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BIG DATA ANALYSIS IN MARKETING DECISION MAKING INDUSTRIAL REVOLUTION ERA 4.0: CASE STUDY ON FASHION INDUSTRY IN INDONESIA

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Abstract: The Industrial Revolution 4.0 era has changed the landscape of the world of manufacturing and technology with the integration of digital technology, automation and sophisticated data communications. The fashion industry in Indonesia is also not immune from the major impact of these changes, especially in marketing decision making. Big data analysis is crucial in optimizing marketing strategies by understanding consumer preferences, market trends and competition. However, the use of big data also brings challenges, especially regarding the security and privacy of consumer data. This research adopts a qualitative method with a literature review approach to investigate the use of big data in marketing decision making in the Indonesian fashion industry. The research results show that big data plays an important role in customer segmentation, consumer behavior analysis, trend prediction, and product innovation. The benefits companies gain from implementing big data include deep understanding of consumer behavior, fast decision making, operational efficiency, better risk management, product and service innovation, improved customer experience, and dynamic price adjustments. However, the challenges faced include data security risks, personal identification risks, and compliance with global privacy regulations. Assessment of the readiness of Indonesian fashion industry companies to adopt big data involves evaluating technology infrastructure, data analysis skills, awareness of big data concepts, data security and privacy, understanding customer behavior, technology adoption, ability to process real-time data, budget availability, readiness for innovation, and acceptance of organizational culture. By considering these aspects, companies can evaluate the extent to which they are ready to integrate big data in marketing decision making to achieve success in the Industrial Revolution 4.0 era.

Keywords: Big data, decision making, revolution industry 4.0

1. Introduction

Era of revolution industry has touch point 4.0. Era 4.0 is phase evolution in a world of manufacturing and technology characterized by integration very sophisticated digital technology, automation and data communications in industrial processes (Isdarmanto, 2020) . The Industrial Era 4.0 is continuation experience from revolution industry third with enhancement in matter digital technology and connectivity. A number of characteristic typical from this era including namely, *Internet of Things* (IoT), Big Data & Analytics, Intelligence Artificial (*Artificial Intelligence*), *Cybersecurity*, *Augmented Reality* (AR) and *Virtual Reality* (VR) (Ismail & Nugroho, 2022) . With such development appearance make transformation technology information has change business world landscape. One of the most striking change is how the data has been be one most valuable asset in taking decisions in various industry. One of them,

the fashion industry in Indonesia, is not exception has experience impact big from change (Sahla, 2018) . In the case of this, Big Data analysis becomes tool important that makes it possible fashion company for optimize marketing strategy.

Marketing is the essence of success every fashion business. Deep understanding about preference consumers, market trends, and competition is factor key in designing effective strategies (Sari & Aslami, 2022) . With no volume of data limited production through transaction *e-commerce*, social media interactions, and various source. Fashion companies in Indonesia have chance for utilizing Big Data as source valuable insight (Muslim, 2017) . Deep Big Data Analytics taking decision marketing own important role in face challenges and opportunities in the Industry 4.0 era.

Big data is terms used for describes the large volume of data obtained from various source and must managed, processed, and analyzed in a way effective. Big data does not only covers a large volume, but also covers speed data growth, diversity data types, and data complexity (Ofori et al., 2020) . Meanwhile, decision marketing is series decision strategy taken by a company for promote and sell product or the service. This matter covers various aspect, start from determination price until promotion, distribution and development product.

According to (Dirgantara & Suryadarma, 2014) showing that Big Data Analytics is becoming A the algorithm will adapt patterns and *behavior* become a useful information for public. However, according to (Vaddhano, 2023) state that company must request agreement from consumer related, looking after transparency, guarantee privacy, as well brave responsible on negligence to data management as form behavior ethical in respond phenomenon marketing big data based. Because p the related with, consumer data used for predict behavior consumer, complete problem *supply* and *demand*, influence decision purchase, up to target difficult specific market segments reachable previously (Hafidz & Muslimah, 2023) .

Although thus, convenience for get data with free create worries separately because data can used for various type reason, fine that for good reason nor bad. Will remain, if use of Big Data for taking decision marketing has proven produce superiority competitive. A capable company collect, analyze, and implement outlook of Big Data has potency for reach more success big in the era of the Revolution Industry 4.0 (Economy et al., 2022) . Study this will deepen use deep Big Data analysis taking decision marketing in the Indonesian fashion industry with objective give more insight clear about how technology this change method company operate and compete.

2. Research Methods

This study adopt method study qualitative, which means focus on understanding depth and interpretation phenomenon. Approach study literature used, shows that this study based on research involving literature understanding and analysis to gathering research and expert views (Sugiyono, 2016) . Data sources used in this study covers books, articles scientific, news, and documents relevant other. This matter show that study depend on source information written and documented as base analysis. With focus on investigating opinions and views expert about ethics business and how ethics business can play role important in face challenges that arise from practice marketing based on big data (Purba et al., 2021) .

3. Results and Discussion

The results and discussion of this research are based on a literature review that has been carried out from various sources, including books and relevant journals regarding Big Data in Marketing Decision Making in the Industrial Revolution Era 4.0. The results and discussion of this research are reviewed as follows:

a. Big data in consumer behavior to segment customers

Big data plays an important role in understanding consumer behavior to segment customers. This process begins with the collection and integration of data from various sources, such as transactions, online interactions, customer feedback, and geographic data. By processing large volumes of this data, companies can understand customer purchasing patterns, including frequency, amount of money spent, and product preferences (Dirgantara & Suryadarma, 2014).

Online behavior analysis is also key in understanding consumer interests. Through tracking online activities such as clicks, searches, and social media interactions, companies can investigate preferences and design more personalized online experiences. Geographic data integration allows segmentation based on location, guiding local marketing strategies (Yanti Febrini et al., 2019). Apart from that, there is customer feedback, or what is better known as product reviews and complaints, which is analyzed using sentiment analysis to understand customer feelings. The results can guide product or service improvements and provide a more personalized customer experience (Djayapranata, 2020).

Big data also supports predictive models and machine learning to predict future consumer behavior. Clustering algorithms are used to group customers based on similar behavioral patterns, creating more accurate segmentation (Fitriawati et al., 2022). By using consumer behavior data, companies can personalize marketing, create better customer experiences, and increase customer retention. Retention analysis involves understanding the frequency of customer purchases and interactions to identify customers who may switch (Faroh, 2017). This process is not static by using big data, companies can update customer segmentation dynamically over time, enabling real-time adjustments to marketing and service strategies according to changes in consumer behavior (Liang et al., 2018). Thus, Big Data helps companies understand customers better and design more effective segmentation strategies.

b. Benefits that companies gain from implementing Big Data

The implementation of big data brings a number of perceived benefits to companies. Big data, companies can carry out deeper data analysis, revealing trends and patterns that may not have been visible before. This helps in understanding consumer behavior better, allowing companies to design more targeted marketing strategies (Ekonomi et al., 2022). Then, the benefits of big data can mean that business decisions can be taken more quickly, because the system can process and analyze data in real time. This also allows for more accurate predictions, helping companies plan better steps for the future (Firmansyah & Prihandono, 2018). Apart from this, operational efficiency increases through business process optimization and more effective supply chain management. Big Data helps identify inefficiencies and provides insights to optimize company operations (Hafidz & Muslimah, 2023).

Big data also helps companies manage risk by analyzing cybersecurity risks and other business risks. Better risk management is key in ensuring business sustainability (Alice & Christian, 2022). The rest can shape product and service innovation that can be driven by big data, with in-depth analysis of customer needs and desires. This helps companies to develop and remain competitive in the market (Maharani., & Muhaimin, 2022). Furthermore, improving customer experience is a direct result of the application of big data, where companies can provide better and more responsive service and enable companies to proactively understand customer needs. Dynamic price adjustments become possible with big data, as companies can make price adjustments based on demand, supply, and other market factors. Information security is also improved through big data, with the ability to detect suspicious activity and protect data from cyber threats (Dirgantara & Suryadarma, 2014).

c. Big data challenges in maintaining the security and privacy of consumer data

Big data provides great benefits in analyzing consumer behavior, but also raises a number of challenges in maintaining the security and privacy of consumer data. This challenge can be expressed through the following (Vaddhano, 2023): *Firstly*, data security is a major concern, this is because of the large volume of data collected, hackers can pose a serious threat. The security of network infrastructure that stores and manages big data needs to be maintained to prevent unauthorized access. *Second*, the risk of personal identification is a serious problem. Although data may have been "anonymized" or "hashed", the risk of re-identification is still possible, especially when the data is combined with other data sources. *Third*, the importance of compliance with global privacy regulations, such as GDPR and CCPA, adds complexity. Companies must ensure compliance with regulations in various jurisdictions that may have different requirements. *Fourth*, access rights management and permission management are challenges. Only authorized persons should have access to consumer data, and there is a need for continuous monitoring of data usage. Fifth, encryption technology plays an important role in protecting consumer data. However, implementing encryption can affect system performance and add complexity. Sixth, the level of consumer awareness and user education regarding data use and security is key. Users need to understand the risks and implications of sharing personal information. *Seventh*, secure data integration in distributed big data processing is also a challenge. Ensuring data integrity and security throughout the processing chain is crucial. Eighth, machine learning models can be vulnerable to adversarial attacks, which can damage the accuracy of consumer behavior analysis. Finally, in the context of business cooperation and data exchange, it is necessary to overcome difficulties related to data security and privacy.

Overcoming these challenges requires a holistic approach involving solid security technology, regulatory compliance, education, and cultural change within the organization. Companies need to invest in strong security systems and adopt best practices to protect consumer data and comply with applicable privacy regulations.

d. Assessing that Indonesian fashion industry companies are ready to adopt Big Data technology in making marketing decisions

Assessing the readiness of fashion industry companies in Indonesia to adopt big data technology in making marketing decisions, several main aspects need to be considered (Opan et al., 2020). First, technological infrastructure is an important foundation. Companies need to have adequate infrastructure to handle and store large volumes of data. Implementation of an efficient data management system is also needed so that data from various sources can be integrated well (Wahidin, 2018). Furthermore, the aspect of human skills in data analysis is key. Human resources need to have adequate data analysis skills to interpret information from big data. Additionally, a strong understanding of machine learning algorithms and models is required to maximize the potential of data analysis.

Awareness and understanding of Big Data concepts is the next step. Stakeholders, including management and executives, need to have a high awareness of the potential of big data in improving marketing decision making. Understanding big data concepts, such as Volume, Velocity, Variety, and Veracity, also needs to be considered (Febrini et al., 2019). Aspects of data security and privacy are crucial. Companies must have a strong security system to protect consumer data and address cybersecurity risks. Privacy policies must also comply with regulations to ensure customer trust in data management (Ayesha et al., 2022).

Deep understanding of customer behavior and preferences through collected data is the next focus. Customer segmentation capabilities are important for more effective personalization of marketing strategies. The adoption of technology in the fashion industry, such as e-commerce, social media analytics and other digital solutions, also plays an

important role in the assessment. This level of technology adoption reflects the extent to which companies are ready to integrate digital solutions in their operations. Partnerships with digital platforms or technology can provide access to broader consumer data (Heitzman & Huang, 2019). The ability to process data in real-time is another criteria. Companies that are able to process and respond to data quickly can support more responsive decision making. Budget availability is a determining factor. Companies need to have an adequate budget to implement big data solutions and ensure their continued use. And readiness for innovation includes adaptation to change and a culture of innovation. Companies need to be ready to adapt to changes in the application of big data and have a culture that supports experimentation and the desire to make data-based changes (Djayapranata, 2020).

Finally, acceptance of organizational culture is essential. An organizational culture that supports innovative initiatives and views the use of data as an integral part of the decision-making process will help create an environment that supports the successful implementation of Big Data.

4. Conclusion

Big data has a crucial role in understanding consumer behavior and implementing customer segmentation. Through collecting and integrating data from various sources, companies can analyze consumers' purchasing patterns, product preferences and online activities. This analysis forms the basis for more accurate customer segmentation, enabling marketing personalization and improved customer experience.

This process involves tracking online activity, analyzing customer feedback, and integrating geographic data. Sentiment analysis is also used to understand consumer feelings through product reviews and complaints. By applying predictive models and machine learning, companies can predict future consumer behavior and create smarter segmentation. Benefits derived from big data implementation include deeper understanding of consumer behavior, faster and more accurate decision making, improved operational efficiency, better risk management, product and service innovation, improved customer experience, dynamic price adjustments, and increased information security.

However, the implementation of big data also poses challenges in maintaining the security and privacy of consumer data. From personal identification risks to compliance with global privacy regulations, companies need to ensure that their security systems and privacy policies are adequate. Assessing the readiness of fashion industry companies in Indonesia to adopt big data technology involves evaluating technology infrastructure, data analysis skills, awareness of big data concepts, data security and privacy, understanding customer behavior, technology adoption in the fashion industry, ability to process real-time data, budget availability, readiness for innovation, and acceptance of organizational culture. By paying attention to these aspects, companies can assess the extent to which they are ready to utilize the potential of big data in marketing decision making.

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