 – 12 years)	2.33	2.52	2.32
Tertiary (>13 years)	2.7	2.8	2.64
t-test	9.75**	7.06**	8.29**
Farming revenue (IDR average per month)			
<100 USD	2.35	2.53	2.37
>100 USD	2.58	2.75	2.52
t-test	6.50**	5.54**	3.91**
Farmer group			
Yes	2.51	2.71	2.47
No	2.36	2.5	2.38
t-test	4.00**	5.34**	2.14*
Farming experience (years)			
1 – 15	2.54	2.69	2.55
>15	2.39	2.58	2.35
t-test	–4.22**	–2.78**	–4.91**
Cattle ownership (Tropical Livestock Unit)			
0 – 1	2.51	2.67	2.46
>1	2.43	2.61	2.42
t-test	–2.00*	-1.38^{NS}	-0.82^{NS}
Region			
Sleman	2.46	2.67	2.47
Bantul	2.52	2.73	2.53
Gunungkidul	2.37	2.52	2.41
Kulon Progo	2.53	2.66	2.46
ANOVA	5.06**	6.97**	2.84*

* , **, ^{NS} The mean difference is significant at 0.05, 0.01 and non-significant.

age group; increased connectivity to digital platforms, exposure to educational initiatives and potentially greater resources are all elements that contribute to the social influence's dimension within the younger demographics, setting them apart from their older counterparts. A more marked resistance to change is found among over-60s, as adopting a mobile application requires a rethink of their long-established practices and habits. This resistance could be inferred by their reliance on traditional cattle farming marketing methods and their reluctance to deviate from long-established routines.

Farmers have a higher education, and their revenue per month recorded a higher PU, PE, and SI compared to farmers with non-tertiary education. In contrast, farmers with more experience had less PU, PE, and SI (Table 2). There are no differences between PE and SI in farms with more than one unit of cattle compared to other farms. Farmers with better socio-demographic characteristics tend to have good digital literacy. Besides, farmers with higher digital literacy can use various digital tools to understand and master the latest technology, providing technical support for their entrepreneurship (Bai *et al.*, 2023).The use of this application is suitable for farmers who have the motivation to expand market access. Therefore, farmers with less education can still use this application because the application is designed for non-expert users so that the menu display is kept as minimal as possible for easy operation. This can be seen in Table 2, where the PE value is generally higher than other variables, indicating that the respondents perceive this application as easy to use.

The study also recorded the highest PU, PE, and SI in the Bantul area. There were some differences in the ratings between the different regions, a phenomenon that can be attributed to the different characteristics of each geographical area. In particular, respondents living in Bantul region gave higher ratings across the parameters (PU=2.52[1], PE=2.73, SI=2.53). This preference is partly explained by the increased urbanization and infrastructure density that characterize the Bantul region. In addition, the proximity to Yogyakarta, a major commercial and cultural center, emerges as an important determinant. This proximity not only brings them closer to end consumers, but also provides convenient access to slaughterhouses. The intricate interplay of these geographical factors underlines the elements that influence valuation outcomes. Bantul's urban sophistication, infrastructural robustness and strategic proximity to Yogyakarta all contribute to the buoyancy of their evaluations, providing valuable insights into the multiple regional dynamics that shape respondents' perspectives.

Cattle farmers of Gunungkidul (PU=2.37, PE=2.52, SI=2.41), however, express a more modest appreciation regarding the application; in fact, their geographical remoteness from Center of Yogyakarta, coupled with a relatively low density of infrastructure, slightly influences their perception of the application's usefulness. This influence is

[1] Only Kulon Progo rated more (2.53)

particularly pronounced in the context of business-to-consumer (B2C) transactions, where residents would be forced to navigate the intricacies of livestock management, an endeavor characterized by significant operational burdens.

Moreover, an analysis of the evaluations considering the years of farming experience reveals a distinctive trend, as those with less than 15 years of experience have expressed more positive assessments (PU=2.54, PE=2.69, SI=2.55), compared to the individuals with over 15 years of experience (PU=2.39, PE=2.58, SI=2.35). These determined differences suggest that habituation, familiarity, and social dynamics play a huge role in shaping perceptions and opinions.This observed trend aligns consistently with the analyzed data under the age's perspective.

Generally, farmers with higher socio-economic status are more likely to adopt innovation due to their perception of technology acceptance (Table 2). Awareness of the use of mobile phones as an extension tool should be increased by providing a capacity building program for smallholder farmers (Girma and Kelil, 2021). In addition, those who are reluctant or resistant to adopting new innovations could benefit from support from peers or group organizations to input the livestock information into the mobile app. Experiencing the benefits of the application will motivate them to learn to use the mobile application themselves or with family members' assistance.

The differences between app adoption and non-adoption farmers

Table 3 shows the differences in perceived usefulness, perceived ease of use, and social influence factors among farmers segmented by their willingness and unwillingness to adopt mobile apps. The average perceived usefulness and social influence factors ranged from more than 2 points to less than 3 points on the Likert scale, while the perceived ease of use showed a higher level, reaching 3 points. The results indicated that farmers who are willing to adopt mobile apps for marketing have a significantly higher perceived usefulness compared to those who are unwilling to adopt mobile apps (P<0.01). Similarly, perceived ease of use and social influence are also significantly higher in mobile apps willing to adopt farmers (P<0.01).

Table 3. The differences between adoption farmers and non-adoption farmers for mobile apps

Criteria	Willingness to adopt mobile apps		t-test
	Adoption	Non-adoption	
Perceived usefulness	2.81±0.36	2.09±0.43	28.39**
Perceived ease of use	3.01±0.32	2.24±0.55	26.58**
Social influence	2.85±0.39	2.01±0.46	30.78**

** is significant with P<0.01.

There are two central determinants in TAM: perceived usefulness, which refers to "*the degree to which a person believes that using a particular system would improve his or her job performance*"; and perceived ease of use, which refers to "*the degree to which a person believes that using a particular system would be effortless*" (Davis, 1989). Based on the results of the analysis in Table 3, it can be interpreted that farmers have a high level of confidence in mobile applications because they believe that it will be able to increase opportunities to access markets and market their livestock. In addition, farmers feel that the mobile application they use is easy to use and does not require significant additional effort. On the other hand, the social environment, in this case peer farmers, has more influence on someone who intends to use mobile applications. Someone who feels that the new technology used has a good impact and is easy to use will attract users to accept a technology (Taherdoost, 2018; Hubert *et al.*, 2019). Therefore, someone who has high confidence in the acceptance of the technology will be more likely to adopt the technology. This explains why farmers who are willing to adopt mobile apps have higher scores.

The significant difference in the value of PU and PE between groups indicates that farmers who are willing to adopt perceive more benefits from using mobile apps to market livestock and are user-friendly. In the study area, 50% of respondents interested in using mobile applications to sell livestock belonged to the high socioeconomic group. These groups typically expect greater benefits than those in lower socioeconomic groups. Despite the myriad efficiency benefits conferred by the utilization of virtual applications, particularly in the context of livestock digital marketing, the restrictions imposed on livestock movement due to Anthrax and FMD present additional opportunities for the proliferation of mobile apps. These constraints underscore the crucial role that digital solutions can play in facilitating livestock transactions, mitigating the logistical challenges posed by such health crises. When people understand the advantages of products, they will follow conventional decision-making processes by developing a positive assessment toward the product (Syahlani *et al.*, 2023). Thus, it can be stated that the mobile app provides more support to farmers, who are willing to adopt the mobile app as an alternative channel for marketing livestock. Moreover, the high SI value implies a willing adopter driven by social factors including farmers and group organizations. In contrast, the group of non-willing adopters believed that external individuals do not hold a greater influence.

Individuals who are open to the adoption of a technology tend to have a belief in their own ability to carry out the proposed behavior, which leads to a greater perceived ease of use. Some studies did not find a correlation between adoption and perceived ease of use because the perceived ease of use did not increase the users' confidence in their own abilities. For instance, an individual who holds a negative expectation (e.g. "*the technology will be difficult to use*") or who has a diminished sense of self-worth, may show a lack of the reassurance needed to embrace something

new, regardless of the apparent simplicity of the adoption process. In order to conquer this obstacle, developers or extension agents can offer users an additional enhancement to their self-confidence by means of positive reinforcement or a self-affirmation assignment (He *et al.*, 2018) as it may help them break through the psychological barriers. In this case, the effect of ease of use on mobile apps adoption is expected to surface.

At this point in time, there are no plans for any major enhancements to the digital application. However, it is anticipated that the technology will initiate a gradual transition of the livestock market to virtual realms, facilitating reduced transaction costs for both buyers and sellers (Wu *et al.*, 2023). This increase in market efficiency and effectiveness is expected to further stimulate increased user adoption (Pascucci *et al.*, 2023).

Although the buyers may not be familiar with the application, it is expected that it will be easily adopted due to the encouragement of the sellers and the concern for public health for the animals. In addition, online applications for the purchase of goods and services are not a new phenomenon in Indonesia, but rather an established phenomenon within the socio-economic context (Prihantoro *et al.*, 2018; Ariansyah *et al.*, 2021). Moreover, the application is expected to remain popular even after the eradication of diseases such as foot-and-mouth disease (FMD) and Anthrax. The application's provision of tangible benefits to stakeholders, including streamlined transaction processes and mitigated health risks, is expected to generate habitual usage among users (Hsiao *et al.*, 2016). As a result, its continued use is expected to be ensured by the potential emergence of significant switching costs for consolidated users (Willys, 2018).

At the same time, the majority of those who are not interested in using mobile applications come from lower socio-economic contexts. Many of these farmers lack the necessary skills to operate their mobile phones. In addition, training with respect to the utilization of mobile phones for marketing purposes is not yet available. Since mobile apps can be a valuable tool for improving beef cattle marketing in this part of the region, even if they are not used to their full potential (Girma and Kelil, 2021), the government should provide the necessary infrastructure to the farmers and should also promote education of extension agents and farmers, which is essential for the improvement of the marketing process of beef cattle. Mobile app developers should consider targeting high-socioeconomic farmers, as they are more likely to be interested in using mobile apps. Additionally, marketing strategies should be focused on farmers located in nearby consumer centers.

Conclusion

The Anthrax and FMD endemics have resulted in a decrease in direct buying and selling activities. Furthermore, farmers frequently encounter obstacles when attempting to access markets to sell their livestock. Farmers who are young (between 18-40 years old), have completed higher education, earn high income from livestock products, and have 1–15 years of farming experience are more likely to have access to market information. Therefore, farmers require information technology to access market information. Market testing ensures that the application is acceptable to potential users by providing a tutorial on how to use the app to gather feedback and determine the segmentation. However, potential users may have varying levels of technology acceptance. The results indicate that farmers from different age categories, educational backgrounds, farm incomes, farmer groups, farming experience, livestock ownership, and regions perceived usefulness (PU), perceived ease of use (PE), and social influence (SI) differently. Moreover, farmers who are willing to adopt mobile applications perceive them as significantly more useful and easier to use and are influenced by social factors.

Conflict of interest

The authors have no conflict of interest to declare. All authors have seen and agree with the contents of the manuscript.

Funding statement

This project was funded by the Matching Fund Kedai Reka, Ministry of Education, Culture, Research, and Technology Indonesia 2022. Y.B.E.S. is independent and did not receive any fund.

Acknowledgement

The authors acknowledge the help and support of PT. Arwindra Eureka Solution in the data collection.

Author’s contribution

The authors confirm contribution to the paper as follows: study conception and design: A. T., B. G. and S. P. S.; data collection: A. T and N. H. Q.; analysis and interpretation of results: A .T., Y. B. E. S. and M. A. U. M.; draft manuscript preparation: A. T., N. H. Q., Y. B. E. S. and All authors reviewed the results and approved the final version of the manuscript.

Ethics approval

Research involving human research participants in this report has been performed based on the Declaration of Helsinki.

References

Abdelsayed, M. 2017. Technical update: Health Data for Healthy Cows. Australian Holstein

Journal. 28–29. Available from: https://search.informit.org/doi/10.3316/informit.900883971122647

Abu, B. M., Y. B. Osei-Asare, and S. Wayo. 2014. Market participation of smallholder maize farmers in the upper west region of Ghana. Afr. J. Agric Res. 9: 2427–2435. doi:10.5897/AJAR2014.8545.

Adeoti, A. 2014. Determinants of Market Participation among Maize Producers in Oyo State, Nigeria. British Journal of Economics, Management and Trade 4: 1115–1127. doi:10.9734/BJEMT/2014/7826.

Adunea, D., A. Bezahagn, L. Azeb, and S. Muhammed. 2019. Beef cattle value chain analysis: Evidence from West Hararghe Zone of Ethiopia. International Journal of Agricultural Science and Food Technology. 5: 077–087. doi:10.17352/2455-815X.000046.

Ajzen, I. 1991. The theory of planned behavior. Organ Behav Hum Decis Process. 50: 179–211. doi:10.1016/0749-5978(91)90020-T.

Ajzen, I., and M. Fishbein. 1975. Belief, attitude, intention and behavior: An introduction to theory and research. Addison-Wesley, Massachusett.

Aku, A., P. Mshenga, V. Afari-Sefa, and J. Ochieng. 2018. Effect of market access provided by farmer organizations on smallholder vegetable farmer's income in Tanzania. Cogent Food Agric. 4: 1560596. doi:10.1080/23311932.2018.1560596.

Ariansyah, K., E. R. E. Sirait, B. A. Nugroho, and M. Suryanegara. 2021. Drivers of and barriers to e-commerce adoption in Indonesia: Individuals' perspectives and the implications. Telecomm Policy. 45: 102219. doi:10.1016/j.telpol.2021.102219.

Baaziz, A. and L. Quoniam. 2014. How to Use Big Data Technologies to Optimize Operations in Upstream Petroleum Industry. SSRN Electronic Journal. doi:10.2139/ssrn.3429410.

Bai, Q., H. Chen, J. Zhou, G. Li, D. Zang, Y. Sow, and Q. Shen. 2023. Digital literacy and farmers' entrepreneurial behavior—Empirical analysis based on CHFS2019 micro data. PLoS One. 18:e0288245. doi:10.1371/journal.pone.0288245.

Bureau Statistic of Yogyakarta. 2023. Number of Livestock by Type and District/City in D.I. Yogyakarta (head), 2014-2016. https://yogyakarta.bps.go.id/indicator/24/56/1/jumlah-ternak-menurut-jenisnya-dan-kabupaten-kota-di-d-i-yogyakarta-.html

Davis, F. D. 1986. Technology Acceptance Model for Empirically Testing New End-User Information Systems: Theory and Results. Cambridge, Massachusett.

Davis, F. D. 1989. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. MIS Quarterly. 13: 319. doi:10.2307/249008.

Dewi, N. M. A. K., S. P. Syahlani, and F. T. Haryadi. 2021. The choice of information sources and marketing channel of Bali cattle farmers in Bali Province. Open Agric. 6: 413–425. doi:10.1515/opag-2021-0018.

Enu-Kwesi, F., and M. O. Opoku. 2020. Relevance of the technology acceptance model (TAM) in information management research: a review of selected empirical evidence. Pressacademia. 7: 34–44. doi:10.17261/Pressacademia.2020.1186.

Fabiyi, S. D., J. Ren, Y. Han, Q. Zhu, and D. Barclay. 2022. Mobile Platform for Livestock Monitoring and Inspection. In: 2022 3rd International Informatics and Software Engineering Conference (IISEC). IEEE. p. 1–6.

Girma, Y., and A. Kelil. 2021. Mobile phone and beef cattle marketing: The case of Girar Jarso district of Oromia region, Ethiopia. Cogent Food Agric. 7. doi:10.1080/23311932.2021.1911032.

Graf-Vlachy, L., K. Buhtz, and A. König. 2018. Social influence in technology adoption: taking stock and moving forward. Management Review Quarterly. 68: 37–76. doi:10.1007/s11301-017-0133-3.

Guntoro, B., N. H. Qui, and A. Triatmojo. 2022. Challenges and Roles of Extension Workers on Cyber Extension as Information Media. KnE Life Sciences. doi:10.18502/kls.v0i0.11843.

He, Y., Q. Chen, and S. Kitkuakul. 2018. Regulatory focus and technology acceptance: Perceived ease of use and usefulness as efficacy. Cogent Business & Management. 5: 1459006. doi:10.1080/23311975.2018.1459006.

Hsiao, C.-H., J.-J. Chang, and K.-Y. Tang. 2016. Exploring the influential factors in continuance usage of mobile social Apps: Satisfaction, habit, and customer value perspectives. Telematics and Informatics. 33: 342–355. doi:10.1016/j.tele.2015.08.014.

Hubert, M., M. Blut, C. Brock, R. W. Zhang, V. Koch, and R. Riedl. 2019. The influence of acceptance and adoption drivers on smart home usage. Eur J Mark. 53: 1073–1098. doi:10.1108/EJM-12-2016-0794.

Kappes, A., T. Tozooneyi, G. Shakil, A. F. Railey, K. M. McIntyre, D. E. Mayberry, J. Rushton, D. L. Pendell, and T. L. Marsh. 2023. Livestock health and disease economics: a scoping review of selected literature. Front Vet Sci. 10. doi:10.3389/fvets.2023.1168649.

Kibona, C. A., and Z. Yuejie. 2021. Factors that influence market participation among traditional beef cattle farmers in the Meatu District of Simiyu Region, Tanzania. PLoS One. 16:e0248576. doi:10.1371/journal.pone.0248576.

Ma, W., M. A. Marini, and D. B. Rahut. 2023. Farmers' organizations and sustainable

development: An introduction. Annals of Public and Cooperative Economics. 94: 683–700. doi:10.1111/apce.12449.

Michels, M., P. J. W. von Ahlefeld, J. Möllmann, and O. Musshoff. 2019. Development and Validation of a Technology Acceptance Model for the Usage of Forward Contracts in Agriculture. Journal of the Austrian Society of Agricultural Economics. 28: 11.

Niu, Z., C. Chen, Y. Gao, Y. Wang, Y. Chen, and K. Zhao. 2022. Peer effects, attention allocation and farmers' adoption of cleaner production technology: Taking green control techniques as an example. J Clean Prod. 339: 130700. doi:10.1016/j.jclepro.2022.130700.

OIE. 2018. Foot and Mouth Disease (Infection with Foot and Mouth Disease Virus). Paris.

Pascucci, F., E. Savelli, and G. Gistri. 2023. How digital technologies reshape marketing: evidence from a qualitative investigation. Italian Journal of Marketing. doi:10.1007/s43039-023-00063-6.

Peng, L., G. Lu, K. Pang, and Q. Yao. 2021. Optimal farmer's income from farm products sales on live streaming with random rewards: Case from China's rural revitalisation strategy. Comput Electron Agric. 189: 106403. doi:10.1016/j.compag.2021.106403.

Pesci, S., R. E. Galt, J. L. Durant, G. M. Manser, L. Asprooth, and N. Pinzón. 2023. A digital divide in direct market farmers' online sales and marketing: Early pandemic evidence from California. J Rural Stud. 101: 103038. doi:10.1016/j.jrurstud.2023.103038.

Prihantoro, W. P., A. Satria, and H. Hartoyo. 2018. The Determinant Factors of Behavior in M-Commerce Application Usage for Online Purchasing. Indonesian Journal of Business and Entrepreneurship. doi:10.17358/ijbe.4.2.118.

Rahimi, B., H. Nadri, H. Lotfnezhad Afshar, and T. Timpka. 2018. A Systematic Review of the Technology Acceptance Model in Health Informatics. Appl Clin Inform. 09: 604–634. doi:10.1055/s-0038-1668091.

Roberts, R., R. Flin, D. Millar, and L. Corradi. 2021. Psychological factors influencing technology adoption: A case study from the oil and gas industry. Technovation. 102: 102219. doi:10.1016/j.technovation.2020.102219.

Rogers, E. M. 2003. Diffusion of Innovations. 5th ed. Free Press, New York.

Rose, D. C., W. J. Sutherland, C. Parker, M. Lobley, M. Winter, C. Morris, S. Twining, C. Ffoulkes, T. Amano, and L. V. Dicks. 2016. Decision support tools for agriculture: Towards effective design and delivery. Agric Syst. 149: 165–174. doi:10.1016/j.agsy.2016.09.009.

Scherer, R., F. Siddiq, and J. Tondeur. 2019. The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. Comput Educ. 128: 13–35. doi:10.1016/j.compedu.2018.09.009.

Shah, S. S., and Z. Asghar. 2023. Dynamics of social influence on consumption choices: A social network representation. Heliyon. 9: e17146. doi:10.1016/j.heliyon.2023.e17146.

Sieng, S., I. W. Patrick, S. W. Walkden-Brown, and C. Sar. 2022. A cost-benefit analysis of foot and mouth disease control program for smallholder cattle farmers in Cambodia. Transbound Emerg Dis. 69: 2126–2139. doi:10.1111/tbed.14207.

Syahlani, S. P., T. J. Wankar, and A. Triatmojo. 2023. The influence of objective and subjective knowledge on attitude and willingness to pay veterinary control number-certified livestock food product. Livestock and Animal Research. 21: 136. doi:10.20961/lar.v21i3.73266.

Taherdoost, H. 2018. A review of technology acceptance and adoption models and theories. Procedia Manuf. 22: 960–967. doi:10.1016/j.promfg.2018.03.137.

Talukder, M., S. Alyammahi, A. Quazi, A. Abdullah, and R. Johns. 2019. Users' Sociocultural Orientation and Smart Systems Acceptance Link: Do Demographics Matter? . Journal of Organizational Computing and Electronic Commerce. 29: 223–247. doi:10.1080/10919392.2019.1611287.

Tolno, E., H. Kobayashi, M. Ichizen, M. Esham, and B. S. Balde. 2015. Economic Analysis of the Role of Farmer Organizations in Enhancing Smallholder Potato Farmers' Income in Middle Guinea. Journal of Agricultural Science. 7. doi:10.5539/jas.v7n3p123.

Ume, C. 2023. The role of improved market access for small-scale organic farming transition: Implications for food security. J Clean Prod. 387: 135889. doi:10.1016/j.jclepro.2023.135889.

Venkatesh, Morris, Davis, and Davis. 2003. User Acceptance of Information Technology: Toward a Unified View. MIS Quarterly. 27: 425. doi:10.2307/30036540.

Willys, N. 2018. Customer Satisfaction, Switching Costs and Customer Loyalty: An Empirical Study on the Mobile Telecommunication Service. American Journal of Industrial and Business Management. 08: 1022–1037. doi:10.4236/ajibm.2018.84070.

Wu, Y., K. Duan, and W. Zhang. 2023. The Impact of Internet Use on Farmers' Land Transfer under the Framework of Transaction Costs. Land (Basel) 12: 1855. doi:10.3390/land12101855.