The impact of digital transformation on financial inclusion: Evidence from MSMEs in Indonesia

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Abstract

The integration of digitalization in micro, small, and medium enterprises (MSMEs) has become a cornerstone in enabling these businesses to thrive within an increasingly competitive and dynamic marketplace. This study, based on data from a survey of 5,553 MSMEs, examines the impact of digitalization on financial inclusion and enterprise productivity. The findings reveal that digitalization reduces MSMEs' dependence on traditional banking systems for credit, facilitating access to alternative financing options through internet-based technologies. Moreover, advancements in technology contribute to increased bank loans and improved MSME productivity by overcoming conventional barriers to financial inclusion and reaching previously underserved segments of the MSME sector. The adoption of formal business status fosters structured and organized operations, thereby enhancing overall performance, while the mere longevity of a business does not guarantee increased productivity. Additionally, improved financial management skills acquired through training are shown to diminish reliance on traditional bank financing. The study also highlights the adverse effects of the COVID-19 pandemic, including lockdown measures, supply chain disruptions, and changes in consumer behavior, which collectively led to a decline in MSME productivity.

Keywords: *Bank loans, Digitalization, Financial inclusion, MSMEs, Productivity*

JEL Classification: G21, O12, O33

INTRODUCTION

The utilization of digitalization for Micro, Small, and Medium Enterprises (MSMEs) has been a game-changer. In recent years, these businesses have harnessed digital tools and technologies to overcome traditional barriers, adopting digital marketing, e-commerce, and social media to establish a significant online presence and reach a broader customer base (Rozak et al., 2023). This has allowed MSMEs to optimize their operations, reduce costs, and enhance overall efficiency and productivity (Bataineh et al., 2022; Bouwman et al., 2019). Furthermore, digitalization has facilitated access to global markets, enabling MSMEs to engage in international trade, expanding

their horizons (Lopez-Gonzalez & Ferencz, 2018), and fostering economic growth and job creation (Gruber, 2019).

The digitalization of the financial sector represents a seismic shift in how financial services are delivered and consumed. With the advent of digital technologies, traditional banking and financial institutions have undergone significant transformations (Rumyantseva et al., 2020) and increased accessibility (Werth et al., 2020). This shift has not only brought unparalleled convenience to consumers but has also facilitated financial inclusion by reaching underserved populations. As the financial sector continues to evolve, digitalization promises to reshape the industry further, emphasizing customer-centricity, efficiency, and security in an increasingly interconnected world (Ludmila et al., 2018).

In Indonesia, the growth of digitalization is driven by the increasing use of the internet and smartphones. A survey by the Indonesian Internet Services Provider Association (APJII) reveals that the number of internet and smartphone users has risen annually, reaching 64.8% in 2018, 73.7% in 2020, 77.01% in 2022, and 78.19% in 2023. This ongoing expansion in internet usage further accelerates the progress of digitalization. As a result, financial services have broadened, with the 2024 National Survey of Financial Literacy and Inclusion (SNLIK) reporting a financial inclusion index of 75.02%, savings accounts totaling 2,769 per 1,000 people, and credit accounts reaching 428 per 1,000 people. However, despite the rise in financial inclusion, a significant portion of the Indonesian population remains unbanked, with around 97.7 million individuals, or 48% of the population, still lacking access to financial services.

Digital technology adaptations have primarily benefited large-scale companies, leaving smaller enterprises behind. Small businesses often rely on simpler technologies and may lack innovative leaders who readily embrace new tools and technological advancements (Surya et al., 2021). While the potential for digital technology to revolutionize financial processes is evident, its full realization remains limited due to low digital financing among MSMEs (Klein & Todesco, 2021). MSMEs struggle to grasp the intricacies of digital financial tools, which hampers their ability to harness these technologies effectively (Leona Niemeyer et al., 2020; Wiesner et al., 2018). Financial constraints often restrict their capacity to invest in digital infrastructure or hire skilled personnel.

Access to finance stands as the most formidable obstacle facing MSMEs, profoundly impacting their sales and employee growth (Rupeika-Apoga, 2014). The difficulties in securing financial support arise from a complex interplay of factors, including the absence of tangible collateral, prolonged bureaucratic processes, and doubts regarding the repayment capabilities of MSMEs (Singh & Wasdani, 2014). This convergence of challenges leaves a significant segment of the approximately 18 million MSMEs in Indonesia without formal financial access, while another 46 million continue to seek additional funding for their operations.

One pivotal mechanism facilitating MSMEs in attaining financial support is financial inclusion. Financial inclusion is of significant importance for the growth and productivity of MSMEs (Ratnawati, 2020; Thathsarani & Jianguo, 2022), as it grants MSMEs the ability to access formal channels of external financing, enabling them to enhance their business operations and achieve expansion (Atkinson, 2017). This inclusive financial approach exerts both direct and indirect influences on the

performance of MSMEs, manifesting in diverse areas such as market share expansion, workforce growth, increased sales volumes, and enhanced profitability.

The impact of digitalization on financial inclusion for MSMEs is multifaceted. It enables MSMEs to access financial services through various digital channels, such as mobile banking apps and online lending platforms, without the need for a physical presence. This accessibility is particularly valuable for MSMEs in underserved or remote areas where traditional banking infrastructure is limited, expanding their reach and opportunities. Additionally, digitalization simplifies the lending process by allowing automated creditworthiness assessments, reducing administrative delays, and lowering the cost of loan origination. This makes it more attractive for financial institutions to serve MSMEs, particularly those with limited credit history or collateral. Digital financial services also contribute to greater transparency and security, as transactions and financial data can be tracked digitally, minimizing fraud and corruption. This, in turn, builds trust between financial institutions and MSMEs. By leveraging digital technologies, these enterprises gain easier access to financial services and opportunities that were once out of reach (Dluhopolskyi et al., 2023). Digitalization enhances access to financial resources, empowering MSMEs to invest in their growth, create jobs, and contribute to economic development, fostering a more inclusive and vibrant business environment (Ghassibe et al., 2019; Kazemikhasragh & Buoni Pineda, 2022; Ndombi Avouba et al., 2023).

Research on the impact of digitalization on financial inclusion and its effects on the productivity of MSMEs in Indonesia remains somewhat limited. However, existing studies conducted in other nations, such as China (Ye et al., 2022), Malaysia (Ilias et al., 2023), India (Yadav & Shaikh, 2023), Sri Lanka (Thathsarani & Jianguo, 2022), and globally (Allen et al., 2022; Khando et al., 2023), demonstrate that digitalization is more effective than conventional approaches in mitigating financial constraints encountered by SMEs and bolstering financial inclusion. These studies provide a foundation for understanding the broader impact of digitalization. Yet, they largely focus on different economic and regulatory environments, leaving a gap in understanding how digitalization functions in the Indonesian context. This study seeks to address this gap by examining the role of digitalization in fostering financial inclusion among MSMEs in Indonesia, where unique challenges, such as a large unbanked population and varying business characteristics, exist. The accessibility of financial services to this sector emerges as a pivotal determinant in elevating MSME productivity and enhancing their resilience to economic shocks.

While further research is warranted to gain comprehensive insights into the precise role of digitalization in fostering financial inclusion and augmenting MSME productivity in Indonesia, ongoing initiatives and strategies highlight the critical importance of digitalization in advancing financial inclusion and supporting the growth of MSMEs.

This study has two primary objectives: first, to examine how digitalization strengthens financial inclusion, and second, to explore the relationship between digitalization and MSME performance. The research delves into the integrated impact of digitalization—focusing on internet use and technological improvement in business—on the performance of MSMEs in developing countries, particularly Indonesia, aiming to address this conceptual gap. The study's findings significantly

contribute to the MSME sector, as many MSMEs face challenges in accessing credit due to limited creditworthiness evidence. They are transitioning toward digital financing activities, utilizing financial documentation, business plans, and collateral instead of the conventional documentation often preferred by banks for credit lending. Conversely, the adoption of digital technology in MSME business operations is anticipated to reduce their dependence on manual labor.

METHODS

This study examines the impact of digitalization on the financial inclusion and performance of MSMEs, with digitalization represented by internet usage, financial inclusion indicated by the structure of loans to banks, and business performance assessed through labor productivity. The primary dataset used in this research is sourced from the 2020 Micro and Small Survey conducted by the Central Statistics Agency (BPS), utilizing data from the 2019 Economic Census (Bahagia et al., 2022). The survey specifically focuses on micro and small industries, defined by a workforce of fewer than 20 individuals. A stratified two-stage cluster sampling approach was employed, and data were collected through questionnaires administered during interviews. The sample size consists of 90,531 businesses across diverse regions, including 88,891 micro and small enterprises. This research focuses on businesses that have utilized capital from loans provided by bank financial institutions, resulting in a cohort of 5,553 respondents for analysis.

This study employed multiple linear regression analysis to address its two primary research questions. It explores the relationship between the percentage of loans obtained from banks and productivity, with the latter serving as the dependent variable. Specifically, the size of bank loans is expressed as a percentage, representing the proportion of a business unit's capital acquired through bank loans relative to its total capital. This calculation excludes bank loans facilitated by government assistance programs.

Profit was used as a proxy for output to measure productivity and determine the marginal productivity of labor. This was calculated by dividing profit by the total number of employees in each business. Each regression model used in the analysis will be explained in the following paragraphs.

The first model aims to examine the impact of internet utilization on the composition of bank loans. The study uses a model adapted from Mushtaq et al. (2022), with modifications to include several variables relevant to this study. The mathematical equation for this model is:

$$FI_i = \alpha_i + \beta_1 Internet_i + \beta_2 Technology_i + \beta_3 Class_i + \beta_4 Age_i + \beta_5 Entity_i + \beta_6 Establish_i + \beta_7 Training_i + \beta_8 Covid_i + \beta_9 Labor_i + \beta_{10} Profit_i + u_i \quad \ldots\ldots.(1)$$

In this equation, FIi represents the composition of business loans to banks as a percentage. Digital proficiency is represented by the variables $Interneti$ and Technology$i$, where a value of 1 indicates internet use and technological improvements in the business, and a value of 0 indicates otherwise. The variable C$lassi$ takes the value 1 for small classification and 0 for micro classification. Business classification is important as it directly affects access to formal financial markets, legal protection, and credibility with lenders, influencing financial inclusion. The age of the business owner

is included as the variable Age$i$, as it may impact business experience, decision-making, and adaptability to digital tools. The status of a business as a legal entity is represented by Entity$i$, and the variable Establish$i$ denotes the business's age in years. The study also includes the variable Training$i$ to indicate whether a business participated in the training. The variable $Covidi$ takes the value 1 if the business was affected by the COVID-19 pandemic and 0 if it was not. Additionally, the number of employees and profits are included as control variables.

The work of McKinnon (1973) and Shaw (1973) initiated research on financial inclusion, highlighting the role of financial liberalization in economic reforms in developing countries. In the 1980s and 1990s, financial reforms were implemented in many economies to deepen financial markets and improve access to formal financial services such as loans and savings (Arun & Kamath, 2015). Various indicators are used to measure financial inclusion, focusing on the availability, adoption, and usage of financial products (Susilowati & Leonnard, 2019). The usage of financial products is assessed by measuring the frequency of consumer interaction with these products over time, such as saving or obtaining loans (Datta & Singh, 2019). Financial inclusion is commonly assessed through surveys conducted by institutions like the World Bank or the IMF, which provide data on financial service access and usage by businesses and households, allowing for cross-country comparisons (Gutiérrez-Romero & Ahamed, 2021).

The second model examines the impact of digitalization on labor productivity. This study draws on variables used by Arvanitis & Loukis (2009) and Onkelinx et al. (2016) to calculate factors influencing labor productivity at the micro level. While previous studies have measured labor productivity using macroeconomic indicators (Bakas et al., 2020; Creemers et al., 2023; Shahnazi, 2021), this study uses profit as a proxy for company output, as discussed earlier. The mathematical equation for this model is:

$$BP_i = \alpha_i + \beta_1 Internet_i + \beta_2 Technology_i + \beta_3 Class_i + \beta_4 Age_i + \beta_5 Entity_i + \beta_6 Establish_i + \beta_7 Training_i + \beta_8 Covid_i + \beta_9 FI_i + u_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

This model investigates how digitalization, financial inclusion, and other factors influence business productivity, with a specific focus on the Indonesian MSME sector.

RESULTS AND DISCUSSION

The research data on Micro and Small Enterprises (MSEs) that take out bank loans reveal that the average composition of loans in this sample is approximately 41.36%, with the lowest being 0.35% and the highest reaching 99%. The average age of business owners is 45 years, ranging from a minimum of 18 years to a maximum of 87 years. Similarly, the average business age is 14 years, with the youngest business being 1 year old and the oldest 90 years. The typical micro or small business employs an average of between 3 and 4 people, with employment numbers ranging from 1 to 19 individuals. As of October 2020, the average profit earned by these enterprises was IDR 9,697,848, with profits ranging from a loss of IDR 53,789,752 to a maximum profit of approximately IDR 965,400,000. Table 1 presents the descriptive statistics of these variables.

Table 1. Descriptive statistics of Micro and Small Enterprises (MSEs)

Variable	Obs	Average	Std. Dev.	Min	Max
Bank Loan	5,553	41.358	20.417	0.35	99
Business Owner Age	5,553	45.099	9.615	18	87
Age of Business	5,553	14.032	9.274	1	90
Number of Labor	5,553	3.663	3.165	1	19
Profit	5,553	9,697,848.1	26,919,154	- 53,789,752	9.654e+08

Less than half of the businesses in the sample utilize the Internet for their operations. Regarding the adoption of new technologies for product innovation, only around 9% have implemented technological advancements. Approximately 77% of businesses are classified as industrial, and only 4% have formal legal entity status. Around 5% of the businesses participated in training programs, and most businesses, around 86%, were affected by COVID-19. Table 2 provides the frequency and percentage distribution of these categorical variables.

Table 2. Distribution of Micro and Small Enterprises (MSEs) characteristics by category

Variable	Obs	Yes		No	
		Frequency	%	Frequency	%
Internet Usage	5,553	2,182	39.29	3,371	60.71
Innovation Using Technology	5,553	522	9.40	5,031	90.60
Small Business Classification	5,553	4,293	77.31	1,260	22.69
Having business legality	5,553	217	3.91	5,336	96.09
Training Participation	5,553	289	5.20	5,264	94.80
COVID-19 impact	5,553	4,803	86.49	750	13.51

The research findings reveal a notable influence of digital technology usage on MSME (Micro, Small, and Medium Enterprises) loan behavior with banks. Specifically, MSMEs utilizing the Internet in their operations reduce the proportion of loans from banks in their capital structure by approximately 1%. This contrasts with the observed effect of new technology adoption in innovation, which increases bank loan composition by 1.586% when companies integrate new technology into their innovative activities. Additionally, participation in training programs by companies correlates with a reduction of approximately 2.4% in the proportion of loans to banks.

Regarding labor productivity, the innovation variable exerts a positive and significant impact. Companies that adopt product innovations using new technology experience a productivity increase of IDR 632,826 per worker. Furthermore, companies with legal business status demonstrate higher productivity, amounting to IDR 2,309,624 per worker. The research also highlights the negative impact of business longevity on workforce productivity. For each additional year of operation, the company's workforce productivity decreases by IDR 10,506 per worker. Finally, the study identifies a significant adverse effect of the COVID-19 pandemic on labor productivity, with a reduction of IDR 757,498 per worker.

The findings indicate that digitalization significantly influences financial inclusion, particularly in terms of MSME loans (Table 3). The observed reduction in MSME reliance on traditional bank loans due to internet usage suggests that digital technology facilitates access to alternative financing sources, such as crowdfunding

platforms, peer-to-peer lending, and online microloans. Internet adoption appears to enhance financial management practices among MSMEs, allowing for improved cash flow management and optimized funding strategies. By leveraging digital tools, MSMEs gain clearer insights into their financial health, reducing their dependence on conventional bank loans. These results align with Kaminskyi et al. (2022), who highlight the ongoing transformation of the credit market driven by digitalization. Alternative financing options often appeal to MSMEs due to their convenience, speed, and flexibility compared to traditional banking services.

Table 2. Estimation result

	Dependent: Financial Inclusion	Dependent: MSMEs Performance
Internet Usage	-1,113*	182.549,07
	(0,59)	(119.934,28)
Bank Loan	-	1.561,264
	-	(2526,783)
Innovation Using Technology	1,586*	632.826,91**
	(0,95)	(267.959,64)
Business Classification	-0,694	-13.943,188
	1,012	(163.713,64)
Business Owner Age	-0,026	-4.367,595
	(0,033)	(6.669,664)
Business Entity	0,374	2.309.624,8***
	(1,427)	(732.491,09)
Age of Business	0,021	-10.506,823*
	(0,034)	(6.304,165)
Training Participation	-2,401*	-209.205,04
	(1,226)	(307.426,22)
COVID-19 impact	1,237	-757.498,66***
	(0,802)	(192.579,07)
Number of Labor	-0,107	-
	(0,145)	-
Profit	0,00000000745	-
	(0,00000000912)	-
Constanta	43,038***	3.274.195,7***
	(1,969)	(413.851,79)

*Note: Standard errors are shown in parentheses; ***, **, * statistical significance at 1%, 5% and 10%*

Moreover, MSMEs engaged in online activities, such as e-commerce, can increase direct sales and revenue without the need for intermediaries, thereby reducing the necessity for loans, particularly for inventory management. Conversely, the adoption of new technologies in innovation tends to increase loan demand in the banking sector. The implementation of advanced technologies typically requires substantial investment in hardware, software, and IT infrastructure. MSMEs often rely on loans to finance these high initial costs, which are critical for acquiring and integrating such technologies into their operations.

Despite the widespread adoption of digital technology, particularly the Internet, in the business sector, this study finds that Internet usage does not significantly contribute to the productivity levels of MSMEs in Indonesia. This result contrasts with findings from Llopis-Albert et al. (2021) and Radicic & Petković (2023), which suggest that digital transformation leads to increased profits, productivity, and competitiveness. The limited impact of internet technology on the productivity of Indonesian MSMEs may be attributed to several factors.

First, the digital divide within the MSME sector creates disparities in access to online resources and technologies. In areas with limited infrastructure or low digital literacy, businesses struggle to leverage the Internet effectively for productivity gains. MSMEs with higher levels of digital literacy, by contrast, are better equipped to utilize digital platforms, adopt financial management tools, and explore alternative financing options like peer-to-peer lending and digital microfinance.

Second, challenges in integrating Internet technologies into existing business processes may arise due to resource constraints, organizational inertia, or a lack of alignment between digital solutions and the specific needs of MSMEs. For instance, smaller enterprises may lack the financial or human capital needed to adopt and adapt to new digital tools efficiently.

Finally, the competitive landscape and market dynamics could moderate the influence of internet usage on productivity. Non-digital factors, such as supply chain efficiency, labor skills, or market demand, may play a more dominant role in determining productivity outcomes for MSMEs.

The use of technology by businesses to innovate has a positive and significant influence on financial inclusion and MSME productivity. Technological innovations simplify business operations, enhance efficiency, and reduce costs, which collectively boost productivity among MSMEs. Technologies such as cloud computing, data analysis, and automation play a crucial role in optimizing processes and resource utilization. These findings align with the research by Gaglio et al. (2022), which highlights the positive impact of digital technology, including social media and internet access via business cell phones, on MSME innovation and performance. Moreover, innovation driven by technological advancements contributes positively to labor productivity. The integration of digital financial services and innovative payment solutions further expands financial inclusion by providing MSMEs access to essential banking and financial tools. This access facilitates better financial management, smooth transactions, and broader economic participation, enabling MSMEs to overcome traditional barriers to financial inclusion and reach underserved segments of the sector.

In addition to technology, this research examines several control variables, including industry classification, business owner age, legal entity status, business duration, participation in training, and the impact of COVID-19. The results indicate that business owner participation in training significantly reduces reliance on bank loans. Training improves the business acumen and operational efficiency of MSMEs, allowing them to optimize financial resources and rely more on internal capital. Consequently, MSMEs are better positioned to fund operations through internal revenue streams or alternative financing methods, reducing the need for external financial support. Enhanced financial management skills acquired through training play a pivotal role in decreasing MSMEs' dependence on traditional bank financing.

Another critical factor influencing MSME productivity is the legal entity status of the business. The findings demonstrate a positive relationship between formal legal status—such as limited partnerships (CV), firms, and limited companies (PT)—and MSME performance. Formal legal structures encourage organized and systematic business operations, adherence to governance standards, financial reporting, and legal compliance. These characteristics foster efficient management, strategic planning, and greater credibility, which, in turn, attract profitable business opportunities, partnerships, and access to financial resources. Larger clients and suppliers often prefer working with legally established businesses due to their perceived stability and professionalism. Moreover, formal markets typically demand compliance with contracts and standards, which informal businesses may find challenging to meet.

The research also reveals that MSMEs affected by the COVID-19 pandemic experienced significant productivity declines due to disruptions such as lockdowns, supply chain interruptions, and shifts in consumer behavior. These challenges reduced consumer demand, disrupted production processes, and placed financial strain on MSMEs. The pandemic-induced market dynamics exacerbated these difficulties, leading to a widespread decline in MSME productivity. However, the crisis also accelerated digital adoption among MSMEs, potentially resulting in lasting operational changes. MSMEs that integrated digital tools during the pandemic are more likely to sustain these practices, enhancing operational efficiencies and resilience in the face of future uncertainties. The long-term adoption of digital transformations will be essential for these businesses to thrive in a rapidly evolving market environment.

Additionally, the study finds that the age of a business has an inverse relationship with its productivity in the MSME context. Older businesses often face challenges adapting to rapid technological advancements, shifting market dynamics, and changing consumer preferences. Organizational inertia, reluctance to adopt innovative practices, and resistance to change may hinder the agility and competitiveness of mature businesses. Legacy systems and practices, which are often less efficient, can further constrain productivity compared to younger, more adaptable businesses. These factors collectively contribute to the observed decline in productivity as businesses age.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study investigates the impact of digitalization on financial inclusion and the productivity of micro, small, and medium enterprises (MSMEs). The findings reveal that digitalization in business reduces MSMEs' reliance on traditional bank credit by enabling access to alternative financing sources. At the same time, the adoption of new technologies for innovation fosters increased bank loans and enhances productivity. Technological innovation has proven effective in overcoming long-standing barriers to financial inclusion, providing access to financial services for segments of the MSME sector that were previously underserved or excluded.

The formal legal status of a business entity also plays a significant role in improving productivity, as formalization encourages more organized and systematic business operations, thereby positively influencing performance. However, this study highlights that the age of a business does not necessarily correlate with higher productivity. Furthermore, enhanced financial management skills acquired through

training programs contribute to reducing MSMEs' dependency on traditional bank financing. The disruptions caused by the COVID-19 pandemic, including lockdowns, supply chain interruptions, and changes in consumer behavior, have had a notable negative impact on MSME productivity, underscoring the challenges faced by businesses during this period.

Recommendations

The findings of this research highlight the urgent need to promote digital literacy among MSMEs and to invest in infrastructure to improve internet access. Strengthening collaboration between government and private sectors is essential to bridge the digital divide, particularly in rural areas where access to technology remains limited. Expanding access to alternative financing options beyond traditional banking is crucial, especially since not all MSMEs can meet the requirements for bank loans. Policies that incentivize and support technological innovation among MSMEs are vital for enhancing productivity, and collaboration with financial institutions to develop tailored financial products for underserved MSME segments is equally important.

In addition to these efforts, implementing education and capacity-building programs is necessary to equip MSMEs with the skills needed to utilize digital tools and improve their financial management effectively. It is also critical for MSMEs to anticipate emerging technological trends that may disrupt traditional economic systems. Policymakers should focus on developing the advanced competencies needed to navigate future technological innovations, ensuring that MSMEs can remain competitive in a rapidly changing digital landscape.

This study is limited by its reliance on data from the 2020 Micro and Small Survey conducted by the Central Statistics Agency (BPS), which restricts the ability to analyze long-term trends and changes in MSMEs' adoption of digitalization and financial inclusion. Moreover, the absence of detailed regional data limits the understanding of how geographical factors influence these relationships. Future research should adopt a longitudinal approach to capture evolving trends in digitalization and financial inclusion over extended periods. Incorporating region-specific data would provide valuable insights into regional disparities, enabling the development of more targeted strategies for digital inclusion and addressing the unique challenges faced by MSMEs in different parts of Indonesia. By addressing these limitations, future studies could offer a more comprehensive understanding of the role of digitalization in enhancing financial inclusion and productivity among MSMEs.

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