

The Big Data Effect on Indonesia MSME with the Mediation of Differentiation Strategy and Innovation Performance

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ABSTRACT

In Indonesia, micro, small, and medium enterprises (MSMEs) drive economic growth, contributing 61.1% of GDP, with fashion as the second-largest sector. As e-commerce expands, MSMEs can harness big data through cloud platforms to boost innovation and competitiveness. This study investigates how big data adoption enhances MSMEs' performance in Indonesia's fashion industry, focusing on its role in decision-making, differentiation strategies, and operational outcomes. The research surveyed 228 MSME owners, combining quantitative data and interviews to assess big data's impact on customer engagement, innovation, and efficiency. Findings reveal that leveraging big data significantly strengthens performance by refining decision-making and accelerating innovation. Key factors like data volume (scale), velocity (speed), and variety (diversity) directly influence success. Additionally, differentiation strategies—such as unique product designs or tailored marketing—mediate the link between data use and improved business outcomes. While the study underscores the urgency for MSMEs to adopt data-driven practices, challenges persist. Limited tech infrastructure and low digital literacy hinder progress, particularly among small-scale owners. To thrive, businesses must prioritize investments in cloud tools and skills training, while policymakers should support affordable tech access. This research offers practical insights for

MSMEs aiming to navigate competitive e-commerce landscapes, emphasizing that innovation and adaptability, powered by data, are critical for sustainable growth.

Keywords: Big Data Usage, MSME's Performance, Differentiation Strategy, Innovation Performance, Fashion

INTRODUCTION

MSME in Indonesia plays a critical role in its economic growth. According to (Mahdi, 2022), the increase in the number of MSMEs rises exponentially throughout the year, growing steadily, especially with the growth of e-commerce. MSME's role is reflected in the Gross Domestic Product (GDP), as MSME contributes 61.1%, the majority of it, compared to the remaining 38.9% for the large business actors, which amounted to only 5,550 or 0.01% of the total number of business actors (Indonesia Ministry of Finance, 2020), while also according to the ASEAN Investment Report on September 2022, Indonesia has the most MSME when being compared to its peers across Southeast Asia (Adi Ahdiat, 2022).

As the MSME grows massively, it grows alongside technology enhancement, most notably in adopting e-commerce as the platform for buying and selling. The MSME market is expected to increase by 23.8%, reaching USD 30 billion in 2022. E-commerce usage in Indonesia is anticipated to increase by 22% between 2021 and 2025

and reach a value of USD 53.8 billion by that year. These numbers highlight the sector's explosive growth, a key factor in how the Indonesian economy continues to develop (Market Research Indonesia, 2022). In recent years, technology improvements have altered MSMEs' operations, allowing them to become more efficient, competitive, and resilient in the face of adversity. Digitalization integrates technology into numerous parts of company operations, enhancing efficiency and production. MSMEs that adopt digitization may optimize procedures, increase consumer interaction, and expand into new markets. According to the World Bank, 2019, digital technology can help MSMEs save expenses by up to 30% while increasing income by up to 20%. E-commerce platforms have also altered how MSMEs access clients and sell their products. Platforms like Amazon, Alibaba, and eBay give MSMEs access to a worldwide client base, allowing them to grow their market reach without making large upfront expenditures. According to (Statista (2024), worldwide e-commerce sales are expected to reach \$8.03 trillion by 2027, indicating the enormous opportunity for MSMEs to use e-commerce for development.

Moreover, Cloud computing has become a game changer for MSMEs by providing affordable access to scalable computer resources. Cloud services like Amazon Web Services (AWS), Microsoft Azure, and Google Cloud help MSMEs cut IT infrastructure expenses, boost collaboration, and secure data. According to an (IDC Survey, 2019), 85% of small firms experienced cost benefits after implementing cloud services. MSMEs must use digital marketing tactics and tools to market their goods and services effectively. Search engine optimization (SEO), email marketing, and social media are just a few

of the platforms that MSMEs may use to target audiences, build brand awareness, and boost sales. In 2021, Smart Insights research states that 49% of businesses are using digital marketing to increase the efficacy of their marketing campaigns. Utilizing technology has become essential for MSMEs hoping to prosper in today's cutthroat business climate. Digital marketing, cloud computing, e-commerce, and digitalization are just a few instances of how technology changes MSMEs and empowers them to achieve innovation and sustainable growth. MSMEs anticipate becoming important global economic development drivers as they continue to use technology.

Big data has become a powerful tool for MSMEs (micro, small, and medium-sized enterprises) to improve operational efficiency, understand customer behavior, and stimulate innovation. Despite obstacles to data collection and analysis, big data analytics can help MSMEs become more competitive and develop. It allows MSMEs to glean insightful information from massive amounts of data, facilitating well-informed decision-making. MSMEs may improve their product offerings, find new markets, and optimize their strategy by evaluating operational data, market trends, and client preferences.

Businesses that use big data analytics are 6% more lucrative and 5% more productive than their rivals, according to (Manyika et al., 2011) in McKinsey Report. Understanding consumer behavior is essential for MSMEs to customize their goods and services. MSMEs may tailor marketing strategies, increase consumer engagement, and foster loyalty by using big data analytics to examine customer interactions, purchase histories, and comments. According to (Accenture, 2018), 91% of customers are more likely to

purchase from brands offering suggestions and deals relevant to their needs. As a subset of big data analytics, predictive analytics helps MSMEs project future results and trends using past data. MSMEs can reduce risks, optimize inventory levels, and forecast market demand using predictive models. Businesses that use predictive analytics are twice as likely to surpass their business objectives, according to the research done by Deloitte in 2021. MSMEs can become more competitive, make better decisions, and spur growth by efficiently using big data. In today's data-driven business environment, MSMEs can seize new chances for innovation and success by embracing big data analytics.

Supporting previous statements, while the potential benefits of Big Data for Micro, Small, and Medium Enterprises (MSMEs) are often highlighted, it is essential to examine the barriers that inhibit its adoption critically. One significant challenge is the high cost of implementing Big Data solutions, which can be prohibitive for MSMEs operating on limited budgets. The investment required for specialized hardware, software, and skilled personnel often exceeds the financial capacity of smaller firms, making it difficult for them to compete with larger enterprises with more substantial resources.

Moreover, MSMEs frequently face resource constraints, including a lack of skilled labor necessary to utilize Big Data technologies effectively. Many employees may not possess the requisite knowledge or training in data analytics, which can lead to underutilization of available technologies and missed growth opportunities. In Indonesia, for instance, a study indicated that MSMEs struggle with inadequate human capital and technological infrastructure, further complicating their

ability to leverage Big Data (Hartono et al., 2021) effectively.

Additionally, technological challenges include outdated systems and insufficient data management capabilities. These limitations can hinder the integration of Big Data analytics into existing business processes and create resistance to change among employees who may be unfamiliar with new technologies (Brady, 2023). Addressing these barriers is crucial for MSMEs to fully capitalize on the advantages of Big Data in enhancing decision-making and operational efficiency. Laney, in 2001, introduced the concept of "big data," which is defined by three characteristics: volume, velocity, and variety. These datasets are often too large to be effectively handled using traditional methods within a reasonable period. In the McKinsey Report, Manyika et al. (2011) expand on this idea, indicating that big data surpasses conventional database software solutions for capturing, storing, managing, and analyzing information. The enormous volume of data and its speed and diverse formats require innovative technologies and methods to process and derive insights from it. (Gandomi and Haider 2015) add to the discussion on immense data complexities, describing it as large volumes of fast-moving, complex, and diverse data that demand advanced techniques for capturing, storing, distributing, managing, and analyzing.

Research (Lee & Trimi, 2021) suggests that SMEs can gain valuable insights into market trends, customer preferences, and operational processes through big data; this enables more informed decision-making, resulting in personalized products and services, improved inventory management, and enhanced customer satisfaction. Additionally, big data allows for more targeted marketing strategies, helping

businesses maximize their return on investment. According to research by (Kumar et al., 2017), big data analytics aids SMEs in identifying emerging trends and potential areas for innovation. This capability is crucial for maintaining competitiveness in dynamic markets, as big data can also improve cost efficiency by enabling better resource management, positively impacting SMEs' bottom lines.

Furthermore, research by (Gupta and George, 2016) shows that big data supports strategic planning and tactical, day-to-day decision-making. It gives SMEs a comprehensive understanding of their industry, allowing them to anticipate trends and prepare accordingly. This strategic foresight is vital for scalability and sustainable growth. Moreover, a study by (Yu et al., 2020) indicates that big data analytics significantly improves customer experiences by facilitating real-time responses and personalized service offerings, boosting customer loyalty and retention. These studies demonstrate that SMEs can transform businesses by leveraging big data beyond technological upgrades.

According to (Mikalef et al., 2020), using big data is crucial for promoting innovation and improving operational efficiency. Organizations that effectively utilize big data can gain substantial competitive advantages. By incorporating big data analytics into their operations, these companies can streamline their processes, optimize the allocation of resources, and react more quickly to changes in the market. (Dubey et al., 2019) emphasize the significance of big data in supply chain management, highlighting that its use can enhance visibility, minimize risks, and improve (Fosso Wamba et al., 2015) argue that big data allows SMEs to make more informed and strategic decisions by

offering insights into customer behavior, market trends, and operational efficiency. Huang and Rust (2018) emphasize that big data analytics can significantly enhance decision-making for SMEs by enabling them to personalize their products, customize marketing strategies, and improve customer service, ultimately leading to increased customer engagement and loyalty.

Big data analytics and technology are being used more and more by micro, small, and medium-sized enterprises (MSMEs) to spur innovation. MSMEs may improve their processes, services, and goods by utilizing technology and data-driven insights, boosting their growth and competitiveness. Thanks to technology, MSMEs can collect and evaluate vast amounts of data about consumer preferences, market trends, and rival tactics. MSMEs can find market gaps, create novel goods or services, and better customize offerings to match the demands of their clients by utilizing this data. A study from PwC in 2017 indicates that 62% of businesses concur that technology has significantly increased their capacity for innovation by offering insights into areas like resource allocation, inventory control, and supply chain management; big data analytics assist MSMEs in optimizing their operations. MSMEs can free up resources to invest in innovation by simplifying procedures and reducing inefficiencies. According to research by (Henke et al., 2016) in McKinsey report, businesses that leverage analytics and data extensively have a higher chance of outperforming their competitors in terms of profitability. MSMEs may interact with customers in fresh and creative ways because of technology. MSMEs could collect feedback, conduct market research, and customize interactions by utilizing digital channels, including social.

MSMEs can create goods and services that appeal to their target market and spur innovation and growth by better understanding client needs and preferences. MSMEs that welcome innovation will be well-positioned to prosper in the digital economy as technology advances.

While the usage of big data is broad and might be unfamiliar, with the integration between the cloud, it is easier for MSMEs to adapt and use big data analytics in the e-commerce platform. Nowadays, e-commerce integrates with big data from the cloud computing system. Entrepreneurs can easily monitor their industry's performance and market condition through e-commerce business analysis insight. They could gather data on market insights and utilize it to gain a competitive advantage. Furthermore, (Kapoor et al., 2018) found that big data analytics can help SMEs innovate more effectively. By analyzing massive datasets, SMEs can get new insights, discover emerging market trends, and create novel goods, services, and business models to suit changing client demands. This innovation ability is critical for SMEs to remain competitive in today's quickly changing business landscape.

Micro, Small, and Medium Enterprises (MSMEs) can harness big data to improve various aspects of their business, ranging from operational efficiency to customer engagement. MSMEs can make more informed decisions that drive growth by analyzing large datasets that track consumer behavior, market trends, and internal processes. For instance, businesses can utilize big data to customize marketing strategies, enhance customer satisfaction, and reduce operational inefficiencies (Bhatti et al., 2022; Qibtiyana & Ali, n.d.). In Indonesia, where digital commerce is rapidly expanding, MSMEs can tap into e-commerce platforms to collect data that will

inform better targeting and personalized offers, a critical advantage in a competitive market (Behl et al., 2022; Handayati et al., 2024).

Big data also aids MSMEs in improving their supply chain management and predictive analytics. Analyzing historical data helps businesses optimize inventory, forecast demand, and improve delivery times, which is especially crucial in the fast-moving e-commerce environment (Ananda et al., 2024; Chatterjee et al., 2022). Furthermore, leveraging big data enables MSMEs to mitigate risks such as fraud, thereby increasing overall operational resilience (Mashruwala, 2024; Potluri & Vajjhala, 2021). With the proper infrastructure and tools, MSMEs in Indonesia can significantly enhance their decision-making capabilities, allowing them to grow in the face of increasing digital competition (Amira et al., 2024; Tarigan & Mawardi, 2024).

While big data offers significant opportunities for MSMEs in Indonesia, they face several challenges in leveraging it effectively. One major hurdle is the lack of technological infrastructure and expertise. Many MSMEs operate with limited resources and may be unable to invest in advanced analytics tools or skilled personnel required to manage and interpret big data (Alfarizi et al., 2023; Wessels & Jokonya, 2021). Without proper infrastructure, it becomes difficult to implement big data solutions, leaving many MSMEs unable to compete with larger enterprises that are better equipped technologically.

Another significant challenge is the complexity of data integration and interpretation. MSMEs often deal with fragmented data from multiple sources, including e-commerce platforms, social

media, and payment systems, making integrating and drawing actionable insights challenging (Anatan, 2023). Furthermore, the lack of precise data governance frameworks complicates efforts to manage data efficiently and ethically (Fridayani et al., n.d.; Handayati et al., 2024).

Lastly, financial constraints remain a key barrier. The initial investment required to adopt big data tools, including hardware, software, and training, is often beyond the reach of smaller enterprises (Maroufkhani et al., 2020). MSMEs in Indonesia typically prioritize immediate operational needs over long-term digital transformations, limiting their ability to leverage big data effectively.

To further elaborate on the challenges MSMEs face in leveraging big data, one additional challenge is the limited digital literacy among MSME owners and employees. Many small business owners lack the necessary understanding of utilizing data analytics tools, which hampers their ability to make the most of the data they collect (Hutama et al., 2023). The skills gap often requires MSMEs to invest in employee training or outsource data analysis, which is financially burdensome for smaller enterprises.

Another challenge for MSMEs is the high cost of big data tools and services. Many MSMEs struggle to justify the investment in sophisticated data analytics platforms, especially given the high costs associated with acquiring these tools, maintaining them, and ensuring proper staff training (Novita, 2023); this creates a digital divide between small businesses and larger enterprises that can afford significant data infrastructure's initial and ongoing expenses.

Despite facing challenges such as limited funding, inadequate infrastructure, and competition from larger companies and

imports, the SME fashion sector has demonstrated remarkable resilience. The COVID-19 pandemic added further obstacles by disrupting supply chains and reducing consumer spending. However, it also accelerated the industry's digital transformation, as many small and medium enterprises (SMEs) adopted e-commerce platforms like Tokopedia, Shopee, Lazada, Bukalapak, and social media channels to boost sales and marketing efforts. This shift to online platforms has enabled SMEs to broaden their reach and continue operations during the pandemic (Development Bank, 2020)

Indonesian fashion SMEs are increasingly entering global markets, taking advantage of government efforts to boost exports. Trade agreements and promotional campaigns are helping to increase the popularity of traditional textiles like batik and contemporary fashion products in international markets. The industry is also witnessing a growing trend towards sustainability, as many businesses adopt eco-friendly practices and materials in response to the rising consumer demand for sustainable fashion products (Badan Pusat Statistik Indonesia, 2020). Additionally (Khan et al., 2022), big data can assist in risk management. Emphasize its importance in detecting fraud, managing supply chain disruptions, and navigating market fluctuations.

While (Ghasemaghaei & Calic, 2020) investigate the nuanced relationships between big data's key attributes—volume, variety, and velocity—and firm innovation performance, they suggest that data volume does not significantly impact innovation outcomes, while data diversity and velocity positively influence innovation performance; this challenges the notion that more data is inherently better, highlighting the importance of data quality and

relevance. The study underscores the critical role of data velocity in enhancing innovation performance, suggesting that the speed at which data is analyzed and applied is crucial. (Gnizy, 2020) examines how big data analytics can reshape marketing strategies in the industrial sector. Utilizing a quantitative research approach, Gnizy analyzes how Porter's generic strategies—low-cost, differentiation, and focus—impact business performance. The study aims to provide insights into how firms can strategically position themselves to achieve long-term competitive advantages by applying big data analytics.

Furthermore, big data analytics can assist SMEs in improving their marketing and customer interaction initiatives. By evaluating customer data, SMEs can better understand their target demographic, allowing them to customize marketing campaigns and services to match their demands better. This individualized approach can increase client happiness, loyalty, sales, and profitability.

Therefore, the conceptual model was formed for this research.

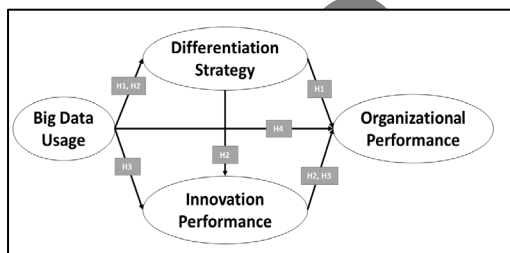


Figure 1: Conceptual Model

Studies have shown that Big Data positively affects Organizational Performance (OP), frequently through the medium of Generic Strategy. Research by (Chen et al., 2012) has demonstrated that companies that use big data analytics perform better; this implies that creative ideas and enhanced performance outcomes can result from the strategic application of

big data. Furthermore, research by Zhu et al. (2006) discovered that the choice and use of generic strategies—such as cost leadership or differentiation—can be influenced by the efficient use of big data, which affects firm performance.

Based on the description above, the predictable relationship is:

H1: Big Data Usage has a positive effect on Organizational Performance with the mediation of Differentiation Strategy

Studies have shown that Big Data positively affects Organizational Performance (OP) and that Innovation Performance and Generic Strategy frequently mediate this effect. (Chen et al., 2012) discovered that companies that use big data analytics perform better; this implies that using big data can result in creative approaches and enhanced performance. Furthermore, Zhu et al. (2006) pointed out that the selection and application of Generic Strategy—such as cost leadership or differentiation—can be influenced by the efficient use of Big Data, which affects firm performance. Additionally, (Avlonitis & Salavou, 2007) research highlights the mediating function of Innovation Performance in this relationship, showing that organizations with greater levels of EO are more likely to innovate, leading to better performance results. These results highlight the critical roles that generic strategy and innovation performance play as mediators in the interaction between big data and how it influences strategic choices, innovates, and ultimately improves organizational performance.

Based on the description above, the predictable relationship is:

H2: Big Data Usage has a positive effect on Organizational Performance with the mediation of Differentiation Strategy and Innovation Performance

Numerous research studies have demonstrated a strong association between Big Data and its favorable effects on Organizational Performance (OP), which Innovation Performance frequently mediates. Research by Chen, Chiang, and Storey (2012) and others has shown that companies that use big data analytics perform better. Applying big data can result in creative approaches and plans that improve productivity. Furthermore, Zhu, Kraemer, and Xu's (2006) study discovered that leveraging big data well can enhance an organization's capacity for innovation; this suggests that significant data's effects on innovation indirectly impact performance and its direct ones. Based on the description above, the predictable relationship is:

H3: Big Data Usage has a positive effect on Organizational Performance with the mediation of Innovation Performance

Multiple research investigations have shown a robust correlation between Big Data and its positive impact on Organizational Performance (OP). Research conducted by Zhu et al. (2006) showed that effectively using big data may enhance performance; this indicates that the impact of big data on organizational performance is indirect and direct. (Ghasemaghaei and Calic, 2020) examine the intricate connections between the main characteristics of big data, namely volume, variety, velocity, and performance.

Based on the description above, the predictable relationship is:

H4: Big Data Usage has a positive effect on Organizational Performance.

METHODS

This research was conducted with a quantitative approach using the Structural

Equation Model PLS. To reveal the usage of big data in e-commerce, this research was conducted on 228 respondents who are the owners of fashion MSMEs in Indonesia, mainly concentrated in Java since the center of the fashion industry in Indonesia. The questionnaire was distributed to the MSMEs who already utilize e-commerce big data in making decisions to differentiate themselves and create innovation to sustain their competitive advantages.

This test starts with a pre-test of 50 respondents. The primary objective of this phase is to identify and resolve any deficiencies in the research design, guaranteeing that the instruments are valid, dependable, and comprehensible (Presser et al., 2004). Researchers can evaluate the comprehension of the questions, the appropriateness of the response options, and the manageability of the instrument's overall duration and flow for participants by administering a pre-test. Researchers frequently concentrate on numerous critical components during the pre-test phase. The queries' clarity and comprehension are a critical component. Participants are requested to provide feedback on any items that they find to be equivocal or perplexing, and this feedback is utilized to improve the formulation of the questions (Fowler, 2014)

This is followed by the frequency distribution analysis, which lays out and analyzes the demographic data to reveal the respondents' profiles and e-commerce usage behaviors. Frequency distributions are frequently depicted in tables, histograms, or bar charts to facilitate data interpretation and effective communication of findings (Field, 2013).

The demographic composition of a sample of 228 participants in research on fashion micro, small, and medium enterprises (MSMEs) in Indonesia provides valuable and noteworthy findings. The gender

distribution demonstrates a near parity with 57% male and 43% female, signifying inclusion and emphasizing the significance of female entrepreneurs. The age distribution indicates a predominant age group of 32-45 years, followed by 18-31 years, implying a combination of seasoned and forward-thinking young entrepreneurs. From a geographical perspective, 83% of the participants are situated in the Jabodetabek area, emphasizing its significance as a key hub for fashion MSMEs. However, this also brings attention to the regional variations in resources.

Regarding education, 62.28% of the participants own a Bachelor's degree, indicating a significant level of knowledge that effectively handles the industry's intricacies. Overall, the data suggests a well-educated and balanced entrepreneurial community. However, there is a need for a more fair allocation of resources in order to encourage development in all areas.

The study of 228 respondents from fashion MSMEs in Indonesia provides insights into their annual income, age, big data usage, and employee numbers. Based on annual income, the distribution of MSMEs is micro enterprises (30%), small enterprises (9%), and medium enterprises (61%); this reflects the economic landscape, where micro-enterprises contribute significantly to local economies despite limited resources and capital challenges. Well-established medium enterprises drive economic growth and innovation.

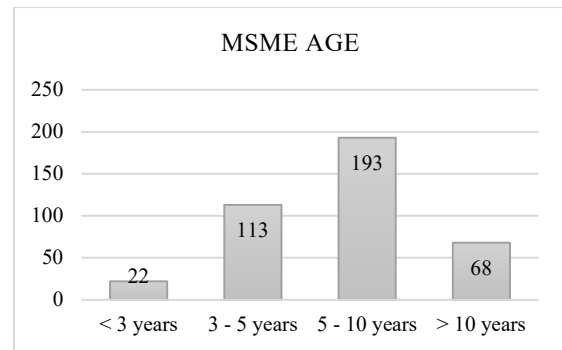


Figure 2: MSME Age

The age of MSMEs (Figure 2) shows a significant number (193) in the 5 - 10 years range, suggesting stability and growth, coinciding with the rise of e-commerce in Indonesia.

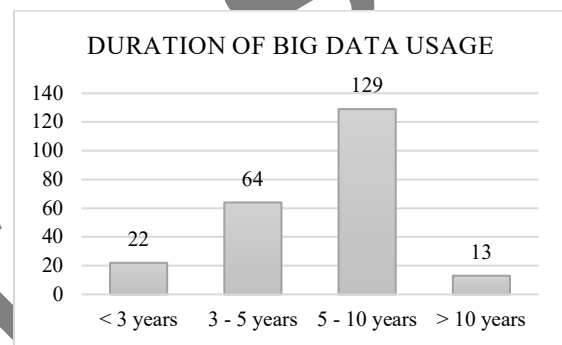


Figure 3: Duration of Big Data Usage

Big data usage (Figure 3) reveals that most have adopted it in the last 5-10 years, leveraging technological advancements and e-commerce platforms for competitive advantage. The workforce distribution highlights that most MSMEs have 11-30 employees, indicating a moderate size that balances operational management and production capacity. This demographic and operational data underscores the dynamic and evolving nature of the fashion MSME sector in Indonesia, highlighting the importance of digital transformation and the need for supportive policies to foster further growth and competitiveness.

Descriptive statistics analysis can also be used to understand the data distribution from the respondents' responses. According to (Creswell & Creswell, 2014), descriptive

statistics encompass measures of central tendency (mean, median, mode) and measurements of variability or dispersion (range, variance, standard deviation).

According to Table 1, the average score for Big Data consumption is 5.01 on a Likert scale ranging from 1 to 6. It is suggested that the respondents had a high degree of big data consumption. Seven indicators: Variety 1 (VAR1), Variety 2 (VAR2), Variety 3 (VAR3), Volume 3 (VOL3), Velocity 1 (VEL1), Velocity 2 (VEL2), and Velocity 4 (VEL4), have mean scores higher than the overall average. Among these indicators, VAR1 has the highest mean score. These findings indicate that the respondents believe they already use diverse data sources to get valuable information about their firm, with VOL2 receiving the lowest average score. The average score for Innovation Performance is 5.02 on a Likert scale ranging from 1 to 6, suggesting a significant degree of innovation performance among the participants. All seven indicators: Innovation Efficacy 3 (ECY3), Innovation Efficacy 4 (ECY4), Innovation Efficacy 5 (ECY5), Innovation Efficiency 1 (EFC1), Innovation Efficiency 2 (EFC2), Innovation Efficiency 3 (EFC3), and Innovation Efficiency 4 (EFC4) have mean scores higher than the overall average. Among these indicators, EFC4 has the highest mean score, indicating that the respondents already possess a comprehensive level of satisfaction with the effectiveness of the innovation project, with ECY1 having the lowest average score. The average score for Differentiation Strategy 5.10 on a Likert scale of 1 to 6 indicates the respondents' high degree of differentiation strategy. Out of the six indicators: Newness 2 (NEW2), Newness 4 (NEW4), Uniqueness 2 (UNQ2), Uniqueness 3 (UNQ3), Uniqueness 4 (UNQ4), and Uniqueness 5 (UNQ5), all

have mean scores higher than the overall average. Among these indicators, UNQ3 has the highest mean score. Respondents' feedback indicates they prioritize the improvement and training related to sales scoring, whereas UNQ1 has the lowest average score. The average score for Organizational Performance is 5.08 on a Likert scale ranging from 1 to 6, suggesting that the respondents prioritize differentiation methods. The five indicators (FIN1, CUS2, CUS3, CUS4, and CUS5) all have mean scores higher than the overall average. CUS2, in particular, has the highest mean score, suggesting that the respondents believe they can meet the customer's needs, while CUS1 gets the lowest average score.

Table 1: Descriptive Statistic Analysis (Author, 2024)

Variables	Dimensions	Indicators	Mean	Std. Dev	Grand Mean
Big Data Usage	Variety	VAR1	5.26	0.89	5.01
		VAR2	5.14	0.96	
		VAR3	5.18	0.85	
	Volume	VOL1	4.79	0.88	
		VOL2	4.71	0.79	
		VOL3	5.11	0.82	
		VOL4	4.87	0.84	
	Velocity	VEL1	5.07	0.82	
		VEL2	5.04	0.87	
		VEL3	4.85	0.83	
		VEL4	5.08	0.89	
	Innovation Performance	Innovation Efficacy	ECY1	4.57	
ECY2			4.92	0.83	
ECY3			5.1	0.89	
ECY4			5.07	0.96	
ECY5			5.16	0.96	
ECY6			4.96	0.92	
ECY7			5	1	
Innovation Efficiency		EFC1	5.06	0.94	
		EFC2	5.04	0.94	
		EFC3	5.15	0.95	
		EFC4	5.18	0.94	
		UNQ3	5.22	0.89	
		UNQ4	5.1	0.86	

		UNQ5	5.11	0.83		
		FIN2	4.99	0.93		
		FIN3	5.02	0.9		
Difference Strategic Strategy	Newness	NEW1	5.06	0.88	5.1	
		NEW2	5.14	0.89		
		NEW3	5.09	0.89		
		NEW4	5.11	0.87		
	Uniqueness	UNQ1	4.96	0.81		
		UNQ2	5.14	0.92		
		UNQ3	5.22	0.89		
		UNQ4	5.1	0.86		
		UNQ5	5.11	0.83		
Organizational Performance Organizational Performance	Financial Return	FIN1	5.19	0.9	5.08	
		FIN2	4.99	0.93		5.08
		FIN3	5.02	0.9		
	Customer Perspective	CUS1	4.93	0.91		
		CUS2	5.21	0.93		
	Operational Excellence	OPE1	5.13	0.82		
		OPE2	5.12	0.85		
		OPE3	5.09	0.85		

The table below presents external loading values for indicators in a structural equation modeling (SEM) study used to assess the accuracy of these indicators in measuring their corresponding dimensions. Indicators with outer loadings above 0.7 are considered valid, while those below this threshold should be evaluated for removal to enhance model reliability and validity. Most indicators surpass the 0.7 criterion, demonstrating strong validity. Exceptions include ECY3 (0.489) and ECY4 (0.666) in the Innovation Efficacy dimension and UNQ3 (0.688) in the Uniqueness dimension, which should be removed. Removing these lower-performing indicators can improve the model's reliability and validity.

The table displays the Fornell-Larcker criteria to evaluate the discriminant validity of constructs in structural equation modeling (SEM). According to this criterion, discriminant validity is attained when the square root of the average variance extracted (AVE) for each

construct exceeds the correlation between that construct and every other construct in the model.

Table 2: Validity & Reliability Outer Loading (Source: Author, 2024)

Variables	Dimensions	Indicators	Outer Loading	Outer Loading Result	
BDU	VAR	VAR1	0.72	Passed	
		VAR2	0.86	Passed	
		VAR3	0.87	Passed	
	VOL	VOL1	0.70	Passed	
		VOL2	0.77	Passed	
		VOL3	0.74	Passed	
		VOL4	0.71	Passed	
	VEL	VEL1	0.77	Passed	
		VEL2	0.80	Passed	
		VEL3	0.77	Passed	
		VEL4	0.73	Passed	
	IP	ECY	ECY1	0.50	Remove
ECY2			0.74	Passed	
ECY3			0.76	Passed	
ECY4			0.75	Passed	
ECY5			0.78	Passed	
ECY6			0.68	Remove	
ECY7			0.71	Passed	
EFC		EFC1	0.86	Passed	
		EFC2	0.78	Passed	
		EFC3	0.80	Passed	
DS	NEW	NEW1	0.79	Passed	
		NEW2	0.80	Passed	
		NEW3	0.80	Passed	
		NEW4	0.77	Passed	
	UNQ	UNQ1	0.75	Passed	
		UNQ2	0.79	Passed	
		UNQ3	0.79	Passed	
		UNQ4	0.69	Remove	
		UNQ5	0.77	Passed	
	OP	FIN	FIN1	0.79	Passed
			FIN2	0.86	Passed
			FIN3	0.86	Passed
CUS		CUS1	0.86	Passed	
		CUS2	0.89	Passed	
OPE		OPE1	0.84	Passed	
		OPE2	0.83	Passed	

OPE3	0.80	Passed
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OPE3	Passed
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Table 3: Validity & Reliability Fornell-Lecker (Source: Author, 2024)

Variables	Dimensions	Indicators	Fornell-Lecker Before	Fornell-Lecker Action	Fornell-Lecker After	
BDU	VAR	VAR1	0.82	Passed	0.85	
		VAR2		Remove		
		VAR3		Passed		
	VOL	VOL1	0.73	Passed	0.73	
		VOL2		Passed		
		VOL3		Passed		
		VOL4		Passed		
	VEL	VEL1	0.77	Passed	0.81	
		VEL2		Passed		
		VEL3		Passed		
		VEL4		Remove		
	IP	ECY	ECY1	0.71	Passed	0.78
ECY2			Passed			
ECY3			Passed			
ECY4			Remove			
ECY5			Passed			
ECY6			Passed			
ECY7			Passed			
EFC		EFC1	0.82	Passed	0.83	
		EFC2		Passed		
		EFC3		Passed		
DS	NEW	NEW1	0.79	Remove	0.82	
		NEW2		Passed		
		NEW3		Passed		
		NEW4		Passed		
	UNQ	UNQ1	0.76	Passed	0.82	
		UNQ2		Passed		
		UNQ3		Remove		
		UNQ4		Passed		
		UNQ5		Passed		
	OP	FIN	FIN1	0.84	Passed	0.84
			FIN2		Passed	
			FIN3		Passed	
CUS		CUS1	0.88	Passed	0.88	
		CUS2		Passed		
OPE		OPE1	0.83	Passed	0.87	
	OPE2	Remove				

To strengthen the reliability and validity of the constructs, it is possible to successively eliminate indicators with low outer loadings to improve the model. According to Hair et al. (2019), this aims to avoid multicollinearity. The indications that need to be eliminated are UNQ3, EFC4, NEW1, INV4, VEL4, VAR2, OPE2, and ECY4.

RESULTS AND DISCUSSIONS

As seen in Table 4 below, VAR3 has the highest score for the Big Data Usage variable, suggesting that fashion MSMEs in Indonesia employ many data sources, such as social media and e-commerce, to obtain significant information. The comprehensive strategy for gathering data exemplifies the industry's need to maintain competitiveness and relevance in a swiftly evolving market. Social media platforms allow these micro, small, and medium enterprises (MSMEs) to get immediate customer feedback, monitor patterns, and better understand consumer behavior. By using this varied data-collecting approach, fashion MSMEs can customize their goods and marketing tactics more precisely to satisfy customer needs.

According to VAR3, both VEL1 and VEL2 also have high scores, indicating that these MSMEs excel in efficient data processing and sustaining a speedy data cycle. This skill is crucial for efficiently exploiting Big Data, allowing MSMEs to rapidly assess and act based on data to make well-informed choices. During time-limited sales events or introducing new products, the capacity to handle and react to data rapidly may affect sales and consumer contentment. The rapid turnaround time is

essential in the fashion sector, where trends may shift rapidly, and prompt decision-making can determine the outcome between triumph and lost prospects.

The variable of Innovation Performance is influenced the most by EFC1, which quantifies the duration of an innovation project and its effect on efficiency. Indonesia's fashion MSMEs rely heavily on the swift execution of innovative initiatives. Rapidly developing and launching new designs or collections may provide these enterprises with a competitive edge and maintain the attractiveness of their products to buyers. In addition, the ECY5 index, which measures changes in market share, significantly impacts innovation efficiency, emphasizes the need to respond promptly to market fluctuations, and adjust innovation tactics to sustain or expand market dominance. For example, a fashion micro, small, and medium enterprise (MSME) that quickly adjusts to a new trend or client desire might attract a more considerable portion of the market, thereby improving its innovation ability.

UNQ5, a differentiation approach focused on MSMEs delivering unique goods, significantly influences perceived uniqueness and highlights the need to distinguish one's goods from competitors to get a competitive edge. Amidst the saturated fashion industry, providing exclusive and discernible merchandise might enable micro, small, and medium enterprises (MSMEs) to differentiate themselves and attract devoted clientele. For instance, a fashion micro, small, and medium enterprise (MSME) that provides unique, limited-edition designs or personalized clothes might distinguish itself from mass-market companies. Regarding novelty, the NEW2 initiative, which focuses on creating innovative services, has the most significant influence

and demonstrates that service innovation, such as implementing novel customer interaction methods or providing tailored shopping experiences, is crucial for staying current and enticing consumers.

The variable CUS2, which assesses customer satisfaction, significantly impacts the customer viewpoint under the Organizational Performance variable and highlights the crucial importance of meeting client requirements for organizational success. In the fashion sector, achieving high customer satisfaction may result in customers returning for future purchases, making suitable recommendations to others, and firmly committing to the brand. An instance of this would be a fashion micro, small, and medium enterprise (MSME) that regularly provides superior items, gives exceptional customer service, and immediately addresses customer questions, resulting in elevated customer satisfaction. The operational excellence category has the highest score in OPE1, which is focused on productivity enhancement and demonstrates that improvements in efficiency, such as optimizing manufacturing processes or implementing efficient supply chain management, are crucial for achieving high performance. Enhancing productivity in fashion MSMEs may lead to cost reduction, increased production, and improved overall operational efficiency. Ultimately, the FIN2 metric, which quantifies the Return on Equity (ROE), has the most impact on the Financial Return and emphasizes the significance of financial measures in evaluating the entire success of a business. For fashion micro, small, and medium enterprises (MSMEs), attaining a high return on equity (ROE) signifies the effective use of invested capital to create revenues, essential for ensuring long-term viability and expansion.

To succeed, fashion MSMEs in Indonesia must effectively use Big Data, excel in innovation performance, implement differentiation strategies, and maintain strong organizational performance metrics. These organizations may succeed in a competitive market by employing a variety of data sources, efficiently processing and exploiting data, inventing effectively, delivering distinctive goods and services, and prioritizing customer happiness, productivity, and financial returns.

Table 4: Path Coefficient Indicators to Dimensions (Source: Author, 2024)

Variables	Dimensions	Indicators	O	T Test	P Values
BDU	VAR	VAR1	0.835	29.851	0.000
		VAR3	0.859	42.375	0.000
	VOL	VOL1	0.702	13.685	0.000
		VOL2	0.772	21.511	0.000
		VOL3	0.739	18.271	0.000
		VOL4	0.705	13.309	0.000
	VEL	VEL1	0.822	29.296	0.000
		VEL2	0.822	24.545	0.000
		VEL3	0.789	22.430	0.000
	IP	ECY	ECY2	0.800	26.846
ECY3			0.770	25.153	0.000
ECY5			0.805	25.113	0.000
ECY7			0.750	17.274	0.000
IP	EFC	EFC1	0.864	40.844	0.000
		EFC2	0.806	25.570	0.000
		EFC3	0.819	26.427	0.000
DS	NEW	NEW2	0.840	30.307	0.000
		NEW3	0.821	29.236	0.000
		NEW4	0.797	23.546	0.000
		UNQ	UNQ1	0.791	18.504
	UNQ2	0.806	21.806	0.000	
	UNQ5	0.848	37.125	0.000	
	OP	FIN	FIN1	0.786	18.199
FIN2			0.861	32.758	0.000
FIN3			0.857	30.457	0.000
CUS		CUS1	0.860	31.723	0.000
		CUS2	0.897	69.629	0.000
OPE		OPE1	0.871	39.072	0.000
	OPE3	0.868	35.723	0.000	

Table 5: Path Coefficient Hypothesis (Source: Author, 2024)

Effect	O	T Test	P Values
Big Data Usage -> Differentiation Strategy -> Organizational Performance	0.397	6.738	0.000
Big Data Usage -> Differentiation Strategy -> Innovation Performance -> Organizational Performance	0.149	3.590	0.000
Big Data Usage -> Innovation Performance -> Organizational Performance	0.125	2.673	0.004
Big Data Usage -> Organizational Performance	0.671	10.211	0.000

All the hypotheses are accepted, indicating that Big Data usage, both directly and through the mediation of differentiation strategy and innovation performance, positively affects organizational performance. The direct effect of Big Data usage on organizational performance is the most significant, underscoring the critical role of data-driven decision-making. For fashion MSMEs in Indonesia that already use e-commerce, this direct impact translates to their ability to leverage diverse data sources, such as social media and e-commerce platforms, to make informed decisions, respond quickly to market trends, and enhance overall efficiency. By harnessing Big Data analytics, these MSMEs can gain insights into customer preferences, identify emerging trends, and optimize their operations to meet market demands effectively.

The differentiation strategy's indirect effect is more substantial than innovation performance, emphasizing the importance of offering unique products and services. Differentiation strategy involves creating distinct and appealing product offerings that set a business apart. For fashion

MSMEs, this could mean developing exclusive designs, limited-edition collections, or customized clothing options that cater to specific customer needs. By focusing on product uniqueness and service innovation, these MSMEs can stand out in a competitive market, attract and retain customers, and improve organizational performance. The ability to offer something different and valuable enhances customer loyalty and can lead to a more substantial market presence.

Therefore, while positively influencing organizational performance, innovation performance plays a slightly less significant role than differentiation strategy. Innovation in this context involves quickly developing and launching new products or services, adapting to market changes, and incorporating new technologies or processes. For fashion MSMEs in Indonesia, innovation might include introducing new materials, adopting sustainable practices, or leveraging technology to improve the customer experience. Although innovation is crucial for staying relevant and competitive, the findings suggest that a strong differentiation strategy's immediate and tangible benefits have a more pronounced impact on organizational performance.

The innovation performance of fashion micro, small, and medium enterprises (MSMEs) in Indonesia can be significantly enhanced by adopting advanced technologies and innovative practices, ultimately contributing to long-term competitiveness. For example, the implementation of artificial intelligence (AI) allows fashion MSMEs to analyze consumer data, predict trends, and personalize marketing strategies, thereby creating a unique customer experience that aligns with Porter's Differentiation Strategy

(Sidiq Adi Prabowo et al., 2022). Furthermore, 3D printing technology enables these businesses to rapidly prototype designs and offer customized products that meet consumer demands and set them apart from competitors. Click or tap here to enter text. Additionally, integrating augmented reality (AR) into online shopping platforms enhances consumer engagement by allowing customers to visualize products in their environments before purchasing (Fatma SJORaida et al., 2024). These concrete examples illustrate how innovation strategies can complement differentiation efforts, enabling Indonesian fashion MSMEs to thrive in a competitive global market while fostering sustainability and ethical practices.

Fashion MSMEs in Indonesia that use e-commerce are uniquely positioned to benefit from these insights. The e-commerce platform provides a rich data source that, when analyzed effectively, can drive strategic decisions and enhance business performance. These MSMEs can use Big Data to personalize marketing efforts, optimize inventory management, and improve customer service. The combination of Big Data analytics and a robust differentiation strategy allows them to anticipate customer needs, respond to trends faster, and create a distinctive brand identity.

In summary, the acceptance of all hypotheses highlights the multifaceted role of Big Data usage in enhancing organizational performance for fashion MSMEs in Indonesia. The direct impact of Big Data is paramount, providing the foundation for informed decision-making and operational efficiency. Meanwhile, the differentiation strategy's substantial indirect effect underscores the importance of unique product offerings in a competitive market. Innovation performance remains a

crucial component of overall success, though less impactful. Together, these factors ensure that fashion MSMEs leveraging e-commerce can remain agile, innovative, and competitive, ultimately leading to improved organizational performance and sustained growth.

CONCLUSIONS

Prior research has shown that Big Data influences organizational performance. Our study confirms that Indonesian fashion MSMEs using e-commerce benefit from Big Data, using data from sources like social media to gain insights. Their effective use of diverse data sources supports differentiation tactics. For example, these MSMEs use Big Data to analyze consumer patterns, tailor marketing, and improve inventory, boosting customer satisfaction and efficiency. Our results show that Big Data directly impacts organizational performance, mediated by differentiation strategy and innovation performance. Differentiation has a greater indirect impact, highlighting its importance in the fashion industry. Indonesian fashion MSMEs on e-commerce platforms can quickly adapt to market changes, create unique products, and innovate services, maintaining their competitive edge. Fashion MSMEs in Indonesia should use Big Data to compete in e-commerce and foster strategic differentiation and innovation. By incorporating Big Data analytics, they can improve resource allocation, adapt to market changes, and achieve growth. This study adds empirical evidence of the benefits of Big Data, facilitated by differentiation and innovation. Ethical data management is vital for SMEs, especially in Java's fashion industry. Balancing data monetization with privacy rights is a key challenge; SMEs must ensure consumer

data is not sold without consent. Equitable access to Big Data tools is also essential, as smaller MSMEs often lack the resources to use these technologies effectively. Entrepreneurship Orientation (EO) positively impacts organizational performance through differentiation and innovation, and Big Data enhances performance similarly. SMEs should focus on developing unique products, using various data sources, and implementing fast data processing to stay competitive. This study highlights Sustainable Development Goals (SDGs) 8 and 12. Since SMEs contribute significantly to Indonesia's GDP, enhancing their performance through EO and Big Data can impact economic growth and job creation. Big Data allows SMEs to optimize production, reduce waste, and better align with customer preferences, promoting responsible consumption and production. Moreover, ethical Big Data usage in the fashion industry is crucial. SMEs must ethically collect and use data, maintaining transparency to prevent biases. Concerns about data quality, reliability, and the ethical issues of being first movers are critical. SMEs are encouraged to address data security, customer trust, and fair employment while leveraging Big Data. Establishing guidelines emphasizing transparency, consent, and accessibility can promote responsible data practices and maintain ethical standards in pursuit of improved performance and innovation.

REFERENCES

- Accenture. (2018). *MAKING IT PERSONAL Why brands must move from communication to conversation for greater personalization. Pulse Check 2018.*
- Adi Ahdiat. (2022, October 11). *Indonesia Punya UMKM Terbanyak di ASEAN, Bagaimana Daya Saingnya?*
<https://Databoks.Katadata.Co.Id/Datapu>

- blish/2022/10/11/Indonesia-Punya-Umkm-Terbanyak-Di-Asean-Bagaimana-Daya-Saingnya.
- Alfarizi, M., Widiastuti, T., & Ngatindriatun. (2023). Exploration of Technological Challenges and Public Economic Trends Phenomenon in the Sustainable Performance of Indonesian Digital MSMEs on Industrial Era 4.0. *Journal of Industrial Integration and Management*, 09(01), 65–96. <https://doi.org/10.1142/S2424862223500045>
- Amira, B., Negeri, U. I., & Utara, S. (2024). Universitas Islam Negeri Sumatra Utara Muhammad Irwan Padli Nasution. *Jurnal Ilmiah Nusantara (JINU)*, 1(4), 695–704. <https://doi.org/10.61722/jinu.v1i4.1888>
- Anatan, L. (2023). *Micro, Small, and Medium Enterprises' Readiness for Digital Transformation in Indonesia*. <https://doi.org/10.3390/economies>
- Avlonitis, G. J., & Salavou, H. E. (2007). Entrepreneurial orientation of SMEs, product innovativeness, and performance. *Journal of Business Research*, 60(5), 566–575. <https://doi.org/10.1016/j.jbusres.2007.01.001>
- Badan Pusat Statistik Indonesia. (2020, April 29). *Statistik Indonesia 2020*. <https://www.bps.go.id/publication/2020/04/29/E9011b3155d45d70823c141f/statistik-indonesia-2020.html>.
- Behl, A., Gaur, J., Pereira, V., Yadav, R., & Laker, B. (2022). Role of big data analytics capabilities to improve sustainable competitive advantage of MSME service firms during COVID-19 – A multi-theoretical approach. *Journal of Business Research*, 148, 378–389. <https://doi.org/https://doi.org/10.1016/j.jbusres.2022.05.009>
- Belgavi, V., Narang, A., & Raj, A. (2018). *INTERNATIONAL FINANCIAL ARCHITECTURE FOR STABILITY AND DEVELOPMENT/ CRYPTO-ASSETS AND FINTECH Expanding Data Collection to Streamline MSME (Micro, Small and Medium Enterprise) Lending*.
- Bhatti, S. H., Ahmed, A., Ferraris, A., Hirwani Wan Hussain, W. M., & Wamba, S. F. (2022). Big data analytics capabilities and MSME innovation and performance: A double mediation model of digital platform and network capabilities. *Annals of Operations Research*. <https://doi.org/10.1007/s10479-022-05002-w>
- Chatterjee, S., Chaudhuri, R., Shah, M., & Maheshwari, P. (2022). Big data driven innovation for sustaining SME supply chain operation in post COVID-19 scenario: Moderating role of SME technology leadership. *Computers and Industrial Engineering*, 168. <https://doi.org/10.1016/j.cie.2022.108058>
- Chen, H., Chiang, R. H. L., Storey, V. C., Lindner, C. H., & Robinson, J. M. (2012). *Business Intelligence and Analytics: From Big Data to Big Impact Quarterly-Business Intelligence and Analytics: From Big Data to Big Impact* (Vol. 36, Issue 4).
- Creswell, & Creswell. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (Fifth Edition). Sage Publications.
- Development Bank, A. (2020). *ADB Annual Report 2020*. www.adb.org/ar2020/digital
- Dubey, R., Gunasekaran, A., Childe, S. J., Blome, C., & Papadopoulos, T. (2019). Big Data and Predictive Analytics and Manufacturing Performance: Integrating Institutional Theory, Resource-Based View and Big Data Culture. *British*

- Journal of Management*, 30(2), 341–361.
<https://doi.org/10.1111/1467-8551.12355>
- Fatma Sjoraida, D., Dwika, N., Amrita, A., & Ruchiyat, E. (2024). INNOVATIVE BUSINESS MODEL DESIGN: A TRIPLE-LAYERED APPROACH FOR INDONESIA'S FASHION SECTOR. In *Kisa Institute* (Vol. 1, Issue 6). www.Kisainstitute.com
- Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics* (4th Edition). Sage Publications.
- Fosso Wamba, S., Akter, S., Edwards, A., Chopin, G., & Gnanzou, D. (2015). How “big data” can make big impact: Findings from a systematic review and a longitudinal case study. *International Journal of Production Economics*, 165, 234–246.
<https://doi.org/10.1016/j.ijpe.2014.12.031>
- Fowler, F. J. (2014). *Survey Research Methods: Vol. Volume 1* (Fifth Edition). SAGE Publications.
- Fridayani, H. D., Hakim, M. L., Hanif, N. A., & Darumurti, A. (n.d.). *Indonesian MSMEs Toward the Global Market: Challenges and Future Agenda Planning*.
<https://ssrn.com/abstract=4783792>
- Gandomi, A., & Haider, M. (2015). Beyond the hype: Big data concepts, methods, and analytics. *International Journal of Information Management*, 35(2), 137–144.
<https://doi.org/10.1016/j.ijinfomgt.2014.10.007>
- Ghasemaghaei, M., & Calic, G. (2020). Assessing the impact of big data on firm innovation performance: Big data is not always better data. *Journal of Business Research*, 108, 147–162.
<https://doi.org/10.1016/j.jbusres.2019.09.062>
- Gnizy, I. (2020). Applying big data to guide firms' future industrial marketing strategies. *Journal of Business and Industrial Marketing*, 35(7), 1221–1235.
<https://doi.org/10.1108/JBIM-06-2019-0318>
- Gupta, M., & George, J. F. (2016). Toward the development of a big data analytics capability. *Information and Management*, 53(8), 1049–1064.
<https://doi.org/10.1016/j.im.2016.07.004>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate Data Analysis (8th ed.)*. Cengage Learning.
- Handayati, R., Haliza, S. N., Haqqoh, A., Kumalasari, E. N., & Saputra, Y. (n.d.). Strategies for SMEs in Managing Big Data for Personalization and Customer Service Enhancement. *Journal of Contemporary Administration and Management*.
<https://doi.org/10.61100/adman.v2i2.208>
- Hartono, B., Atmaja, H., Ratnawati, S., Verawati, D., & Ikhwan, K. (2021). Indonesian MSMEs and big data: Seizing opportunities by minimizing bottlenecks. *Journal of Management Information and Decision Sciences*, 24(3).
- Henke, N., Bughin, J., Chui, M., Manyika, J., Saleh, T., & Wiseman, B. (2016). *The age of analytics: competing in a data-driven world*.
- Huang, M. H., & Rust, R. T. (2018). Artificial Intelligence in Service. *Journal of Service Research*, 21(2), 155–172.
<https://doi.org/10.1177/1094670517752459>
- Hutama, D., Raharjo, K., & Nugroho, A. (2023). *Impact of Digital Capability on SMEs Performance: Mediating Role of Digital Business Transformation*. 26(3).

- IDC Survey. (2019). *The Opportunities Cloud Service Providers Should Pursue in 2020*. IDC Web Page.
- Indonesia Ministry of Finance. (2020). *UMKM kuat, ekonomi berdaulat*. <https://www.djkn.kemendagri.go.id/artikel/baca/14214/UMKM-Kuat-Ekonomi-Berdaulat.html#:~:text=Usaha%20mikro%2C%20kecil%20dan%20menengah,Rp8.573%2C89%20triliun>.
- Kapoor, K. K., Tamilmani, K., Rana, N. P., Patil, P., Dwivedi, Y. K., & Nerur, S. (2018). Advances in Social Media Research: Past, Present and Future. *Information Systems Frontiers*, 20(3), 531–558. <https://doi.org/10.1007/s10796-017-9810-y>
- Khan, N. A., Awang, A., & Karim, S. A. A. (2022). Security in Internet of Things: A Review. In *IEEE Access* (Vol. 10, pp. 104649–104670). Institute of Electrical and Electronics Engineers Inc. <https://doi.org/10.1109/ACCESS.2022.3209355>
- Kumar, V., Anand, A., & Song, H. (2017). Future of Retailer Profitability: An Organizing Framework. *Journal of Retailing*, 1(93), 96–119.
- Laney, D. (2001, February 6). 3-D Data Management: Controlling Data Volume, Velocity and Variety. *Application Delivery Strategies by META Group Inc*.
- Lee, S. M., & Trimi, S. (2021). Convergence innovation in the digital age and the COVID-19 pandemic crisis. *Journal of Business Research*, 123, 14–22. <https://doi.org/10.1016/j.jbusres.2020.09.041>
- Mahdi. (2022). *Berapa Jumlah UMKM di Indonesia?* <https://dataindonesia.id/sector-rili/detail/berapa-jumlah-umkm-di-indonesia>.
- Manyika, J., Chui, M., Brown, B., Bughin, J., Dobbs, R., Roxburgh, C., & Byers, A. H. (2011). *Big data: The next frontier for innovation, competition, and productivity*.
- Market Research Indonesia. (2022). *The robust growth of Indonesia's e-commerce industry*. <https://www.researchinindonesia.com/insight/the-robust-growth-of-indonesia-e-commerce-industry>.
- Maroufkhani, P., Tseng, M. L., Iranmanesh, M., Ismail, W. K. W., & Khalid, H. (2020). Big data analytics adoption: Determinants and performances among small to medium-sized enterprises. *International Journal of Information Management*, 54. <https://doi.org/10.1016/j.ijinfomgt.2020.102190>
- Mashruwala, A. (n.d.). *Fraud Detection and Prevention in Financial Services Using Big Data Analytics*. <https://doi.org/10.13140/RG.2.2.16018.26561>
- Mikalef, P., Krogstie, J., Pappas, I. O., & Pavlou, P. (2020). Exploring the relationship between big data analytics capability and competitive performance: The mediating roles of dynamic and operational capabilities. *Information and Management*, 57(2). <https://doi.org/10.1016/j.im.2019.05.004>
- NOVITA, D. (2023). PROBLEMS FACING MICRO, SMALL AND MEDIUM ENTERPRISES (MSMEs) IN INDONESIA: A LITERATURE REVIEW. *INTERNATIONAL JOURNAL OF RESEARCH IN EDUCATION HUMANITIES AND COMMERCE*, 04(05), 256–262. <https://doi.org/10.37602/ijrehc.2023.4521>

- Point of Sale's Transaction Data: Envisioning Micro Small and Medium Enterprise (MSME)'s Inventory Management Strategy. (2024). *International Journal of Business and Technology Management*. <https://doi.org/10.55057/ijbtm.2024.6.1.38>
- Potluri, R. M., & Vajjhala, N. R. (2021). Risks in Adoption and Implementation of Big Data Analytics. *International Journal of Risk and Contingency Management*, 10(3), 1–11. <https://doi.org/10.4018/ijrcm.2021070101>
- Presser, S., Couper, M. P., Lessler, J. T., Martin, E., Martin, J., Rothgeb, J. M., & Singer, E. (2004). Methods for testing and evaluating survey questions. *Public Opinion Quarterly*, 68(1), 109–130. <https://doi.org/10.1093/poq/nfh008>
- Qibtiyana, M., & Ali, H. (n.d.). *Utilization of Big Data in Increasing the Competitiveness of MSMEs*. <https://doi.org/10.38035/sijet.v1i3>
- Satria Pamungkas, E., Ayu Kusumawati, Y., Tang Herman, R., & Shanti, M. (n.d.). *BuSia: Mobile Apps Design to Promote MSMEs Fashion in Indonesia*.
- Sidiq Adi Prabowo, F., Fauzan Oktavian, M., & Syarif Hidayatullah, D. (n.d.). *The Effect of Market Orientation, Learning Orientation and Product Innovation Agility on Fashion MSMEs Business Performance at Trunojoyo Area, Bandung City* (Vol. 5).
- Statista. (2024). *Worldwide retail e-commerce sales from 2014 to 2023 (in billion U.S. dollars)*. <https://www.Statista.Com/Statistics/379046/Worldwide-Retail-e-Commerce-Sales/>.
- Tarigan, E. S., & Mawardi, W. (2024). Utilization Of Big Data In Business Analysis In Micro, Small And Medium Enterprises (MSME) In Order To Increase The Scale Of Economic Business In The Sumatra Region. *Ekombis Review: Jurnal Ilmiah Ekonomi Dan Bisnis*, 12(1). <https://doi.org/10.37676/ekombis.v12i1>
- Wessels, T., & Jokonya, O. (2021). Factors affecting the Adoption of Big Data as a Service in SMEs. *Procedia Computer Science*, 196, 332–339. <https://doi.org/10.1016/j.procs.2021.12.021>
- World Bank. (2019). *World Development Report 2019: The Changing Nature of Work*.
- Yu, A. P. I., Chuang, S. C., Cheng, Y. H., & Wu, Y. C. (2020). The influence of sharing versus self-use on the preference for different promotional offers. *Journal of Retailing and Consumer Services*, 54. <https://doi.org/10.1016/j.jretconser.2019.102026>
- Zhu, K., Kraemer, K. L., & Xu, S. (2006). The process of innovation assimilation by firms in different countries: A technology diffusion perspective on e-business. *Management Science*, 52(10), 1557–1576. <https://doi.org/10.1287/mnsc.1050.0487>