

Determinants of Vietnamese Farmers' Intention to Adopt Ecommerce Platforms for Fresh Produce Retail: An Integrated TOE-TAM Framework



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ABSTRACT: The application of e-commerce platforms for retailing agricultural products has been increasingly adopted for several benefits namely market expansion and connection, brand establishment, price improvement as well as the motivation for farmers to actively ameliorate their farming practices, product quality and package. However, this retail method is still lagging far behind in Vietnam - despite the need for digitalization to solve persistent problems, namely the imbalanced supply, demand and accompanied price loss in the traditional distribution channel. Thus, this research aims to investigate the factors that impact the Vietnamese farmers' intention to adopt e-commerce platforms for fresh produce retail. The paper applies the integrated Technology Acceptance Model and Technology-Organization-Environment framework. Through an online survey, a sample of 344 farmers who produced fruits and vegetables across Vietnam was drawn to confirm the hypotheses of this study. The results showed that there are positive relationships between three factors "Perceived usefulness" (PU), "Perceived Ease of use" (PEOU) and "Intention to Adopt" (INT). Among the variables, technological context (TC) is positively associated with both PU and PEOU, and organizational context (OC) impacts PU positively. Moreover, the environmental context (EC) is shown to positively influence the intention to adopt e-commerce platforms for fresh produce retail. Findings are valuable to the development of e-commerce platforms and policies to promote Vietnamese farmers' intention of using e-commerce platforms to retail agricultural products.

KEYWORDS: farmer, e-commerce platforms, fresh produce, retail, structural equation model, technology acceptance model (TAM), technology-organization-environment framework (TOE)

I. INTRODUCTION

Agriculture is considered as the backbone of the rural economy and plays a pivotal role in sustainable development (World Bank, 2008). According to Vietnam General Statistics Office (2022), the agricultural sector was the employer to about 14.2 million people, a third of Vietnam's workforce, and contributed 13.97% to the country's GDP growth rate.

Despite growth and resilience, the agricultural sector is still facing internal and external challenges. Externally, COVID-induced domestic travel restrictions and border congestion have exacerbated supply chain disruption, especially for perishable foods namely fruits and vegetables, which are time-and-temperature-sensitive. Internally, deficiencies in Vietnamese farmers' farming practices have also been pinpointed. Specifically, Vietnamese farmers are likely to mass-produce certain kinds of agricultural products after positive market responses from the latest season without actively finding outputs. The excessive supply of seasonal fruits and vegetables, and the serious loss in produce prices has thus been a persistent problem throughout the years. Accompanied with this spontaneous mass production, the characteristics of small-scale and scattering lead to the great variation in product quality while making economies of scale unattainable. This also marks down the prices for agricultural products and puts more onerous pressure on governmental officials, local cooperatives, and relevant factors to deal with the surplus, not to mention the opportunity for export. Therefore, ensuring a comprehensive transformation of the agricultural systems into sustainable, productive, and inclusive food systems would be of great necessity (Le Minh Hoan, 2021).

Along with the advancement of Information & Communication Technologies (ICT), the use of e-commerce platforms in the retailing process emerges as one of the promising innovative solutions (Baoukaris, et al., 2002) This is consistent with Vietnamese policies' agenda in national modernization. Also, the contemporary context is favorable to this method. The demand shift towards digital commerce is probably to last for years. In Vietnam, the proportion of unique online purchasers was the highest in Southeast Asia, at 41% (Google, Temasek, Bain & Company, 2021).

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Stated by the Food and Agriculture Organization (FAO), e-commerce platforms have proved to be highly beneficial in the consumption of fresh produce. They establish direct interaction between producers and consumers, which shortens the waiting time for fresh produce consumption thereby reducing post-harvest wastage. Participation in Agri e-commerce also makes way for farmers to be active in market research as well as standardizing product quality and packaging. Also, farmers can enjoy e-commerce platforms' logistics systems and supportive regional branding to gain price and cost advantages, which subsequently creates opportunities to export (James & Kennechi, 2019).

Although the application of e-commerce platforms has demonstrated its benefits and been facilitated by practical governmental plans, e-commerce platforms as well as the end consumers, it continues to experience a lack of farmers' proactivity to join e-commerce platforms. Only approximately 5 million households have joined e-commerce platforms with most of the participation being government-induced, whereas the proposed goal is 15 million (Duy, 2021). Furthermore, the number of existing literatures focusing on the ecommerce platforms as an agricultural retail channel in the special context of pandemic is modest, which raises the need for further studies to clarify the determinants of farmers' intention to retail fresh produce by this method.

As a result, the authors conducted the study "Determinants of Vietnamese Farmers' Intention to Adopt Ecommerce Platforms for Fresh Produce Retail". The factors that affect the farmer's intention to adopt e-commerce platforms for fresh produce retail and the extent to which they are affected have been analyzed and the dimension of impact has been determined. The study provides evidence as a reference to incentivize the application of e-commerce from the perspective of policy, and sheds light on new research directions in the future.

II. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

A. *Technology Acceptance Model*

TAM is a theoretical model derived from Fishbein and Ajzen's Theory of Reasoned Action (TRA) in 1975 that illustrates how users accept and adopt technology [12]. This is one of the popular theories that model the intention towards technology use. The origins of the TAM structure include Perceived Ease of Use and Perceived Usefulness, which contribute to determining Intention to Use Behavior and Actual Use.

A variety of studies using the TAM model survey the intention of adoption technology toward business operations (Awa, et al., 2015; Triposakul, 2018). Correspondingly, technology adoption behavior of expanding modern distribution channels and the information technology utilization in farming and livestock have employed TAM model for research (Ifinedo, 2011; Karim & Qi, 2021; Liu, et al., 2021).

B. *Technology-Organization-Environment Framework (TOE)*

Tornatzky and Fleischer's Technology-Organization-Environment (TOE) model has been widely applied in IT adoption studies (Aboelmaged, 2014), as e-commerce or e-business tools (Hong & Zhu, 2016). According to TOE, all factors that influence the choice of a firm to embrace a technology can be divided into three categories: the technological context (TC), the organizational context (OC), and the environmental context (EC). The study applies the TOE framework as a new contribution to understanding farmers' intention to adopt e-commerce platforms.

Several studies have used the TOE framework to examine the application of information technology in organizational operations to achieve efficient business performance (Gangwar, et al., 2015; Awa, et al., 2017), in addition, the model is applied in the application of information technology to manage data information systems (Giampietri & Trestini, 2020).

C. *E-commerce and online retail via e-commerce platforms*

E-commerce refers to business transactions between a company and other companies (B2B); between a company and a consumer or consumers (B2C) conducted over computer networks. In the industrial revolution 4.0, e-commerce has gained great popularity owing to its contributions to economic growth.

According to NAICS (2012), retail is the final step of the distribution process in which retailers sell their merchandise to the ultimate consumers. There are two distinct retail models, namely the traditional retail model and the online retail model, based on the Internet. The traditional retail model mainly operates in the physical form where the suppliers interact directly with the customers in brick-and-mortar stores, while the online retail model allows customers to access online information about products, orders, and payment methods. The traditional retail model is currently influenced greatly by the increasingly popular application of the Internet into business. Online retailers are assumed to achieve greater economies of scale because they can simultaneously serve hundreds or thousands of customers. Moreover, the online business does not require to use several physical infrastructures, making the online retail business model highly scalable (Enders & Jelassi, 2000).

D. *Main determinants*

a) *Technological context*

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TC concerns internal and external factors that are technologically relevant (Oliveira & Martins, 2011). They impact indirectly through cognitive variables of PEOU and PU. PEOU and PU are the intermediaries of the relationship between TC and the adoption of social media by individual and household retailers (Huong, et al., 2020). The more favorable the technology context is, the easier it is for people to adopt the technology and get more benefits when applying social networking in business.

H1. Technological context has a positive effect on PU.

H2. Technological context has a positive effect on PEOU.

b) *Organizational context*

OC relates to the businesses' characteristics and resources, including farm size, top managers' support, non-farming income, and training courses. The role of these characteristics is substantial in the decision-making process of applying and implementing innovation (Oliveira & Martins, 2011).

H3. Organizational context has a positive effect on PU.

H4. Organizational context has a positive effect on PEOU.

c) *Environmental context*

EC includes the role of government policies, competitors, commercial partners, and customers in impacting the decision-making behavior (Kamath & Liker, 1994). Tornatzky & Fleischer (1990) stated that the organization's innovation trends are shaped by opportunities and threats from the environment. There is a strong correlation between business households' decisions to use e-commerce platforms such as peer pressure, the pace of technical transformation, market volatility, and customer pressure. The impact of consumer readiness was discussed.

H5. Environmental context has a positive effect on Intention to adopt.

d) *Perceived usefulness*

Davis (1989) defined PU as the extent to which an individual reckons that adopting a particular technology would facilitate job performance. A technology perceived as highly useful is the one that users suppose that a good use-performance relationship exists. As a result, if someone is positively impressed when using a certain system, they may reckon that their work performance has increased to some amount, and their intention will shift in a positive manner.

H6. Perceived usefulness has a positive effect on Intention to adopt.

e) *Perceived ease of use*

PEOU is interpreted as the level to which the usage of a novel technology is believed not to take much effort (Davis, 1989). Among research on the application of new technologies including e-commerce, the role of PEOU is demonstrated as one of the two most important determinants of the intention to adopt new technology (Chen & Tan, 2004).

H7. Perceived ease of use has a positive effect on Intention to adopt.

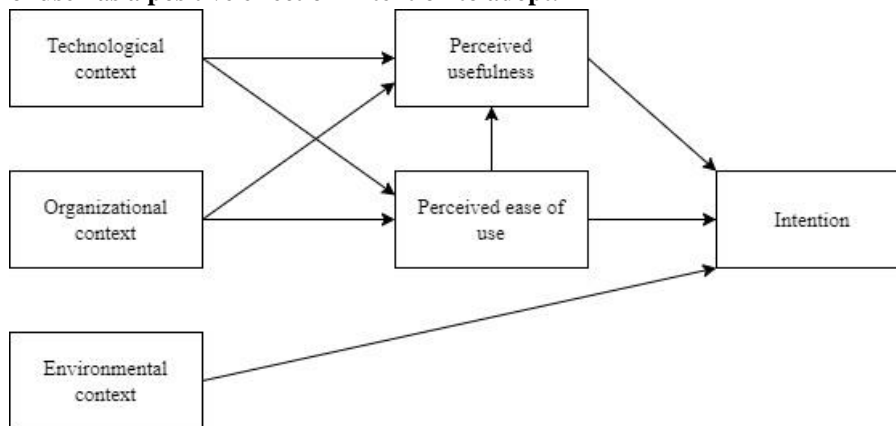


Figure 1. Proposed Research Model
Source: Authors, 2022

III. RESEARCH METHOD

A survey was conducted by sending online questionnaires to farmers and households selling agricultural products around the country of Vietnam from January 15, 2022, to January 29, 2022. The authors created a structured questionnaire to obtain respondents' opinions and feedback towards fresh produce retail through e-commerce platforms. Respondents were invited to illustrate their agreement level to measure each variable through a five-point Likert scale (from 1 = "strongly disagree" to 5 = "strongly agree"). In total, 370 questionnaires were completed. 26 responses were eliminated from the analysis because of improper completion. Finally, the analysis was carried out with 344 questionnaires.

In addition, the authors conducted 5 in-depth interviews with a farmer, two e-commerce platform officers and two experts to explore the insights into farmers' intention to retail their products on e-commerce platforms.

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IV. DATA ANALYSIS AND RESULTS

A. Sample descriptive statistics

54.9% of 344 respondents were men and the age group was between 36-45 years old on average. Most of them completed the upper-secondary school level (88.6%), which indicated that most farmers are well-educated. The average farm size was 0.34 hectares. Most of the respondents claimed that they intended to adopt E-commerce platforms for agricultural product retail (79.8%).

B. Measurement model

To assess the validity of the measurement model, the authors used Cronbach's Alpha to estimate the internal consistency, the convergent, and the discriminant validity of the measurement items. The closeness in relationships of the tested items in one group could be revealed in the test (Cronbach, et al., 2004). In this study, six latent variables and 34 observable variables in total are involved. To be regarded as observed variables, factor loadings should be above 0.5 (Hair, et al., 2010). The result of the scale reliability test satisfies Cronbach's Alpha with the values lying between the range of 0.759-0.913. This demonstrates that the observed variables are adequate and correspond to their constructs. Thus, the good reliability of all constructs is confirmed.

The confirmatory factor analysis (CFA) using AMOS 20 was utilized to assess the measurement model (Arbuckle, et al., 2014). The parameters with an associated p level < 0.05 were deemed significant. The model fit was tested using fit indices such as the Chi-square on the degree of freedom (CMIN/DF); the Goodness of fit index (GFI); the Comparative fit index (CFI); the Tucker-Lewis coefficient (TLI); the Root mean square error of approximation (RMSEA), the Test of close fit (PCLOSE). For model to be fit, the recommended respective value of χ^2 should be under 3. The value of CFI, GFI, NFI and TLI should be above 0.9 and RMSEA value must be lower than 0.08 (Gefen, et al., 2000). Meanwhile, PCLOSE must be more than 0.05 (Hu, et al., 1999).

From **Table 1**, the measurement model demonstrated good fit with the obtained data, so the structural model testing using SEM proceeded. **Figure 2** shows the result of the measurement model.

Table 1. Summary of Goodness of Fit Indices for Measurement Model

Model fit Indices	CMIN/DF	GFI	CFI	TLI	RMSEA	PCLOSE
Model	1.129	0.912	0.990	0.989	0.019	1.000

Source: Investigated by authors in 2022

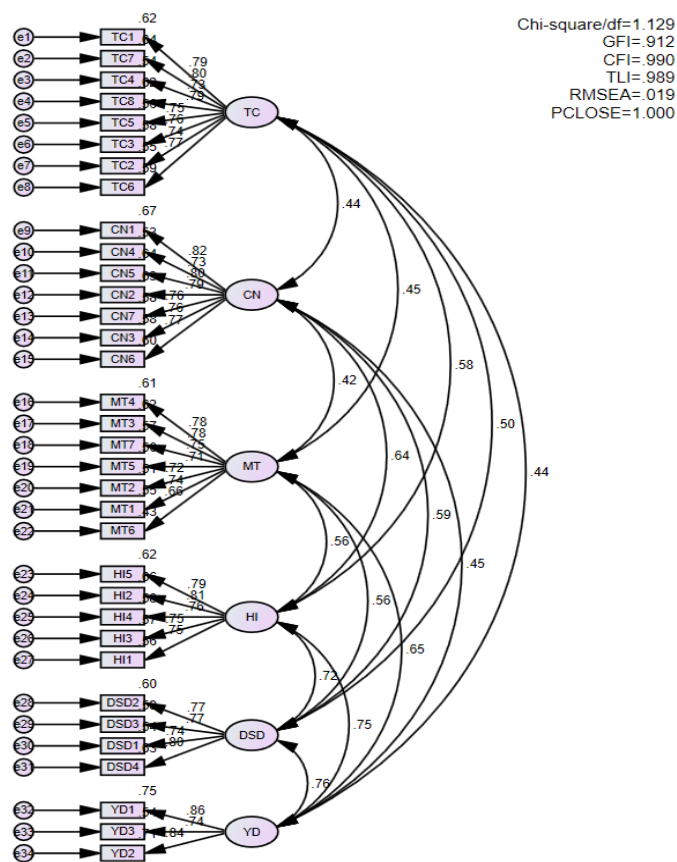


Figure 2. Measurement Model

Source: Investigated by authors in 2022

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C. Structural model

The hypothesized conceptual research model was tested using SEM. **Table 2** displays the goodness of fit for the model. Because the specified standards are satisfied by all the values of goodness of its indices, the model is regarded as fit for further analysis. **Figure 3** depicts a structural model.

Table 2. Summary of Goodness of Fit Indices for Structural Model

Model fit Indices	CMIN/DF	GFI	CFI	TLI	RMSEA	PCLOSE
Model	1.222	0.905	0.983	0.982	0.025	1.000

Source: Investigated by authors in 2022

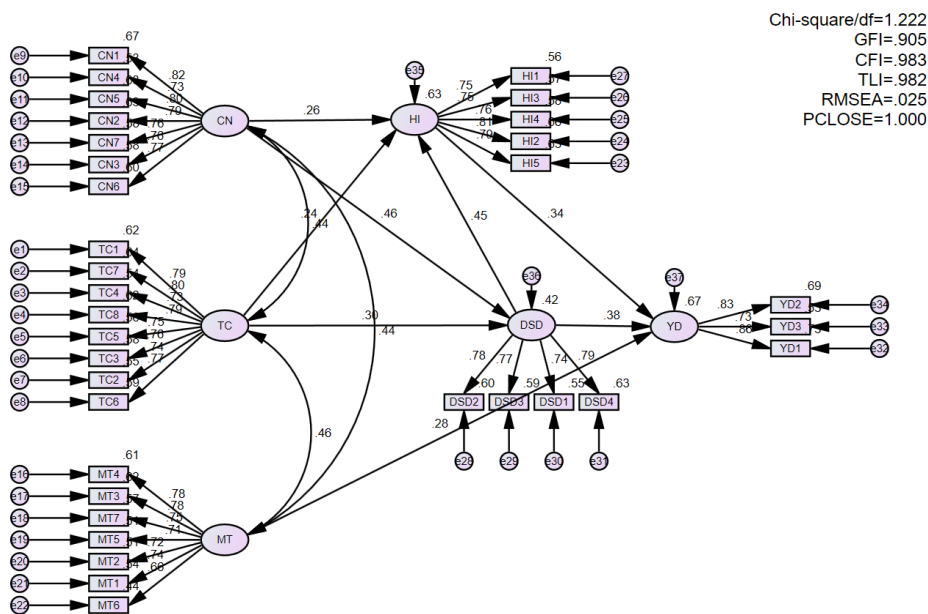


Figure 3. Structural Model
Source: Investigated by authors in 2022

The properties of the structural model including beta coefficient, standard error, critical ratio and the results of hypotheses are given in **Table 3**. The significance level is set at 0.05. Squared multiple correlation R^2 , which is the testimony of the model strength, is reported in **Table 3**. The research model explained 67%, 63.1%, and 41.7%, of the variance in INT, PU, and PEOU, respectively.

Table 3. Summary of Testing of Hypothesis

	Estimates (β)	Unstandardized Regression weight	S. E	CR	P	Squared Multiple correlation	Results
PEU \leftarrow TC	0.457	0.471	0.064	7.367	***	0.417	Supported
PEU \leftarrow OC	0.297	0.331	0.066	5.029	***		Supported
PU \leftarrow TC	0.263	0.262	0.057	4.578	***	0.631	Supported
PU \leftarrow OC	0.241	0.260	0.057	4.592	***		Supported
PU \leftarrow PEU	0.448	0.431	0.064	6.770	***		Supported
INT \leftarrow EC	0.285	0.297	0.050	5.897	***	0.670	Supported
INT \leftarrow PEU	0.379	0.353	0.069	5.151	***		Supported
INT \leftarrow PU	0.339	0.328	0.071	4.648	***		Supported

Source: Investigated by authors in 2022

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The results of hypothesis testing are shown in Table 3, where beta coefficients represent the proportional relevance of each antecedent of responsible consumption. All proposed relationships are proven to be valid.

All three determinants of intention to adopt e-commerce platforms for produce retail are significant with distinct beta coefficients, contributing various weights to the variance of intention to apply e-commerce platforms into fresh produce retail activities.

The most influential factor impacting the intention to adopt e-commerce platforms for produce retail is perceived ease of use ($\beta=0.379$; $p<0.05$). This supports H7 stating that Perceived ease of use positively affects INT. The second important antecedent of intention to adopt e-commerce platforms is perceived usefulness ($\beta=0.339$; $p<0.05$). So H6, namely perceived usefulness positively influences INT, is backed up. The third factor is the economic context ($\beta=0.285$; $p<0.05$), which supports hypothesis H5.

Regarding the antecedents of PEU, both TC and OC have $p<0.05$ with $\beta=0.457$ and 0.297 respectively. Thus, H2, technological context positively impacts PEU, and H4, organizational context exerts a positive influence on PEU, are supported.

Concerning the antecedents of PU, both TC and OC have $p<0.05$ with $\beta=0.263$ and 0.241 respectively. Therefore, H1 stating that the effect of technological context on PU is positive and H3, the organizational context has a positive effect on PU, are supported.

V. RECOMMENDATIONS

From the research results, the authors put forward several recommendations as follows. For farmers in general, they should be more active in participating in the e-commerce platforms for product retail due to their various benefits, especially to keep up with the current trend of digital transformation. Before participating, farmers may consult with experienced groups and experts to acknowledge the ease of use as well as the benefits that e-commerce retail can reap. Moreover, despite the availability of e-commerce-relevant training courses, farmers should take the initiative in selecting standard ones to effectively learn and apply this retail practice.

For farmers who have been using e-commerce platforms, sharing personal experience can be of great reference value to other farmers and officials. This can help relevant factors find solutions to the technical difficulties so that farmers can effectively apply this retail method. Also, sharing first-hand experience can expand the social network of users, together with profitable business relationships. Altogether, this facilitates the application of e-commerce platforms in agriculture, which subsequently paves the way for the acceleration of digital transformation in other industries.

For e-commerce platforms, it is recommended that they update contemporary trends and innovations to provide farmers with timely updated and efficient services. Instructions should be available and accessible both online and offline, because perceived ease of use was proven to be the most influential factor in farmers' intention in this study. In addition, farmers' participations are, as shown, determined by environmental factors, which raises the need to promote users' evaluation and peer-initiated invitations. E-commerce platforms should also focus on disseminating their preeminence of fresh produce retailing on social media so that more farmers can acknowledge the need to join them.

For the government, they should act as the leading force with practical and specific supportive policies. While governmental orders are necessary to get farmers involved in e-commerce platforms, positive stimulation is recommended instead of authoritarian enforcement, since this is likely to be counter-productive in promoting the participation of farmers. Furthermore, local authorities and cooperatives, who directly interact with farmers, should have sufficient knowledge, a sense of responsibility and patience in assisting the residents, particularly the middle-aged and above, in e-commerce operations. Close assessment and companion with farmers should also be maintained to make timely support and policy modifications. Besides, the government needs to continue bolstering the infrastructure, namely Internet penetration, logistics systems and professional training courses and the like.

CONCLUSIONS

In this study, the determinants of farmers' intention towards adopting e-commerce in fresh produce retailing were analyzed by the integrated TOE and TAM model. Emerging among the findings are notable insights that enrich literature about e-commerce platforms adoption. From the results, three factors directly affect farmers' intention to accept e-commerce platforms as a retail channel for agricultural products. Specifically, the perception about ease of use and usefulness respectively exerts the most considerable positive influence on the intention of farmers towards retailing fresh produce through e-commerce platforms. Also, the environmental context is another important factor when finding solutions to encourage Vietnamese farmers to contribute to the Agri-e-commerce development. Meanwhile, the impacts of technology and organization contexts on perceived ease of use and perceived usefulness suggest that not only the farmers themselves but also the e-commerce platforms are critical to this retail channel adoption.

The main limitation of this research lies in the sample size which can be improved to represent the Vietnamese farmers' population. Yet, this study enriches the extant literature on the intention of farmers towards adopting e-commerce platforms as a retail channel for fresh produce. The authors hope future studies can achieve a sample size that is sufficient to establish the findings' generalizability. Also, in-depth direct interviews are of great value to offer more meaningful insights.

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ACKNOWLEDGMENT

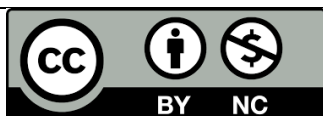
The authors genuinely appreciate IJSSHR for the opportunity to publish this research. The contribution of Michael Shell and IJSSHR's teams for creating the IJSSHR LaTeX style is also acknowledged. We are deeply grateful to the support of Nhung Thi Nguyen in connecting with the farmers for interviews and surveys. Moreover, the participation of all farmers, e-commerce platforms officers and experts are recognized.

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