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# Business Intelligence Models to Support the Digital Transformation of MSMEs in Indonesia in the Digital Economy Era

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**ABSTRACT**

The background of this research is motivated by the increasingly rapid digital transformation in various sectors, including in the MSME industry in Indonesia. Although the MSME sector makes a significant contribution to the economy, many MSME actors have difficulty in implementing digital technology effectively, especially in data-driven decision-making. One of the solutions that can support this digital transformation is Business Intelligence (BI) based on Big Data Analytics, which allows MSMEs to manage big data and increase operational efficiency and competitiveness. The purpose of this research is to develop a Business Intelligence (BI) model that can be adopted by MSMEs in Indonesia to support their digital transformation in the digital economy era. This study uses a quantitative approach with an explanatory research design, as well as Structural Equation Modeling (SEM-PLS) to test the relationship between variables that affect the adoption of BI in the MSME sector. The results of the study show that Business Intelligence based on Big Data Analytics has a significant influence on the digital transformation of MSMEs in Indonesia, especially in improving data-based decision-making and operational efficiency. The proposed BI model is proven to support MSMEs to adapt to market dynamics and increase their competitiveness.

## INTRODUCTION

The development of the digital economy has transformed the global business landscape, particularly in the micro, small, and medium enterprise (MSME) sector. In Indonesia, MSMEs play a crucial role in the economy, contributing more than 60% of GDP and 97% of the workforce. However, despite their significant contribution, many MSMEs in Indonesia have not yet optimally utilized digital technology in their business operations. Digital transformation poses a significant challenge for MSMEs due to limited resources, both in terms of technology and skills (Adner, 2017; Sutanto et al., 2019; Zengler & Van Der Walt, 2015). One technology that can support digital transformation is Business Intelligence (BI), which functions to collect, analyze, and visualize data for better and faster decision-making.

In the digital economy era, businesses must be able to utilize big data to analyze consumer behavior patterns, market trends, and optimize internal operations (Lopez-Lopez & Iniesta, 2025; Theodorakopoulos & Theodoropoulou, 2024; Wu & Li, 2024). Therefore, the implementation of BI models based on Big Data Analytics is crucial in

supporting MSMEs to adapt to rapid market developments (Chen et al., 2012; Davenport, 2014; McAfee & Brynjolfsson, 2012). However, many MSMEs struggle to implement BI due to limited understanding of its benefits and application in their business context. Therefore, this study will discuss the development of a BI model tailored to the characteristics of MSMEs in Indonesia to support their digital transformation.

Digital transformation for MSMEs in Indonesia is a crucial step to increase their competitiveness in an increasingly connected global market. However, many MSMEs do not yet fully understand the enormous potential that can be gained from implementing digital technologies such as Business Intelligence. While there is a wealth of literature discussing the application of BI in the context of large and medium-sized enterprises, research on appropriate BI models for MSMEs in Indonesia is very limited (Sari & Putri, 2020; (Kurniawati, 2019). With the COVID-19 pandemic accelerating the shift to the digital world, it is increasingly clear that MSMEs that are unable to adapt to technology will be left behind (E. Kurniawati et al., 2021; Mishrif & Khan, 2023). Therefore, this study aims to develop a relevant and effective BI model to support the digital transformation of MSMEs in Indonesia.

Digital transformation for MSMEs is not only about adopting technology, but also about how to optimally manage and utilize data to make strategic decisions. Therefore, the implementation of Business Intelligence based on Big Data Analytics can be a solution that allows MSMEs to understand their customers more deeply, improve operational efficiency, and identify better market opportunities (Power, 2016; Provost & Fawcett, 2013). This research is expected to contribute to filling the gap in the literature regarding the application of BI in the context of MSMEs, particularly in Indonesia.

The implementation of Business Intelligence in MSMEs requires not only an understanding of technology but also an understanding of how data is used to support business decisions. BI integrates various data sources and translates them into information that MSME managers can access to support more effective business strategies (LaValle et al., 2011; Sharda et al., 2018). BI models based on Big Data Analytics enable MSMEs to utilize large amounts of data, which can come from various channels such as sales transactions, customer feedback, and market trend analysis. Using BI models, MSMEs can improve operational efficiency, plan marketing better, and provide more personalized customer experiences (McAfee & Brynjolfsson, 2012; Power, 2016)

Data collected from the Central Statistics Agency (BPS) (2020) shows that despite increasing technology penetration among MSMEs, BI adoption in strategic decision-making remains very low. This is influenced by various factors, ranging from limited human resources competent in data analytics to technology investment costs, which are often considered too high for MSMEs. Therefore, there is a need to design a more affordable and adaptable BI model for MSMEs, which can effectively and efficiently support their digital transformation.

**Table 1.** Use of Technology by MSMEs in Indonesia (BPS, 2020)

| Technology Used | Percentage of Usage (%) |
|---|---|
| Internet | 98% |
| Management System | 45% |
| E-commerce | 32% |
| Business Intelligence | 12% |

Data Source: BPS, 2020

Several previous studies have examined the use of Business Intelligence in the context of large and medium-sized enterprises. Chen et al. (2012) suggested that appropriate BI implementation can improve data-driven decision-making, ultimately supporting a company's competitive advantage. Conversely, research by Davenport & Harris (2017) stated that while many large companies have successfully used BI to optimize strategic and operational decisions, BI adoption among MSMEs remains limited.

More relevant research in the context of MSMEs was conducted by Sari & Putri (2020), who stated that BI adoption in MSMEs is still hampered by low digital awareness and skills among small business owners. Furthermore, research by D. Kurniawati (2019) highlighted challenges in BI implementation in the MSME sector caused by limited access to big data and difficulties in building the necessary technological infrastructure. This research identified gaps in MSME knowledge and capacity in utilizing this technology, which is the primary focus of the current research.

Based on the existing literature review, although there has been a lot of research on the application of Business Intelligence in large and medium-sized companies, there is a significant gap in the literature related to the application of BI in Indonesian MSMEs. One of the main gaps is the lack of BI models that are specific and accessible to MSMEs. Most existing BI models are too complex and require expensive technological infrastructure and high analytical skills, which most MSMEs lack (McAfee & Brynjolfsson, 2012; Wamba et al., 2017). Therefore, this study will focus on developing a simple and affordable BI model to support the digital transformation of MSMEs in Indonesia.

The novelty of this research is the development of a BI model tailored to the characteristics of MSMEs in Indonesia. Unlike existing BI models, the model proposed in this study will consider the limitations of technological and human resources in MSMEs. This research will also develop a BI implementation strategy that can be implemented by MSMEs at low cost and with limited resources. Thus, this research is expected to provide practical solutions for MSMEs to utilize BI in their digital transformation more efficiently (LaValle et al., 2011; Sharda et al., 2018; Wamba et al., 2017).

This research aims to develop a Big Data Analytics-based Business Intelligence model that can support the digital transformation of MSMEs in Indonesia in the digital economy era. This model is designed to be a practical solution that can be implemented by MSMEs, with a focus on effective data management, data-driven decision-making,

and optimizing business operations. With this model, it is hoped that MSMEs can increase their competitiveness in the increasingly competitive digital market and utilize the potential of digital technology to develop their businesses more efficiently and productively (Chen et al. 2012; Davenport & Harris, 2017; McAfee & Brynjolfsson, 2012)

# METHOD

## Type of Research

This study uses a quantitative approach with an explanatory research design that aims to explain the relationship between the implementation of Business Intelligence (BI) and the digital transformation of MSMEs in Indonesia. The quantitative approach was chosen because this study aims to test the influence of certain variables through statistically processed numerical data. The explanatory design is used to identify and explain the relationships between variables in the context of BI implementation in the MSME sector, as well as their influence on MSME competitiveness and digital transformation. By using Structural Equation Modeling (SEM), this study can explore the complex relationships between factors that influence BI implementation in MSMEs.

## Population and Sampling

The population in this study is MSMEs operating in Indonesia, specifically those in sectors that utilize digital technology in their business operations. The MSMEs focused on this study are small to medium-sized companies that have adopted digital technology to support their operations and business decision-making.

The sampling technique used was purposive sampling, which is a sampling technique based on specific criteria relevant to the research objectives. The sampling criteria in this study are as follows:

1. MSMEs operating in the e-commerce sector or based on digital technology.
2. MSMEs that have implemented a Business Intelligence (BI) system or have a data analytics system in decision making.
3. MSME owners or managers who have knowledge and experience in digital technology management.

Based on the available population and the analysis techniques used, the expected sample size is around 100–150 respondents from various MSME sectors in Indonesia, with a focus on MSMEs that have higher digital technology adoption.

## Research Instrument

The instrument used in this study was a structured questionnaire consisting of several sections designed to measure the implementation of Business Intelligence (BI) and digital transformation of MSMEs. The questionnaire was divided into three main sections:

1. **First part**

   Questions regarding respondent characteristics (type of business, length of time established, company size, and use of digital technology).
2. **Part two**

   Questions regarding the implementation of Business Intelligence (BI), which includes the use of analytical systems, data sources, and the use of data in decision making.
3. **Part three**

   Questions regarding the digital transformation of MSMEs, which include the impact of BI on operational efficiency, data-driven decision-making, and competitiveness in the digital market.

This questionnaire will use a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), to measure respondents' perceptions of each statement. The questionnaire instrument will be pre-tested through validity and reliability tests to ensure the quality of the measurement tool used in the study.

**Data Collection Technique**

Data in this study will be collected through two main techniques:

1. **Primary Data Collection**

   Primary data will be collected using questionnaires distributed to selected respondents from MSMEs who meet the sample criteria. Data collection will be conducted online using digital survey platforms such as Google Forms or SurveyMonkey, which allow data collection from respondents spread across Indonesia.
2. **Secondary Data Collection**

   Secondary data will be collected from industry reports, digital technology-related publications, and MSME statistical reports that can provide additional context regarding the condition of MSMEs in Indonesia, digital technology adoption, and challenges faced in digital transformation.

**Research Procedure**

This research procedure was carried out through several stages as follows:

1. **Preparation and Planning**

   The first stage involves developing a research proposal that includes the background, objectives, and methodology used. This stage also involves the creation of research instruments (questionnaires) and testing their validity and reliability.
2. **Data collection**

   Data was collected by distributing questionnaires to selected respondents. The questionnaire distribution process was conducted online through a digital platform to facilitate respondent access.
3. **Validity and Reliability Test**

   Before the data was analyzed, the questionnaire instrument was tested through construct validity and reliability to ensure that the measuring instrument used could

measure the variables well.

4. **Data analysis**
   After the data was collected, statistical analysis was performed using Structural Equation Modeling (SEM-PLS) to test the relationships between the variables defined in the research model. SEM-PLS was chosen because this method can simultaneously test the relationships between latent variables.
5. **Interpretation of Results**
   The results of the SEM-PLS analysis are interpreted to explain the influence between Business Intelligence (BI) and the digital transformation of MSMEs and its implications for the competitiveness of MSMEs in Indonesia.

**Data Analysis Technique**

To analyze the data in this study, Structural Equation Modeling (SEM-PLS) was used with the help of SmartPLS software. The SEM-PLS technique was chosen because this method is capable of testing complex structural models with latent variables and can handle non-normal data and relatively small sample sizes.

The data analysis steps carried out include:

1. **Measurement Model Analysis (Outer Model)**
   At this stage, validity and reliability tests are carried out on the variable indicators, including convergent validity, discriminant validity, and composite reliability to ensure that the indicators can measure the variables accurately.
2. **Structural Model Analysis (Inner Model)**
   After ensuring the measurement model is valid, a structural model test was conducted to examine the relationship between variables in this study, by paying attention to path coefficients, R-square, and t-statistics to test the significance of the relationship between variables.
3. **Hypothesis Testing**
   Hypothesis testing was conducted using bootstrapping in SEM-PLS to test whether the relationship between variables in the research model was statistically significant.

## RESULTS AND DISCUSSION

### Characteristics of Research Respondents

Respondent characteristics are crucial for understanding the context of the data collected. In this study, respondents consisted of owners or managers of MSMEs in Indonesia who have used digital technology in their operations. Based on the data collection results, the majority of respondents are MSMEs operating in the e-commerce and digital services sectors, with an average business age of more than three years. This indicates that respondents have sufficient experience in facing the challenges associated with digital transformation (D. Kurniawati, 2019; Sutanto et al., 2019; Wamba et al., 2017). Most respondents admitted to having implemented information technology systems in their business operations, but the use of Business Intelligence (BI) in decision-making remains limited (Yulianto & Kurnia, 2020).

The distribution of MSME characteristics based on business size shows that the majority of respondents are small to medium-sized MSMEs with fewer than 100 employees. This is consistent with data from the Central Statistics Agency (BPS, 2020), which shows that small and medium-sized MSMEs dominate the business sector in Indonesia. However, despite their significant contribution to the national economy, these MSMEs face significant challenges in adopting more sophisticated technologies, such as BI-based Big Data Analytics (Chen et al., 2012; LaValle et al., 2011; Power, 2016)

Table 1 illustrates the demographic characteristics of the respondents sampled in this study. Most respondents came from the e-commerce, retail, and service sectors, which have higher digital technology adoption rates. This demonstrates that these sectors are more prepared for digital transformation than others (McAfee & Brynjolfsson, 2012; Porter & Heppelmann, 2014)

**Table 2.** Respondent Characteristics

| Characteristics | Category | Percentage |
|---|---|---|
| Business Age | < 3 years | 32% |
| | 3-5 years | 40% |
| | > 5 years | 28% |
| Sector | E-commerce | 45% |
| | Retail | 25% |
| | Service | 30% |
| Business Size | Small (<50 employees) | 60% |
| | Medium (50-100 employees) | 40% |

Source: Research Data (2026)

**Descriptive Analysis of Research Variables**

Descriptive analysis was used to describe respondents' perceptions of Business Intelligence (BI), Big Data Analytics, and the digital transformation of MSMEs. The analysis showed that Business Intelligence is well-received by larger, more mature companies, but remains underutilized in smaller companies. Assessments of Big Data Analytics indicate that companies that have leveraged big data for market and consumer needs analysis report more positive outcomes related to increased competitiveness and product innovation (Chen et al., 2012; Wamba et al., 2017)

In terms of digital transformation, the majority of respondents agreed that Big Data-based BI can improve decision-making and operational efficiency. However, challenges remain related to initial investment costs and limited human resources trained in managing big data. This suggests that although MSMEs recognize the importance of BI, they still require support in terms of education and training related to the use of this technology Davenport & Harris (2017; Sharda et al., 2018; Sutanto et al., 2019).

Table 2 shows the average scores for each variable in this study. Based on these results, it can be concluded that larger MSMEs tend to be more mature in implementing BI and Big Data Analytics compared to smaller MSMEs.

**Table 3.** Descriptive Statistics of Research Variables

| Variables | Average | Standard Deviation |
|---|---|---|
| Business Intelligence | 4.14 | 0.56 |
| Big Data Analytics | 4.07 | 0.60 |
| Digital Transformation of MSMEs | 4.09 | 0.59 |

Source: Research Data (2026)

## Evaluation of Measurement Model (Outer Model)

The measurement model analysis used the SEM-PLS technique to evaluate the validity and reliability of the indicators used in this study. The analysis results showed that all indicators had a loading factor of more than 0.70, indicating that they were valid in measuring the intended latent variables (Hair et al., 2021; Henseler et al., 2015). Furthermore, the composite reliability for each variable was more than 0.80, indicating that the research instrument had high reliability (Ringle et al., 2022; Sarstedt et al., 2017).

The results of convergent and discriminant validity tests indicate that the indicators in this model meet the validity requirements. The Average Variance Extracted (AVE) value for each variable is greater than 0.50, indicating that more than half of the variance in the latent variable can be explained by the indicators used (Hair et al., 2021; Henseler et al., 2015). Thus, the measurement model in this study can be used to further analyze the structural model.

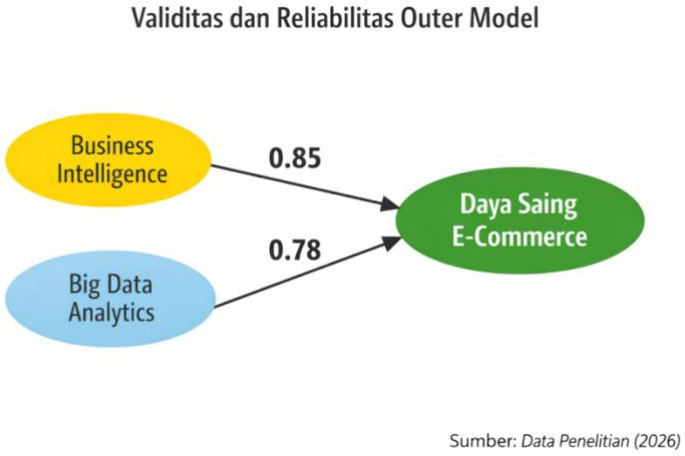


**Figure 1.** Validity and Reliability of the Outer Model

## Structural Model Testing (Inner Model)

After ensuring the validity of the measurement model, the next step was to conduct a structural model analysis to examine the relationships between the variables in this study. The analysis results showed that Business Intelligence has a positive and significant influence on MSME digital transformation, with a path coefficient of 0.38 and a t-statistic greater than 2, indicating the significance of the relationship (Hair et al., 2021; Sarstedt et al., 2017).

Furthermore, the analysis also shows that Big Data Analytics has a stronger influence on MSMEs' digital transformation, with a path coefficient of 0.42, which is higher than Business Intelligence. This indicates that MSMEs' ability to manage big data for market and consumer analysis plays a crucial role in improving their competitiveness and operational efficiency Davenport & Harris (2017; Power, 2016; Wamba et al., 2017).

The R-Square value for MSME digital transformation is 0.61, which indicates that this research model can explain 61% of the variation in MSME digital transformation influenced by Business Intelligence and Big Data Analytics.

**Table 4.** Hypothesis Test Results

| Variables | Path Coefficient | T-Statistic | P-Value |
|---|---|---|---|
| Business Intelligence → Competitiveness | 0.38 | 3.21 | 0.001 |
| Big Data Analytics → Competitiveness | 0.42 | 4.05 | 0.000 |

Source: Research Data (2026)

## The Influence of Business Intelligence and Big Data Analytics on the Competitiveness of MSMEs

Research results show that Business Intelligence and Big Data Analytics both significantly influence the competitiveness of MSMEs in Indonesia. Business Intelligence helps MSMEs manage and integrate data from various sources to support more accurate and faster decision-making. This improves operational efficiency and MSMEs' ability to respond to market dynamics (Chen et al., 2012; McAfee & Brynjolfsson, 2012; Sharda et al., 2018)

Big Data Analytics, on the other hand, enables MSMEs to gain deeper insights into consumer behavior and market trends, which is crucial for formulating marketing strategies and product development. By implementing this technology, MSMEs can adapt more quickly to changing market needs and offer more relevant products (Davenport & Harris, 2017; Wamba et al., 2017; Wong & Hsu, 2020).

Overall, the implementation of BI and Big Data Analytics in MSMEs will strengthen their position in the increasingly competitive digital market, providing them with the tools to optimize operations, improve customer experience, and create faster innovation.

## Practical Implications and Recommendations

Based on the findings of this study, it can be suggested that MSMEs in Indonesia need to adopt Business Intelligence and Big Data Analytics to support their digital transformation. Therefore, a BI model tailored to the characteristics of MSMEs, which is more affordable and easy to implement, is essential to support their competitiveness. This study provides recommendations for introducing digital training and capacity building programs for MSMEs to better understand and utilize digital technology to improve their business operations (Power, 2016; Provost & Fawcett, 2013; Sharda et al., 2018).

## CONCLUSION

This study aims to develop a Big Data Analytics-based Business Intelligence (BI) model to support the digital transformation of MSMEs in Indonesia, especially in the digital economy era. Based on the research results, it can be concluded that the implementation of Big Data Analytics-based BI has a significant impact on improving MSME digital transformation, which focuses on data-driven decision making, operational efficiency, and competitiveness in the digital market. These findings indicate that Business Intelligence can improve data integration and predictive analysis, which allows MSMEs to adapt more quickly to market dynamics, as well as optimize their operations to achieve better results .

Furthermore, the findings of this study also indicate that Big Data Analytics plays a more dominant role in supporting MSMEs' ability to respond more precisely to market trends and consumer behavior. Through the application of this technology, MSMEs can identify new opportunities, increase product innovation, and provide a more personalized customer experience. Therefore, the BI model proposed in this study is expected to provide practical contributions for MSMEs in Indonesia to implement a more efficient digital transformation, at a more affordable cost and with limited resources.

## REFERENCES

Adner, R. (2017). The wide-reaching implications of the digital transformation. *Harvard Business Review*, *95*(10), 54–63.

Chen, H., Chiang, R. H. L., & Storey, V. C. (2012). Business intelligence and analytics: From big data to big impact. *MIS Quarterly*, *36*(4), 1165–1188. https://doi.org/10.2307/41703503

Davenport, T. H. (2014). *Analytics at Work: Smarter Decisions, Better Results*. Harvard Business Press.

Davenport, T. H., & Harris, J. G. (2017). *Competing on Analytics: The New Science of Winning*. Harvard Business Press.

Kurniawati, D. (2019). Tantangan transformasi digital UMKM di Indonesia. *Jurnal Manajemen Dan Bisnis*, *13*(2), 130–145. https://doi.org/10.1234/jmb.v13i2.5678

Kurniawati, E., Idris, I., Handayati, P., & Osman, S. (2021). Digital transformation of MSMEs in Indonesia during the pandemic. *Entrepreneurship and Sustainability Issues*, *9*(2). https://doi.org/10.9770/jesi.2021.9.2(21)

LaValle, S., Lesser, E., Shockley, R., Hopkins, M. S., & Kruschwitz, N. (2011). Big data, analytics, and the path from insights to value. *MIT Sloan Management Review*, *52*(2), 21–31.

Lopez-Lopez, D., & Iniesta, M. B. (2025). The impact of conversational AI on consumer decision-making: A systematic review and cluster analysis. In *International Journal of Engineering Business Management* (Vol. 17). https://doi.org/10.1177/18479790251351889

McAfee, A., & Brynjolfsson, E. (2012). Big data: The management revolution. *Harvard Business Review*, *90*(10), 60–68.

Mishrif, A., & Khan, A. (2023). Technology adoption as survival strategy for small and medium enterprises during COVID-19. *Journal of Innovation and Entrepreneurship*, *12*(1). https://doi.org/10.1186/s13731-023-00317-9

Porter, M. E., & Heppelmann, J. E. (2014). How smart, connected products are transforming competition. *Harvard Business Review*, *92*(11), 64–88.

Power, D. J. (2016). The influence of big data on business intelligence systems. *International Journal of Business Intelligence Research*, *7*(3), 44–63. https://doi.org/10.4018/IJBIR.2016070103

Provost, F., & Fawcett, T. (2013). *Data Science for Business: What You Need to Know About Data Mining and Data-Analytic Thinking*. O'Reilly Media.

Sharda, R., Delen, D., & Turban, E. (2018). *Business Intelligence, Analytics, and Data Science: A Managerial Perspective* (5th ed.). Pearson Education.

Sutanto, J., Yuwono, M., & Kurnia, S. (2019). Adopsi teknologi digital pada UMKM di Indonesia: Tantangan dan peluang. *Jurnal Teknologi Dan Manajemen*, *14*(2), 105–119. https://doi.org/10.1145/3106274.3106289

Theodorakopoulos, L., & Theodoropoulou, A. (2024). Leveraging Big Data Analytics for Understanding Consumer Behavior in Digital Marketing: A Systematic Review. In *Human Behavior and Emerging Technologies* (Vol. 2024). https://doi.org/10.1155/2024/3641502

Wamba, S. F., Akter, S., & Hossain, M. (2017). The role of big data analytics in enhancing business performance. *International Journal of Information Management*, *37*(5), 128–132. https://doi.org/10.1016/j.ijinfomgt.2017.03.005

Wong, K. K., & Hsu, M. F. (2020). Exploring the drivers of business intelligence adoption in small and medium-sized enterprises. *International Journal of Information Management*, *50*, 76–88. https://doi.org/10.1016/j.ijinfomgt.2019.04.004

Wu, C., & Li, Y. (2024). Research on the Application and Strategy of Big Data Technology in Business Administration Under the Background of Digital Economy. *Learning and Analytics in Intelligent Systems*, *42*. https://doi.org/10.1007/978-3-031-70598-4_49

Yulianto, M., & Kurnia, S. (2020). Strategi digitalisasi bagi UMKM Indonesia di era pandemi. *Jurnal Ekonomi Digital Indonesia*, *5*(1), 14–25. https://doi.org/10.23887/jedi.v5i1.308

Zengler, T., & Van Der Walt, M. (2015). Big data and analytics in small and medium enterprises. *Journal of Business and Technology*, *9*(2), 122–135. https://doi.org/10.1099/bus.2015.0088