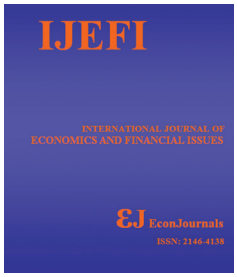

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Integration of Digital Technology to E-Commerce Transactions as a Basis for Central Digital Currency Development

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ABSTRACT

This study analyses the effect of digital technology integration on e-commerce transactions as a basis for Central Digital Currency (CBDC) development. By taking into account independent variables such as the number of internet users and the number of mobile device users, this study identifies the correlation between the development of digital technology and the adoption of e-commerce transactions with the potential implementation of Central Digital Currency (CBDC). Using the panel data regression analysis method, the results show a significant relationship between digital technology and an increase in the volume of e-commerce transactions, which can accelerate the development of Central Digital Currency (CBDC). The findings also strengthen the argument that the increased use of digital technology can be an important indicator in the development of digital currencies by central banks. This study suggests the need for more comprehensive regulations in support of the digital ecosystem and infrastructure readiness for Central Digital Currency (CBDC) in the future.

Keywords: Digital Technology, Internet Users, Mobile Device Users, E-commerce, Central Digital Currency
JEL Classifications: E42, F15, L81, O33, G28

1. INTRODUCTION

The rapid development of digital technology has transformed various sectors of the global economy, including the financial industry, which is experiencing significant changes due to the expansion of e-commerce and digital payment systems (Chen and Zhao, 2022). The growth of e-commerce transactions not only reflects consumer preferences increasingly turning to digital solutions, but also represents a broader economic trend towards digitalisation (Doe and Smith, 2021). In ASEAN member states, the adoption of digital technology is becoming an important element in supporting trade, payments and financial inclusion (Rahman and Lim, 2020).

The increasing number of internet users presents a great opportunity for innovation in digital payments. One such innovation is the development of Central Bank Digital Currency (CBDC), which is a digital form of state currency that has the potential to revolutionize national and regional financial systems (Lee and Wang, 2021). Central Bank Digital Currency (CBDC) can provide a secure, efficient and scalable transaction medium, especially in regions where traditional banking infrastructure may be underdeveloped or fragmented (Morris and Natarajan, 2022).

The significance of Central Bank Digital Currency (CBDC) in the ASEAN region is twofold. Firstly, Central Bank Digital Currency (CBDC) offers a solution to the growing need for cross-border transactions that are often challenged by currency conversion costs and differences in regulatory frameworks between countries. Second, Central Bank Digital Currency (CBDC) provides greater opportunities for financial inclusion, especially for the unbanked or underbanked, by opening up access to the formal financial system

through digital platforms (Tan and Ng, 2023). The increase in the number of internet users and the number of mobile device users in the ASEAN region indicates the readiness of countries in the region to adopt digital financial innovations, where Central Bank Digital Currency (CBDC) acts as a key instrument in promoting financial inclusion and economic integration (Sari and Kumar, 2022).

This research will analyze the impact of the number of internet users and the number of mobile device users on e-commerce growth and see how these factors contribute to the readiness of ASEAN countries to adopt Central Bank Digital Currency (CBDC), thereby providing strategic insights into the use of digital technology to accelerate economic integration, improve the efficiency of cross-border payments, and promote greater financial inclusion through the introduction of Central Bank Digital Currency (Jamal and Lee, 2023).

2. LITERATURE REVIEW

E-commerce is defined as any business activity that involves electronic transactions, and internet technology plays a central role in accelerating the global trade process (Kumar and Sharma, 2022). E-commerce can also be defined as the use of the internet to conduct business transactions nationally and internationally (Li and Zhang, 2021). E-commerce has taken on two important roles, namely as a more effective and efficient channel and aggregator of information and as a potential mechanism to replace many economic activities that were once carried out in a business entity (Chen and Lee, 2022). E-commerce is also a link between service or goods providers and consumers. Through e-commerce, everyone has the same opportunities and chances to succeed and compete in the business world (Wang and Zhang, 2023).

The growing number of internet users, as observed in the ASEAN region, has expanded the reach of the global market, thus facilitating cross-border economic interactions with higher efficiency (Nguyen and Tran, 2022). In line with this, research by (Hagiu and Wright, 2020) emphasises that the presence of digital technologies, such as the use of mobile devices and digital platforms, has opened up wider market access, reduced physical barriers, and lowered transaction costs. With the increasing involvement of society in the digital economy, there is a great opportunity for the development of more innovative and decentralised payment systems, including Central Digital Currency (Aditya and Hendra, 2023).

The concept of Central Digital Currency (CBDC) has become increasingly relevant in recent years in response to the rapid development of financial technology and the growing need for efficiency in global payment systems (Fadli and Surya, 2023). Central Digital Currency (CBDC) is defined as a digital form of fiat currency issued by a central bank and strictly regulated to facilitate electronic transactions more securely and quickly (BIS, 2020). Research by (Auer et al. 2021) indicates that Central Digital Currency (CBDC) has the potential to improve monetary stability and accelerate financial inclusion, especially in developing countries such as ASEAN that still face challenges in accessing formal finance.

In ASEAN, the digitalisation of the financial sector is experiencing significant growth, supported by the development of technological infrastructure and high internet users (Rahman and Tan, 2022). A study conducted by (Ali et al. 2020) highlighted that with the increasing number of internet users and mobile device users in the ASEAN region, there is great potential to encourage the development of Central Digital Currency (CBDC). In addition, a report from the International Monetary Fund shows that developing countries in ASEAN, such as Indonesia, Thailand, and Vietnam, have shown readiness in adopting digital technology in the financial sector.

3. RESEARCH METHOD

3.1. Research Scope

The scope of this research includes an in-depth analysis of the integration of digital technology into e-commerce transactions, which provides a strong foundation for the development of Central Digital Currency as a more secure, efficient and globally integrated means of payment. The analysis involves quantitative data processing to identify the influence relationship of digital variables such as the number of internet users, the number of mobile device users and the level of e-commerce transactions. Secondary data sources were obtained from the World Bank and Asean.org. The data analysis in this study involves collecting and processing quantitative data to identify the relationship between digital technology and digital economic growth, as well as its impact on monetary stability and payment systems. As such, this research provides strategic insights into the potential and challenges faced in realising digital technology integration in the development of a Central Digital Currency.

3.2. Panel Data Regression Model

According to (Baltagi, 2005) panel data is generated from observations of a number of individuals monitored over several different time spans. Panel data regression analysis aims to estimate and predict differences in characteristics between individuals or between times and find the middle value of the data set (both sample and population) by observing the relationship between the variable under study dependent variable and the variable used to explain it independent variable (Widarjono, 2013). Then mathematically the regression model of this study is arranged as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon \quad (3.1)$$

Description:
Y: E-commerce transaction rate (TEC) (%)
β_0: Intercept
β_1, β_2: Regression Coefficient
X_1: Number of Internet Users (UI) (%)
X_2: Number of Mobile Device Users (MCU) (%)
ε: Error Term

3.3. Data Analysis Procedure

3.3.1. Descriptive statistical analysis

Descriptive statistical analysis aims to provide a comprehensive view of the variables used in the study. This analysis functions in

descriptions that include the mean and median of a set of sorted data. In addition, this analysis includes data distribution such as maximum value, minimum value, and standard deviation value as an indicator of data distribution in research (Smith and Johnson, 2022).

3.3.2. Classical assumption testing

The classic assumption test is a series of tests carried out to ensure that the regression model used fulfils the basic assumptions necessary for the regression results to be reliable. These assumptions are important to obtain unbiased, consistent, and efficient estimates of model parameters by going through tests of normality, multicollinearity, heteroscedasticity, and autocorrelation (Anderson and Lee, 2023).

3.3.3. Panel data regression estimation model selection

In panel data analysis, the three main models often used for estimation are the Common Effect Model, Fixed Effect Model, and Random Effect Model. To determine the most appropriate model, a series of tests such as the chow test, hausman test, and Breusch-pagan Lagrange multiplier test are required (Gujarati, 2015).

3.3.4. Hypothesis testing

Hypothesis testing plays a role in drawing research conclusions and assessing the accuracy of the data, consisting of three forms of testing including the t test, f test, and the Coefficient of Determination Test (Williams and Thompson, 2022).

4. RESULTS AND DISCUSSION

4.1. Descriptive Statistical Analysis

Descriptive statistical analysis functions in descriptions that include the mean and median of a set of sorted data. In addition, this analysis includes data distribution such as maximum value, minimum value, and standard deviation value as an indicator of data distribution in the study.

Based on Table 1, the average level of e-commerce transactions as measured by the TEC value of the observation sample in ASEAN during the 2015-2021 period is 4.138730 with a median value of 2.190000 and a maximum value of 50.08000 and a minimum value of 0.050000. The average value of the variable number of internet users (UI) is 3.884946 with a median value of 3.964155 and a maximum value of 4.585783 and a minimum value of 2.388763. The average variable number of mobile device users (MCU) is 4.796069 with a median value of 4.873754 and a maximum value of 5.202726 and a minimum value of 3.942472.

4.2. Classical Assumptions

Based on the normality test using the Skewness Kurtosis method, the probability is 0.147933 > 0.05 (Table 2). Then the skewness value of 1.045340 and the kurtosis value of 1.239515 indicate that the data follows a normal distribution pattern.

Based on the results of the multicollinearity test, it was found that there were no variables with relationships exceeding a correlation value of 8 (Table 3). Therefore, it can be concluded that there is no significant multicollinearity between the independent variables used in this study. This means that the variables do not show a strong linear relationship or lack of significant interrelationships among others, so there is no significant interdependence.

Table 1: Descriptive statistical analysis results

Statistical classifications	UI (X1)	MCU (X2)	TEC (Y)
Mean	3.884946	4.796069	4.138730
Median	3.964155	4.873754	2.190000
Maximum	4.585783	5.202726	50.08000
Minimum	2.388763	3.942472	0.050000

Source: Research results year 2024

Table 2: Normality test

Distribution parameters	Statistic	Prob
Skewness	1.045340	0.147933
Skewness 3/5	1.717730	0.042923
Kurtosis	1.239515	0.107577
Normality	2.272491	0.321022

Source: Research results year 2024

Table 3: Multicollinearity test

Variables	UI (X1)	MCU (X2)
UI (X1)	1.000000	0.417746
MCU (X2)	0.417746	1.000000

Source: Research results year 2024

Table 4: Heteroscedasticity test

Dependent variables	Chi-Sq. statistic	Chi-square table	Conclusion
2	0.539880	5.99146	Free of heteroscedasticity

Source: Research results year 2024

Table 5: Autocorrelation test

Dependent variables	Chi-Sq. statistic	Chi-square table	Conclusions
1	0.614134	3.84146	Free of autocorrelation

Source: Research results year 2024

The heteroscedasticity test shows that Chi-square count 0.539880 < Chi-square Table 5.99146 at df of independent variables = 2 with probability level > 0.05. This means Ho is rejected so there is no heteroscedasticity problem in the equation (Table 4).

Based on the test results in Table 5, it shows that the calculated Chi-Square value is 0.614134 < Chi-square table 3.84146 at degree of freedom of lag length = 1 with 5% significance level. This results in the rejection of H0 indicating that there is no autocorrelation in the equation.

4.3. Model Selection

The Chow test results found that the Chi-square statistic (57.611111) > Chi-square table (15.50731) at degree of freedom = 8.52 with a probability level of 0.0000 < 0.05 means rejecting H_0 so that the Fix effect model should be used (Table 6).

The Hausman Test results found that the statistical Chi-square value is 7.424128> Chi-square table 5.99146 at degrees of freedom = 2 with a significant level of 0.2044> 0.05, so H0 is rejected (Table 7). Therefore, the Fixed Effect model is the preferred choice.

Table 6: Chow test

No	Test summary	Chi-square statistic	Chi-square Df	Prob.	Conclusions
1	Fix Effect Model	57.611111	8.52	0.0000	H_0 accepted

Source: Research results year 2024

Table 7: Hausman test

No	Test summary	Chi-square Statistic	Chi-square Df	Prob.	Conclusions
1	Random effect model	7.424128	2	0.2044	H_a accepted

Source: Research results year 2024

Table 8: Results of OLS calculation of panel data regression equations for selected FEM models

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	30.41731	30.20201	1.007129	0.3185
UI (X1)	10.68664	2.394955	4.462148	0.0000
TEC (X2)	14.13566	6.941743	2.036328	0.0468

Source: Research results year 2024

The regression calculation results, as displayed in Table 8, show a confidence level of 0.5% which is then transformed into mathematical form as follows:

$$Y = 30.4173091598 + 10.6866440008*X_1 + 14.1356625416*X_2$$

F-Stat = 8.276192

$R_2 = 0.614134$

4.4. Statistical Hypothesis Test

1. The t-test results show that the variable number of internet users has a t-count of 4.462148 which is greater than the t-table value of 1.671 with a probability level of 0.0000 < 0.05, which means rejecting H_0 so that the variable number of internet users has a significant effect on the level of e-commerce transactions as a basis for developing central digital currency (Table 9).
2. The t-test results show that the variable number of mobile device users has a t-count of 2.036328, this value is smaller than the t-table value of 1.671 with a probability level of 0.0468 <0.05, which means rejecting H0, indicating that the variable number of mobile device users has a significant effect on the level of e-commerce transactions as a basis for developing central digital currency.

From the F statistical value obtained, in Table 10 it can be concluded that H_0 is rejected because the F Statistical value of 8.276192> F table value of 3.150 these findings indicate that statistically the variable number of internet users and the number of mobile device users together have a significant effect on e-commerce transactions as the basis for the development of Central Digital Currency (CBDC).

Based on the regression results, the R-Squared value of 0.614134 indicates that 61% of the variation in the variable level of e-commerce transactions as the basis for the development of central digital currency can be explained by the variable number of internet users and the number of mobile device users. While 39% of other variations are outside the panel data regression model.

Table 9: t-statistic test

Variable	t-statistics	t-table	Probabilities	Conclusion
UI (X1)	4.462148	1.671	0.0000	H_0 rejected
TEC (X2)	2.036328	1.671	0.0468	H_0 rejected

Source: Research results year 2024

Table 10: Statistical F test results

F-statistics	F-table	Conclusions
8.276192	3.150	H_0 rejected

Source: Research results year 2024

Based on the results of panel data regression analysis, it is found that the number of internet users (UI) and the number of mobile device users (MCU) significantly affect the level of e-commerce transactions (TEC). This indicates that the digital ecosystem in ASEAN is mature enough to support the adoption of central bank digital currency (Halim and Widodo, 2023). The use of Central Digital Currency (CBDC) is expected to overcome several challenges faced in e-commerce transactions, such as:

a. Security and speed of transactions
   The blockchain technology underlying Central Digital Currency (CBDC) can improve transaction security and minimize the risk of fraud, which is still an important issue in digital transactions (Rahman and Ali, 2023).
b. Cross-border transactions
   ASEAN is a region with a high volume of cross-border trade, and the use of Central Digital Currency (CBDC) can simplify cross-border transactions by reducing currency conversion costs and speeding up the settlement process (Nguyen and Pham, 2023).
c. Payment system efficiency
   Central Digital Currency (CBDC) is expected to lower transaction costs and reduce dependence on traditional banking systems and third parties that generally involve higher costs (Sari and Budi, 2023).

The research also highlights how increasing digital literacy and the number of mobile device users play an important role in improving financial inclusion. Based on the descriptive data, it can be seen that the average number of mobile device users in ASEAN is significant, reflecting that people in the ASEAN region already have widespread access to digital infrastructure. The development of Central Digital Currency (CBDC) has the potential to further drive financial inclusion, especially for populations previously underserved by traditional banking systems, such as rural residents or informal sector workers who rely on cash payments (Junaidi and Wati, 2023). According to a World Bank report, in many

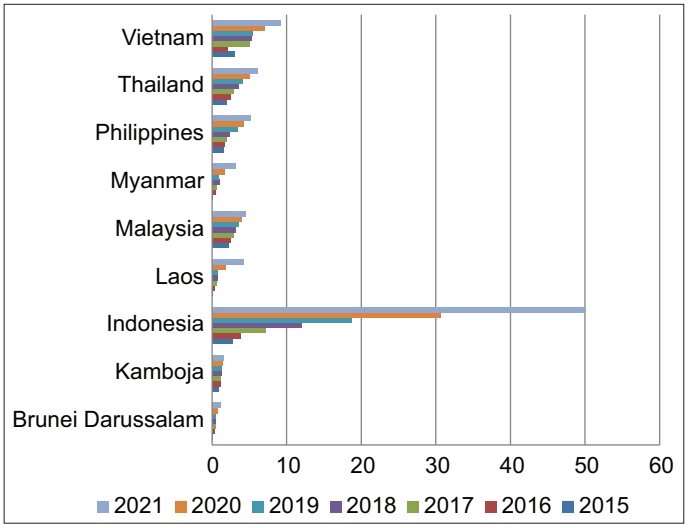
developing countries, including in ASEAN, there are 1.7 billion people who do not have access to formal banking services. Central Digital Currency (CBDC) can provide an innovative solution to facilitate access to digital finance by providing an easily accessible and secure means of payment (World Bank, 2023). This could open up new opportunities for people to participate in the digital economy, expand e-commerce market share, and promote more inclusive economic growth.

The significant growth of e-commerce transactions in ASEAN could drive the digital economic revolution and create the need for more efficient and secure payment systems (Nguyen and Le, 2023). The increasing number of internet users (UI) and the number of mobile device users (MCU), as shown by the regression analysis results in this study, provides a strong basis for the development of Central Digital Currency (CBDC). This phenomenon is in line with the global trend where digitization of the financial sector has become an important agenda in economic transformation, especially in developing and developed countries that are striving to increase financial inclusion and reduce dependence on physical cash (Figure 1).

Vietnam is one of the fastest growing digital economies in ASEAN. With 70% of internet users, Vietnam is also one of the largest e-commerce markets in the ASEAN region. The State Bank of Vietnam has begun research into the development of a Central Digital Currency (CBDC), especially after the explosion of interest in cryptocurrencies. However, regulations related to digital currencies are still under development. On the other hand, the Vietnamese government has committed to developing digital infrastructure to support technology-based economic transformation. The development of Central Digital Currency (CBDC) in Vietnam has the potential to expand access to finance, especially in remote areas, and strengthen the country's position in the ASEAN digital economy (Tran and Nguyen, 2023).

Thailand has shown high commitment in exploring the potential of Central Digital Currency (CBDC) through the Bank of Thailand (BoT). A Central Digital Currency (CBDC) pilot project for transactions has been implemented with the aim of improving the efficiency of the interbank payment system. Meanwhile, Thailand is also experiencing rapid growth in e-commerce usage by 2023 to reach a value of over USD 26 billion. The Bank of Thailand continues to explore the implementation of Central Digital Currency (CBDC) to increase financial inclusion, especially for people who are underserved by the traditional banking system. One of the key challenges faced is the inequality of digital access between major cities and rural areas, which requires improved technological infrastructure to support wider adoption (Chai and Prasert, 2023).

Figure 1: ASEAN E-commerce transaction development 2015-2021



The Philippines is one of the countries with rapid uptake of digital financial technology, especially in the remittance sector. The Central Bank of the Philippines (BSP) has been exploring the potential of Central Digital Currency (CBDC) as a means to accelerate financial inclusion. With over 70% of the population having internet access, the Philippines also has a rapidly growing e-commerce user base. However, the biggest challenge in the development of Central Digital Currency (CBDC) in the Philippines is the unequal access to digital infrastructure, especially in remote areas. With improved infrastructure and increased access to digital finance, Central Digital Currency (CBDC) in the Philippines has the potential to reduce dependence on conventional payment systems and support transactions (Lara and Mendoza, 2023).

Myanmar is one of the ASEAN countries that faces the biggest challenge in terms of digital infrastructure. With an internet user rate of around 30%, the country is still in the early stages of digital technology adoption. The Myanmar government has not shown any signs of serious exploration of Central Digital Currency (CBDC), given the unstable political and economic situation. However, the potential of Central Digital Currency (CBDC) in Myanmar lies in its ability to provide financial access to a population that does not have access to formal banks. If political stability is achieved and digital infrastructure is improved, Central Digital Currency (CBDC) could play a role in accelerating the digital economic transformation in Myanmar (Soe and Tun, 2023).

Malaysia has one of the best digital technology infrastructures in ASEAN. According to a report from Bank Negara Malaysia (BNM), internet users reach 89%, and e-commerce is growing significantly, estimated to be worth 120 billion by 2023. Bank Negara Malaysia has initiated a study on Central Digital Currency (CBDC), although its implementation is still in the exploratory stage. Malaysia faces regulatory challenges to balance digital innovation and cybersecurity. However, with a mature digital infrastructure and government commitment to support the adoption of blockchain technology, Malaysia has great potential in developing a Central Digital Currency (CBDC) to improve the efficiency of the national payment system and support digital economic integration in ASEAN (Rahman and Tan, 2023).

Laos is still in the early stages of digital technology development. Internet users are relatively low compared to other ASEAN countries, around 43% in 2023. Laos is still lagging behind in terms of e-commerce adoption and technology infrastructure,

which is a major bottleneck in the development of the Central Digital Currency (CBDC). However, with the help of foreign investment and digital infrastructure improvement programs from neighboring countries, Laos has the potential to increase access to digital finance in the next few years. If the digital infrastructure is improved, the Central Digital Currency (CBDC) could become an important tool in accelerating the transformation of Laos' currently agriculture-based economy (Phommasack and Seng, 2023).

Indonesia, as one of the largest economies in ASEAN, has experienced significant growth in e-commerce transactions. Based on data, the number of internet users in Indonesia reaches more than 200 million people, with the contribution of the digital economy increasing every year (Setiawan and Raharjo, 2023). This technology in the e-commerce sector provides a strong foundation for the development of Central Digital Currency (CBDC) in the future. The "Garuda" project, which is being developed by Bank Indonesia, is a Central Digital Currency (CBDC) initiative that aims to increase financial inclusion across Indonesia. In addition, the implementation of Central Digital Currency (CBDC) in Indonesia is expected to address some of the issues faced by the traditional financial sector, such as high cross-border transaction costs and lack of access to banking services in remote areas (Hendarto and Sari, 2023). This finding is in line with research (Prasetyo and Lestari, 2023) which highlights that countries with better digital infrastructure, such as Indonesia, will have a greater chance of success in Central Digital Currency (CBDC) implementation.

Cambodia is one of the ASEAN countries that has launched a Central Digital Currency (CBDC) known as Bakong. Launched by the National Bank of Cambodia (NBC), Bakong is a blockchain-based payment platform designed to increase financial inclusion and reduce dependence on the US dollar. Bakong has managed to reach more than 200,000 users since its launch. This shows that Central Digital Currency (CBDC) can help accelerate access to finance. Bakong's success is an attractive model for other ASEAN countries to implement Central Digital Currency (CBDC) with a focus on financial inclusion (Chhay and Kim, 2023).

Brunei Darussalam has a high level of technology adoption with more than 95% internet users. The Brunei Darussalam Central Bank (BDCB) has been observing the development of Central Digital Currency (CBDC) globally, although there are no concrete steps for the implementation stage. As a country with a dominant oil and gas sector, Brunei Darussalam sees the potential of using Central Digital Currency (CBDC) in strengthening the efficiency of domestic and cross-border payment systems. A key challenge in Brunei Darussalam is economic diversification and reducing dependence on the energy sector, which can be supported by the development of the digital technology sector, including the adoption of Central Digital Currency (Hussain and Farah, 2023).

5. CONCLUSION AND SUGGESTIONS

This study confirms that the significant growth of e-commerce transactions in the ASEAN region not only reflects the progress of digitalization, but also provides a strong foundation for the development of a Central Digital Currency (CBDC). The results of panel data regression analysis show that the number of internet users (UI) and mobile device users (MCU) contribute significantly to the level of e-commerce transactions (TEC), indicating the maturity of the digital ecosystem in ASEAN. The implementation of Central Digital Currency (CBDC) is expected to improve the efficiency of the payment system, reduce transaction costs, and strengthen financial inclusion by providing wider access to the community, especially groups previously marginalized from banking services.

Monetary authorities in ASEAN need to pay more attention to the development of policies that support the integration of digital technology in the financial sector, with the adoption of Central Digital Currency (CBDC). ASEAN countries also need to collaborate in creating a regional legal framework that enables.

Interoperability of digital currencies between countries, given the large volume of cross-border trade in the ASEAN region. Furthermore, the development and adoption of a Central Digital Currency (CBDC) in ASEAN should be considered as a long-term strategy that not only supports the growth of the e-commerce sector, but also enhances financial stability and social inclusion in the digital age.

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