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The Impact of Big Data Analytics on Business Intelligence in E-Commerce: A Review

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Abstract— Big Data Analytics (BDA) is becoming a popular tool to gain insight into businesses and increase their competitive advantage. So, it is important to understand how it works and the opportunities it presents to growing businesses. The primary aim of this study is to evaluate the impact of using Data Analytics on Business Intelligence for e-commerce, focusing on how to promote the use of Big Data Analytics in the e-commerce sector by SMEs. One objective is to develop strategies that can be used by small businesses to take advantage of complicated tools such as BDA and sentiment analysis of social media platforms in order to boost their economic growth.

Keywords: *Big data analytics; Business intelligence; E-commerce; Social media data*

1. INTRODUCTION

Big Data Analytics (BDA) and Business Intelligence (BI) are becoming increasingly important tools in shaping the way e-commerce businesses make decisions (Mariani and Wamba, 2020). Using these tools aims for organisations to gain a competitive advantage within the growing e-commerce market by deploying effective strategies. Big data analytics is focused on uncovering why certain models work better than others by finding correlations and patterns. Its primary purpose is to use statistics and machine learning algorithms to answer specific questions by analysing data sets (Ertemel, 2015). On the other hand, business intelligence involves combining existing performance reports with information gained from data analytics to maximise profit (Ertemel, 2015). The widespread use of the Internet has led to the growth of customers utilising online shopping (e-commerce). More brands are spending their budget on creating an efficient online platform to meet customers' needs (Ferreira et al., 2017). Therefore, in the modern business climate, it has become more important for organisations to evaluate and process their performance data to identify what works and to create better marketing strategies that cater to their customers. According to Sun and Strang (2014), BI and analytics are being prioritised by nearly 50% of interviewed executives, and a further increase in its usage is expected in the next few years.

However, current studies investigating the use of analytics applied to business intelligence do not sufficiently address the consequence of applying these tools in utilising data from social media channels (Ram et al., 2016). This paper aims to gather and examine information to show how e-commerce businesses can gain an advantage by incorporating social media data and other possible data sources in conjunction with BI and big data analytics and evaluate its potential impact on the market. This study also proposes methods in which the use of BI and analytics can be further promoted for practical usage across businesses. The research objectives aim to answer the following:

1. What is the impact of data analytics being applied to business intelligence in the e-commerce market?
2. How can methods be developed to combine data from multiple sources, such as social media, for organisations to manage business intelligence?
3. How can the use of big data analytics for BI be promoted for usage in smaller e-commerce businesses?

This research is important because of the relative difficulty in understanding data analytics and business intelligence, which can be further demystified for higher executives and managers (Zhuang et al., 2021). This

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paper contributes by analysing the impact of data analytics within the context of business intelligence and synthesising methods to collect data from social media to develop marketing strategies for e-commerce businesses.

2. REVIEW OF LITERATURE

Data in the context of BDA can be defined by several qualities, including a large volume of data, speed in producing data and wide-ranging data types. Firstly, looking at volume, most of the existing data was produced in the last five years (Ertmel, 2015; Fan et al., 2015). With advancements in digital storage technology and reduced costs, collecting and storing such large volumes of data for BDA has become more feasible. Secondly, the speed of processing data in storage servers several years ago needed a significant amount of time. However, data can be analysed in real-time rapidly to make informed decisions (Fan et al., 2015). Lastly, for various data, structured and unstructured data are used in BDA to provide valuable insights (Ertmel, 2015). These data sources include financial statements, customer habits, inventory and other relevant variables relating to the business. According to Sun et al. (2015), there are three classification models of BDA, which are predictive, descriptive, and prescriptive analysis. Predictive analysis makes predictions by using existing data and statistics to look for patterns. Analysts use machine learning algorithms to build models that accurately forecast future changes. Statistical methods include linear regression, decision trees and neural networks. Its benefit is to reduce risks and increase operational efficiency. The descriptive analysis deals with trends and relationships dealing with traffic and customer engagement. Prescriptive analysis is focused on optimising solutions using various constraints and decision variables. It provides recommendations to optimize certain performance metrics while considering how it will also affect other metrics within the business, unlike predictive analysis, which mainly works with metrics in isolation.

Ferreira et al. (2017) note that Business Intelligence techniques are concerned with using internal and external information to get an overall picture of company performance. Typically, BI models generate key performance indicators (KPIs) and reports, allowing business executives to understand previously overlooked trends. By allocating more financial resources towards BI and using new technologically advanced tools, small businesses could get higher quality information that optimizes their assets. Several challenges exist in applying BI for e-commerce, which include the costs of creating good BI models, a lack of understanding of the impact of BI on profits that inhibit more businesses from using BI and the maintenance required. A solution is to identify important operational factors, including the number of monthly sales, product stock and daily visits.

To identify the factors that lead to promoting e-commerce activity, the Key Success Factors (KSF) can be introduced. Overall, KSF can be used to examine the expectations and motivations of online shoppers. Looking at online food stores, the primary reason shoppers buy online is to save time and better comfort (Colla and Lapoule, 2012). Online shopping allows customers to order products at any time of day conveniently. This makes it more accessible to customers with limited time during the day and accommodates those with disabilities. Negative factors include delivery time and lack of communication. In addition, customers may want assurance of the quality of products through close examination, which may deter them from using online shopping in preference to physically going to the store (Colla and Lapoule, 2012).

In line with other studies, a functional web design based on sound design principles and usable interfaces has been shown to guarantee the success of e-commerce operations (Colla and Lapoule, 2012). Several aspects of the website can be considered, such as having updated content (product information and deals) and the page's formatting, including layout, navigation buttons and quick feedback. E-commerce businesses need to allocate time to optimize their web pages' UX to make them more user-friendly. In addition, meeting customer needs by incorporating features such as having a search system capable of filtering through product lists and accurate images showcasing the product will help customers spend less time and make decisions about purchasing (Colla and Lapoule, 2012).

Additionally, the product storage and transport mode to the destination (customer) can be considered. One way is pick-up from the retail shop directly after orders, and the other is to send the package to the person's home or a selected designated location (owned by the retail store) where the person can come to pick up their deliveries at their convenience. The second option alleviates the risk of failure of not being able to receive packages while not at home, and it saves the business money (Colla and Lapoule, 2012). However, the second option is not as widely

used, so a strategy to promote this alternative method to more businesses should be considered. Another marketing strategy to increase engagement is for businesses to give complementary items to add competitive advantage and more value than their competition (Ferreira et al., 2017). Examining the impact of BDA on BI requires the identification of such key driving factors, which potentially correlate with customer satisfaction levels. Overall, looking at the various studies presented, offering various options to consumers tends to result in positive feedback. Considering the variables discussed above, big data analytics can be used to measure a correlation between user engagement and these variables to observe which factor has the most impact on profit. Later in the study, during the data collection stage, the factors mentioned can be asked about when interviewing e-commerce businesses to assess how organizations deal with driving engagement.

Regarding the architecture of incorporating business intelligence with the organization, an effective model will improve the business's competitive advantage and profits (Ferreira et al., 2017). One suggested architecture is modelled after Data Warehouse (Ferreira et al., 2017). The architecture supports the use of BI on four levels. The purpose of this architecture. The first level is the 'Data level', which involves the customer interacting with the online shopping website portal. Then, the data is collected and sent to a web server. This data is cleaned and made into logs or records to be extracted and transformed. The second level is the 'Data Warehouse Server'. It involves the company's Data Warehouse and data marts (a relational database to store records in rows and columns) to keep track of all the records. The third level is the 'OLAP Server'. At this level, data is arranged to be processed and analysed to identify the appropriate correlations or trends. Finally, at the fourth level is 'Business Intelligence Analytics'. At this level, after processing the data, reports are produced. The reports contain information on key drivers for change. Also, at this level, data mining techniques can be used for further evaluation (Ferreira et al., 2017).

3. METHODOLOGY

The methods used in this research will follow both a qualitative and semi-structured approach. A qualitative approach provides a more fluid understanding of the impact of BDA and BI by getting the perspective of business executives (Zhuang et al., 2021). The justification for conducting a qualitative study is as follows. According to Mariani and Wamba (2020), qualitative research allows for a deeper level of detail during analysis and can be adapted to the type of information streaming during collection. It makes it easier to change directions when the incoming data is not giving the desired outcomes, thus remaining less restricted. With qualitative research, when a common group is identified, gathering data from individuals within the group can be used to make predictions about the direction the group is likely to go in (Mariani and Wamba, 2020). In this study, the candidates belong to management-level executives of e-commerce businesses. In addition, qualitative research has the advantage of incorporating the human experience, which can potentially identify overlooked perspectives. Typically, the costs for this approach are reduced due to the smaller sample sizes, allowing the project to be conducted on a smaller budget. The results of a qualitative study are better suited for marketing departments to collaborate on ideas and make communication easier. A qualitative approach can be used to examine the relationship between customers and the brand by exploring the perspective of consumers.

The collection of data will be using primary sources of data. It will be gathered using semi-structured interviews of managers and employees working for several case businesses. The e-commerce businesses will span several types of industries, namely media and online retail services. The process will be divided into stages. The first stage is interviewing higher executives from two different teams with operations based in the UK. Also, at this stage, a few regular customers of those services will be interviewed. The first stage aims to gather preliminary data that will examine the extent to which BDA is used with BI in various contexts, and it will be used for comparisons later in the study. The second stage of interviews will be carried out after thoroughly examining the initially collected data and comparison with secondary data from other studies. After several months, a second set of interviews will involve the same candidates from the first stage and other candidates within the management team of multiple e-commerce businesses spanning different industries. This stage will allow the study to gain more data points and will be used to ask follow-up questions based on the first set of interviews (Mariani and Wamba, 2020). The contacts from the first set of interviews can provide a referral for further exploration during the second stage. In short, a qualitative study with semi-structured interviews for data collection is the desired approach to understand better the impact and challenges of BDA/BI used by businesses.

4. CONCLUSION

The topic to be discussed in this research is Big Data Analytics (BDA) applied in the E-Commerce sector, and it intends to focus on three main areas. First, how BDA and BI are impacting the e-commerce market's growth. Second, the aim is to recommend optimising BDA and BI usage by having a well-defined, integrated pipeline and using various data sources, such as social media. Third, to design methods in which the usage of BDA and BI can be promoted by small businesses for economic growth. This objective requires collecting primary data from businesses using a semi-structured approach for further analysis.

The research philosophy that will be followed is interpretivism. It is useful for interpreting qualitative data such as stakeholder perspective and behaviour. This study aims to identify common experiences faced by SMEs attempting to use BDA and BI as part of their pipeline. Interpretivism lines up with the study's objectives as it tries to understand and explore ways business's view BDA, and it allows the analysis to gain further insights by analysing different perspectives and user experiences in the context of e-commerce. The results of this study may be used to identify areas for improvement and make it easier to construct actionable strategies that SMEs can adopt to boost their economic growth. The results can reveal new valuable trends that exist within the e-commerce sector.

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