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## BIG DATA TOOLS AND PERFORMANCE OF AGRIBUSINESS IN RIVERS STATE

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### ABSTRACT

*This study examined Big Data tools and performance of agribusiness. The dimensions of Big Data tools adopted are data mining and data analytics; while product quality and market availability were adopted as measures of agribusiness performance. The study adopted a survey research design. The population of the study comprised 90 registered agribusinesses in Rivers State. A Sample size of 74 agribusinesses was determined using the Taro Yamane formula for sample size determination. A total of 74 structured questionnaire were distributed to the sample elements. However, the final analyses was based on data gleaned from 60 copies of the questionnaire, which upon retrieval, were found to be correctly completed and free from errors. The Spearman's Rank Order Correlation was used to examine the extent to which proxies of Big Data tools relate to metrics of agribusiness performance. The results showed that there is a positive and statistically significant relationship between Big Data tools (data mining and data analytics) and performance of agribusiness (product quality and market availability) in Rivers State. The study thus concludes that Big Data tools inform enhanced performance of agribusinesses in Rivers State and recommends that government should support agribusiness by providing agricultural loan to investors in agribusiness; and establish special research centres for agribusiness development.*

**Keywords:** Agribusiness performance, big data tools, data analytics, data mining, market availability, product quality

### INTRODUCTION

Big data tools involve sensors, devices, mobile applications and Internet-enabled technologies used to mine data from different databases and carryout analytics to gain insight into important trends (Riahi & Riahi, 2018). Data mining and analytics tools enable firms to gather data from different databases, analyze the information and deduce meaningful insights that helps in understanding buyers preferences, and producing quality products to satisfy them (Ribarics, 2016). The adoption of Information and Communication Technology (ITC) in agriculture-based businesses (agribusiness) has changed the traditional perception of agriculture and business. (Arjun, 2016); and has entered to a stage of knowledge discovery where information is the major driver.

Storey and Song (2017) traced the development of agribusiness, and identified nine significant areas of contribution. These are economics of cooperative marketing and management, design and development of credit market institutions, organizational design, market structure and performance analysis, supply chain management and design, optimization of operational efficiency, development of data and analysis for financial management, strategic management, and agribusiness education. Agribusiness requires a lot of research for quality product and accessibility to suitable markets.

Agribusiness constitutes a strategic alignment between actions of multiple stakeholders, like firms, research centers, consumers, government, and the society in general (Sonka, 2014). Agribusiness connotes an enterprise involved in large-scale inputs supplies, production, processing, and storage and marketing of agricultural and allied products (Ogidi, 2014). It is a complex and diverse sub-system of national economy that includes entities handling production, processing, and distribution of food and its derivatives as well as others related services (Kozera-Kowalska & Uglis, 2021). It is not just the traditional agriculture. It encompasses the producers, the supporting organizations, and the consumption (Dawn & Dana, 2001). It involves the business of total supply chain mechanism (Kozera-Kowalska & Uglis, 2021). It is agriculture and business (Zylbersztaj, 2016).

Agribusiness is affected by several indicators; natural (weather) and human factors (technology), in fact, is the incredible array of technology, tied to the individual, communities and government. It is embraced by the whole world because of its important to economic transformation (Zylbersztaj, 2016). We are all involved. Agriculture has become a global economic discourse due to its capacity to transform the economy of developing countries (Menard & Klein, 2004).

Agribusiness is different from other businesses due to basic elements like food as a product, biological nature of production, seasonal nature of business, uncertainty of weather, types of firms, variety of market conditions, rural ties and government involvement (Zhao & Yang, 2018). These factors make agribusiness complex, compared to traditional agriculture that only requires a readily market for sales of perishable good and preservation methods (Menard & Klein, 2004). The main focus of this study was to examine the link between big data tools and performance of agribusiness in Rivers State.

## LITERATURE REVIEW

### Big Data Tools

Profit making is a cardinal objective of business organization. However, this objective may not be achieved all the time due lack of tools required to undertake critical business functions. While organization “exist to provide goods and services for the society, the amount and quality of these goods/services is a result of the innovativeness (use of new technology) of organizations in the competitive economy (Avadikyan et al., 2016). Economies depend on performance of firms; while firms depend on performance of various economic sectors. No firm can do well in a poor economic system. According to Zeb-Obipi (2022), the wealth of nations increase with increase in workers’ productivity. However, the tools available to workers determine their level of productivity. A productive workforce drive successful businesses, societies and nations. This perhaps, explains the concern of developing economies to increase productivity through improved quality of products and market availability for agribusiness (Kaushik, 2016).

Several big data tools exist. In this study however, we focus on data mining tools and data analytics tools. Data mining tools represent a subset of business intelligence (Mohammed & Syed, 2018). The elements of data mining tools are classification, cluster, prediction and association (Chen & Chen, 2008). Classification assigns a set of data to a particular group. It is appropriate for group identification (Witten & Frank, 2005). Prediction data mining tool aims to differentiate factors that affect the performance of organizations (Berry & Linoff, 2000). It is effective for forecasting business success (Gibelt, 2017). Cluster data mining is concerned with pattern observation or groups of similar events together. Clustering data mining tool can be directly applied to more expounded set so that relationships between different attributes will emerge (Kaufman & Peter, 2005). Association data mining is an important well-researched problem in data mining which aims to find hidden relationships among items in large databases (Alharbi, 2015). It has been used in various areas like medicine, relational databases, large database and distributed database (Alharbi, 2015).

Data analytics methods on the other hand, complement one another. It starts with descriptive methods that provide insight from historical data (Riahi & Riahi, 2018). Diagnostics analytics takes a deeper look at data to understand root causes of events (Milovic & Radojevic, 2015). The aim is to provide understanding of relationships and sequences while looking backward (Baum et al., 2018). Predictive Analytics is the third method of analytics after descriptive and diagnostic analytics. Predictive analytics serves as a forecasting tool that supports the detection of tendencies and the prediction of future trends (Delen & Ram, 2018). Predictive analytics combines the art and science of discovering meaningful and novel insight from various data, using techniques such as machine learning, and mathematical and statistical algorithms that supports timely decision-making process (Youssra & Sam, 2018). Lastly, prescriptive analytics is the fourth stage of analytics; and whose objective is to prescribe what actions must be taken to arrest potential issues and propose promising trends that fully utilize logical procedures. Example of prescriptive analytics is large-scale Internet of Things (IoT) surveillance system that prevents large queues in business and suggests weather for agribusiness (Lawler & Joseph, 2017).

### **Agribusiness Performance**

Traditionally agriculture is deemed a science (agricultural Science). Agriculture is changing from mere farming to a technology oriented industry comprising production, agri-science and agribusiness. Agribusiness is concerned with understanding how institutions, organizations, and markets affect vertical and horizontal coordination within the food system (Saghaian et al., 2022). The performance of agribusinesses may be gauged through product quality and market availability.

Product quality describes consumers' assessment of overall excellence of products they receive. It is consumers' comprehensive evaluation of a product and the extent to which it meets their expectations and provides satisfaction (Das-Guru & Paulssen, 2018). Product quality is a prominent way firms that aspire to achieve increased profits through new customer acquisition and retention of current ones attain their aim (Ateke & Amangala, 2021). Product quality is linked to customer satisfaction (Völckner & Hofmann, 2007). Satisfaction occurs when products offered by firms meet or exceed consumers' expectations (Arguello et al., 2019). Quality measurement offers benefits such as knowing how a business process works (Kirchler et al., 2010). Measurement of satisfaction can also be used to find out where to innovate and improve

in order to satisfy customers, especially for things that are considered important to customers (Henseler, 2017).

A market consist individuals, groups, institutions, organizations, etc. that have need for product, and who are willing and have the authority to buy those product. Market availability explain the extent to which there is a buyer group that are ready and willing to buy products offered for sale by marketers. Agribusiness product are often seasonal, hence, require a ready market to be profitable. The market for agribusiness is no longer a primitive market where buyers find it difficult to meet sellers or collaborate with others professionals (Adamashvili et al., 2020). The internet has opened the market-space for both buyers and sellers of agriproducts.

### **Big Data Tools and Agribusiness Performance**

The concept of data mining tool is a subset of business intelligence as stated by (Mohammed & Syed, 2018). Considering the complex nature of agribusiness, food as a product; the natural factor; biological nature (perishable goods), weather variation, seasonal variations of crops requires the new technology like Data Mining. With data mining tool, it is possible to mined data from different distributed databases (Ranjan, 2008).

It is easy to measure products quality based on the data on experience of customers (Das-Guru & Paulssen, 2018). Data mining as knowledge sharing tool also helps the stakeholders to maximized opportunity or minimizes time wastage. It provides tool for searching for customers, providing data for analysis and reporting and also provide data to examined consumers behavior and recommend product for them as well.

Big data analytics provides tool like crop scouting (investigation), geographical information systems, information management system (Arjun, 2016). Since the origin of mankind, agriculture has been a leading sector, it exploit natural resources (land) for the satisfaction of the basic need (food) for man. Data analytics is significant in quality measurement. Data analytics used the four methods to reviewed measurement of customers' satisfaction. Find out areas of innovation and improvement.

It reviewed the hidden patterns in Agribusiness, especially for things that are considered important to producers (Henseler, 2017). Agribusiness is now a global business where producers, professionals, customers and all the stakeholders can easily meet or collaborate together. Data analytics are widely used in all areas of business in the developed world (Adamashvili, et al., 2020).

Consequently upon the foregoing, the following hypotheses were formulated to guide the present study:

- Ho<sub>1</sub>: There is no significant relationship between data mining and product quality of agribusiness in Rivers State.
- Ho<sub>2</sub>: There is no significant positive relationship between data mining and market availability for agribusiness in Rivers State.
- Ho<sub>3</sub>: There is no significant relationship between data analytics and product quality of agribusiness in Rivers State.
- Ho<sub>4</sub>: There is no significant positive relationship between data analytics and market availability for agribusiness in Rivers State.

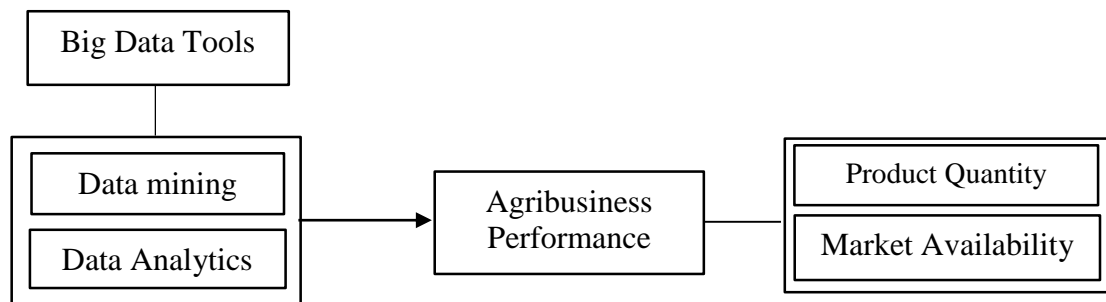


Fig. 1: Big Data tools and performance of agribusinesses.

### Theoretical foundation

This paper is anchored on resource based view theory (Berney, 1991) which analyzes and interprets resources of the organizations to understand how organizations achieve sustainable competitive advantage. It focuses on the concept of how difficult to imitate attributes of the firm as sources of superior performance and competitive advantage. It viewed resources as an important aspect of the organization, that resources that cannot be easily transferred or purchased require an extended learning curve or a major change in the organization climate and culture. Therefore, it is more unique to the organization when successfully applied and it will be more difficult to imitate by competitors. The RBV takes an 'inside-out' view or firm specific perspective on why organizations succeed or fail in the market place (Mugera, 2012). How the use of technology enhanced employee performance, increases customers satisfaction and market share (Mweru & Muya, 2015).

### METHODOLOGY

This study adopted a cross sectional survey research design. As an empirical study, it required data collection, presentation and analysis. The population of the study comprised ninety (90) registered agribusiness in Rivers State, Nigeria ([www.directory.org.ng](http://www.directory.org.ng)). To obtain an accurate sample size, The Taro Yamane formula was used to determine the sample size of seventy four (74) agribusinesses. Seventy four (74) structured questionnaire were distributed to the seventy four (74) agribusinesses. Sixty questionnaire were properly completed and returned, while fourteen (14) of the questionnaire were not properly completed, and were discarded. The correctly completed sixty (60) copies of the questionnaire were used in the final analyses. The study employed descriptive (mean and standard deviation) and inferential (Spearman Rank Order Correlation) statistical tools to determine present and analyze the data gathered from the field.

Mean and standard deviation were used to measure central tendencies and dispersions while the Spearman Rank Order Correlation was used to test the relationship between dimensions of Big Data tools (data mining and data analytics) and measure of agribusiness performance (product quality and market availability). The test of hypotheses was premised on the adoption of the 0.05 level of significance, given the preference and emphasis on 95% confidence interval in the assessment of relationships (Sarantakos, 2005).

**DATA ANALYSES, RESULTS AND INTERPRETATION****Table 1: Descriptive Statistics on Data Mining**

	N	Min.	Max.	Sum	Mean	Std. Dev.
To what extent does your organization able to mine data from distributed databases?	60	1.00	4.00	140.00	2.33	.89569
To what extent does the data mined able to supports effective collaboration?	60	1.00	4.00	151.00	2.51	.77002
To what extent does historical data mined supports the analysis of product quality and availability of market?	60	2.00	4.00	161.00	2.68	.67627
To what extent does your organization able to find solution to agribusiness problems based on data mined from distributed databases?	60	1.00	4.00	163.00	2.71	.78312
Valid N (listwise)	60					

Source: Research survey, 2022.

Table 1 showed the extent to which data mining enhanced the performance of agribusiness in Rivers State, Nigeria. Question one showed that the respondents supported that the organizations are able to mine data from distributed databases with a mean of 2.33 and standard deviation of 0.89569, question two added that data mined from distributed databases supports effective collaboration with a mean of 2.51 and standard deviation of 0.77002, question three added that historical data supports the analysis of product quality and market availability with a mean 2.68 and standard of 0.67627 and finally question four showed that the respondents agreed that the organizations are able to find solutions to agribusiness problems based on data mined from distributed databases with a mean of 2.71 and standard deviation of 0.78312.

**Table 2: Descriptive Statistics on Data Analytics**

	N	Min.	Max.	Sum	Mean	Std. Dev.
To what extent does your organization able to review hidden pattern from the historical data?	60	2.00	4.00	176.00	2.9333	.63424
To what extent is your organization conversant with diagnostics analytics?	60	1.00	4.00	143.00	2.3833	.95831
To what extent does your organization able to discovered problems that exist in agribusiness?	60	1.00	4.00	142.00	2.3667	.99092
To what extent does your organization able to discover the seasonal variation of products and markets?	60	1.00	4.00	171.00	2.8500	1.17639
Valid N (listwise)	60					

Source: Research survey, 2022.

Table 3 showed the extent to which data analytics supports agribusiness in Rivers State, Nigeria. Question one showed that respondents accepted that the organizations are able to review hidden patterns from the historical data with mean of 2.93 and standard deviation of 0.63424, question two indicated that organizations are conversant with diagnostics analytics with a mean of 2.38



and standard deviation of 0.95831, while question three indicated that the organizations are able to discover problems that exist in agribusiness with mean of 2.67 and standard deviation of 0.99092 and finally question four supported that that organizations are able to discover seasonal variation of products and markets with mean of 2.85 and standard deviation of 1.17639 respectively.

**Table 3: Descriptive Statistics on Quality Product**

	N	Min.	Max.	Sum	Mean	Std. Dev.
To what extent are customers satisfied with the price of product?	60	1.00	4.00	160.00	2.66	.91442
To what extent are the consumers always ready to buy the product from agribusiness business in Rivers State?	60	1.00	4.00	164.00	2.73	.97192
To what extent are customers aware of the product without perceived promotion?	60	1.00	4.00	139.00	2.32	.89568
To what extent does product exceed customers' expectation?	60	1.00	4.00	163.00	2.71	.78312
Valid N (listwise)	60					

Source: Research survey, 2022.

Table 3 showed the extents to agribusiness products are acceptable by consumers in Rivers State, Nigeria. Question one showed that the respondents indicated that the customers are satisfied with the price of product with a mean 2.66 and standard deviation of 0.91442, question two indicated that customers are always ready to buy the product from agribusiness in Rivers State with a mean of 2.73 and standard deviation of 0.97192, question three indicated that customers are aware of the product without perceived promotion with a mean of 2.32 and standard deviation of 0.89568 and finally question four added that products exceeded customers' expectation with a mean of 2.71 and standard deviation of 0.78312.

**Table 4: Descriptive Statistics on Market availability**

	N	Min.	Max.	Sum	Mean	Std. Dev.
To what extent are consumers able to access the agribusiness market?	60	2.00	4.00	176.00	2.9333	.63424
To what extent are agribusiness produce brought from farm to market without branding?	60	1.00	4.00	163.00	2.7167	.78312
In the season of a particular product, to what extent are products supplies always exceed product demanded?	60	1.00	4.00	153.00	2.5500	.79030
To what extent are products supply less than products demanded at a particular season	60	2.00	4.00	208.00	3.4667	.87269
Valid N (listwise)	60					

Source: Research survey, 2022.

Table 4 showed the extents to which consumers are able to access the agribusiness market in Rivers State. Question one showed that the respondents supported that it is easy for the consumers to access the agribusiness markets with a mean of 2.93 and standard deviation of

0.63424, question two showed that the respondents supported that agribusiness produce are brought from the farm to the market with any form of processing with a mean of 2.72 and standard deviation of 0.78312, question three also supported that in the season of a particular product, product supplies always exceed product demanded with a mean of 2.55 and standard deviation of 0.79030 and finally question four added that in the same way , at a particular season or out of season product supply are always less than product demanded with a mean of 3.47 and standard deviation of 0.87269.

**Table 5: Correlation matrix on data mining tool and metrics of agribusiness performance**

			Data Mining	Product Quality	Market Availability
Spearman's rho	Data Mining	Correlation Coefficient	1.000	.740**	.749**
		Sig. (2-tailed)	.	.000	.000
		N	60	60	60
	Product Quantity	Correlation Coefficient	.740**	1.000	.919**
		Sig. (2-tailed)	.000	.	.000
		N	60	60	60
	Market Availability	Correlation Coefficient	.749**	.919**	1.000
		Sig. (2-tailed)	.000	.000	.
		N	60	60	60

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Source: Research survey, 2022.

Table 5 showed the relationship between Data Mining and Performance of Agribusiness in Rivers State, Nigeria. The table showed that there is a positive relationship between data mining and product quality. The coefficient of correlation was significant at ( $r = 0.742$ ) and ( $p$ -value =  $0.000 < 0.05$ ) for 95% level of freedom, Also Data mining and market availability was significant at ( $r = 0.749$ ) and ( $p$ -value =  $0.000 < 0.05$ ) for 95% level of freedom. This showed that there is a significant positive relationship between data mining and Performance of Agribusiness in Rivers State, Nigeria.

**Table 6: Correlation matrix on data analytics tool and metrics of agribusiness performance**

			Data Analytics	Quality product	Market Availability
Spearman's rho	Data Analytics	Correlation Coefficient	1.000	.511**	.614**
		Sig. (2-tailed)	.	.000	.000
		N	60	60	60
	Quality product	Correlation Coefficient	.511**	1.000	.919**
		Sig. (2-tailed)	.000	.	.000
		N	60	60	60
	Market Availability	Correlation Coefficient	.614**	.919**	1.000
		Sig. (2-tailed)	.000	.000	.
		N	60	60	60

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Source: Research survey, 2022.

Table 6 showed the relationship between Data Analytics and Performance of Agribusiness in Rivers State, Nigeria. The table showed that there is a positive relationship between data



Analytics and product quality, the coefficient of correlation was significant at ( $r = 0.511$ ) and ( $p$ -value =  $0.000 < 0.05$ ) for 95% level of freedom, Also Data Analytics and market availability was significant at ( $r = 0.614$ ) and ( $p$ -value =  $0.000 < 0.05$ ) for 95% level of freedom. This showed that there is a significant positive relationship between data analytics and Performance of Agribusiness in Rivers State, Nigeria.

### CONCLUSION AND RECOMMENDATIONS

Big data tools enhance performance of agribusinesses. The application of Big Data tools, such as data mining and data analytics, will increase product quality and provide accessible markets for agribusinesses. It will also aid producers to produce quality product that will be acceptable to the global market. It is an effective way for inter business collaborations and virtual marketing; and creates employment and promotes social and economic development. Big data tools enhance performance of agribusinesses. It is a business for everybody (producers and consumers). The application of Big Data tools in Agribusiness is ideal for the social economic transformation of a developing economic such as Rivers State. Based on the findings which amplify the relevance of Big Data tools to performance of agribusinesses, the study recommends that government should support agribusiness by providing agricultural loan to investors in agribusiness; and establish special research centres for agribusiness development.

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