

ARTIFICIAL INTELLIGENCE AND MARKET SHARE OF MANUFACTURING COMPANIES IN RIVERS STATE

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ABSTRACT

This study investigated the effect of Artificial Intelligence on market share of manufacturing companies in Rivers State, Nigeria. The explanatory survey research design was adopted for the study. The objectives of this study were to: determine the nature and extent of adoption of Artificial Intelligence in manufacturing companies and examine the extent to which robotics, machine learning and data mining affect the market share of manufacturing companies in Rivers State, Nigeria. The population of the study comprised of 98 manufacturing companies and the entire population of 98 entities were used as the sample size for the study. The questionnaire was the main instrument used in data collection. 98 copies of the questionnaire were administered to the employees (representatives) of the manufacturing companies and all the copies of the questionnaire were completed and returned. The study employed the descriptive statistics like simple percentages and tables as well as mean and standard deviation to present and analyze the data from the respondents. Regression analysis technique was adopted in testing the hypotheses and it was found that all the dimensions of Artificial Intelligence (AI) had positive effect on market share. The descriptive analysis revealed that more than 10% of the manufacturing companies adopted Artificial Intelligence. Based on that, a further analysis was carried out using regression tool and it was discovered that robotics, machine learning and data mining had positive significant effect on market share. It was therefore concluded that Artificial Intelligence has positive significant effect on market share of manufacturing companies in Rivers State. Consequently, it was recommended that to improve the market share of manufacturing companies, robotics should be adopted and used in these companies in such areas of manufacturing operations and feedback system.

Keywords: Artificial Intelligence, Market Share, Robotic, Machine Learning, Data Mining, Increased Patronage, Growth in Customers.

INTRODUCTION

According to manufacturer's association of Nigeria (MAN, 2016), membership of the association in 1980 was 4,850 and by 2010 the number reduced to 2,000. Many factories have closed in many parts of the country. In the South-South of Nigeria of which Rivers State is part, many large manufacturing firms such as West African Glass Industry and Nigerian Engineering Works were forced to down tool and some companies operate only on skeletal basis. For those still in production, their capacity utilization had dropped from a high rate of 80% in the 1980's to below 30% in 2016 and statistics from the Nigerian Association of Chambers of Commerce, Industry, Mine and Agriculture in 2015, shows that the casualties of retrenchment in the manufacturing industry number over one million people.

In order to boost performance in today's competitive market, a growing number of manufacturing companies, particularly in developed countries are turning to artificial intelligence (AI) to help transform their operations and services. Modern information technologies and the advent of machines powered by artificial intelligence (AI) have already influenced the world of work in this 21st century. Computers, algorithms and software simplify the work process and everyday tasks and have given a facelift to our business operations. Whether in the health, finance, media,

manufacturing, legal and nearly every industry, companies are using AI to automate routine tasks, facilitate customer interactions and discover valuable data that would be impracticable, if not impossible for humans to find on their own (Henshaw & Bueme, 2017). Frascaroli (2019), revealed that a study by Forrester reported that 46 per cent of companies that implement AI today use it on their sales and marketing departments, and 40 per cent use it on customer support. High costs, multiple repetitive tasks, and hours spent doing non-complex tasks are some of the challenges that companies face daily that AI can quickly solve. The main advantage of this technology is its contribution to automating processes and optimizing scarce resources (Frascaroli, 2019).

Despite the benefits of artificial intelligence, as it relates to robots, machine learning, and data mining to a business, the volume of literature on artificial intelligence in Nigeria appears to be low. More so, there seems to be inadequate empirical evidence on the link between artificial intelligence and business growth. For example, Morikawa (2016) examined firms' attitude towards artificial intelligence; Cockburn, Henderson, and Stern (2017) investigated the effect of artificial intelligence on task automation; and Alberto, Guido and Stefano (1996) examined artificial intelligence in production scheduling. These prior studies failed to establish the association between artificial intelligence and business growth. The few available previous studies that actually established the link between artificial intelligence and business growth such as Neha et al., (2018), and Financial Stability Board (2017) are of foreign origin and consequently, deficient in local contents. Environmental differences could cause differences in research findings across different nations and cultures of the world. The few available studies in Nigeria differ from the present study either in the industry where the studies were conducted, the methodology adopted, or the dimensions of the variables used. For example, Oke (2008) did an empirical review on artificial intelligence and revealed that researches on artificial intelligence in the last two decades have greatly improved performance of both manufacturing and service systems. He further revealed that the application of artificial intelligence technologies in Nigerian banks is the key factor for banks expansion in the 21st century. Obasan (2015) examined the effect of machine learning as a catalyst to business growth and expansion in the 21st century. While Oke's work focused on the banking industry, Obasan's study used only one dimension of artificial intelligence. More so, the study was based on the banking sector.

In view of the above discussions and the existing gaps created in prior studies, this present study is therefore designed to investigate the relationship between artificial intelligence and market share of manufacturing companies in Rivers State of Nigeria.

Operational Conceptual Framework



H₀₁: Robotics has no significant effect on market share of manufacturing companies in Rivers State.

H₀₂: Machine learning has no significant effect on market share of manufacturing companies in Rivers State.

H₀₃: Data mining has no significant effect on market share of manufacturing companies in Rivers State.

Artificial Intelligence

Artificial Intelligence (AI) which is also referred to as Machine Intelligence (MI) is intelligence demonstrated by machines, in contrast to the natural intelligence (NI) displayed by humans and other animals. In computer science, AI research is defined as the study of "intelligent agents": any device that perceives its environment and takes actions that maximize its chances of successfully achieving its goals. In the real sense of the word, the term "artificial intelligence" is applied when a machine mimics "cognitive" functions that humans associate with other human minds, such as "learning" and "problem solving" (Russell & Norvig 2003).

The scope of AI is disputed, as machines become increasingly capable, tasks considered as requiring intelligence are often removed from the definition, a phenomenon known as the AI effect, leading to the quip, "AI is whatever hasn't been done yet (Legg & Hutter, 2007). For instance, optical character recognition is frequently excluded from artificial intelligence, having become a routine technology. Capabilities generally classified as AI as of 2017 include successfully understanding human speech, competing at the highest level in strategic game systems (such as chess and Go), autonomous cars, intelligent routing autonomous cars, intelligent routing in content delivery network and military simulations (Legg & Hutter 2007).

According to McCorduck (2004) Artificial Intelligence was founded as an academic discipline in 1956, and has experienced several waves of optimism, followed by disappointment and the loss of funding (known as the AI winter), followed by new approaches, success and renewed funding. For most of its history, AI research has been divided into subfields that often fail to communicate with each other. These sub-fields are based on technical considerations, such as particular goals (e.g. robotics or machine learning), the use of particular tools (logic or artificial neural networks), or deep philosophical differences (Clark, 2015; Ford, & Colvin, 2015; Gale, 2011). Subfields have also been based on social factors (particular institutions or the work of particular researchers).

Robotics

The evolving technological revolution driving the world economic order is witnessing a dramatic rapid change in all dimensions due to more reliance and use of artificial intelligence and the deployment of robots. Charlie (2018) in his article US manufacturing: resurgence sparks dramatic change posited that robotics, big data and the Industrial Internet of Things (IoT) are changing the fortunes of U.S. manufacturing and its workers, with dramatic impact on the domestic supply chain. Robots are advanced automation technologies generally used for production and non-production activities in order to make life easier and to improve productivity at the workplace. In the manufacturing systems, many manufacturers have turned robotics and automation for more reliable manufacturing system solutions.

Application examples of robots are found in the construction industry, car parks, nuclear installations, airports, mines, hospitals, welding shipyards, space stations, and automotive applications. In particular, robots are found in unusual places where the environmental and working conditions presents hazards and/or where dangerous tasks are performed. Robotics deals with the design, construction, operation, as well as computer systems for their control, sensory feedback, and information processing. These technologies are used to develop machines that can substitute for humans and replicate human actions (Cadena et al., 2016).

Machine Learning

Business organizations are focusing and taking a deeper dive into their data to find new and innovative ways of driving their business growth and competitiveness. The evolutionary advances

in science and technology that has warranted the tremendous growth in capacity and improvement in data storage and data processing, particularly in machine learning is affording business organizations the opportunity of adopting larger and more all-inclusive and robust analytical strategies to advance their goals. Hall, Phan and Whitson (2016) opines that a smart phone or an i-phone which could conveniently be inserted into the pocket has more storage and computing power than a mainframe in the 80s, while large amounts of complex and unorganized data that is largely dirty, noisy, or unstructured, is widely available across a nearly infinite network of computing environments. This is especially as industry leaders have been working hard in developing new AI and machine learning technologies over the past decade and thus, Malik and Jeswani (2018) reiterate that many well-known companies are now using Machine learning to optimize business processes in ways that might have been deemed science fiction decades ago.

Data Mining

Knowledge is the most valuable asset of a manufacturing enterprise, as it enables a business to differentiate itself from competitors and to compete efficiently and effectively to the best of its ability and knowledge exists in all business functions, including purchasing, marketing, design, production, maintenance and distribution, but knowledge can be notoriously difficult to identify, capture, and manage (Harding & Kusiak 2006). Knowledge can be as simple as knowing who is best to contact when a specific material is becoming short or can be as complex as mathematical.

The advancements in Information Technology (IT), data acquisition systems, storage technology and the developments in machine learning tools have enticed researchers to take steps towards discovering knowledge from databases (KDD) Data from almost all the processes of the organization such as product and process design, material planning and control, assembling, scheduling, maintenance, recycling, etc., are recorded. These data stores consequently, offer enormous potentials as sources of new knowledge. Making use of collected data is becoming an issue and data mining has positioned itself as a natural solution for converting the data into useful knowledge. The extracted knowledge can be used to model, classify, and make predictions for numerous applications and therefore creating much value for the business. Data mining has been attracting a significant interest and amount of research, media and various industry attention in recent years. Across a wide variety of fields, data are being collected and accumulated at a dramatic pace with supersonic speed.

Market Share

Market share is the percentage of a market (defined in terms of either units or revenue) accounted for by a specific entity. *Armstrong and Greene (2007) posit that market share is said to be a key indicator of market competitiveness - that is, how well a firm is doing against its competitors. This metric, supplemented by changes in sales revenue, helps managers evaluate both primary and selective demand in their market. That is, it enables a judgment call not only total market growth or decline but also trends in customers' selections among competitors.*

Market share growth provides a clear indication of the acceptability of a business organization's products or services in the market. This is an external measure of business growth which depends in part on the state of competition in the business sector or industry. A firm's market share can increase as a result of concerted efforts on behalf of the firm to increase its share, or simply from dynamics in the industry, such as the withdrawal of a competitor which could warrant such result being awarded to the business. Market share growth can be evaluated based on the business sector or at the level of a given product category (Kerin et al 1992).When market share growth occurs, a venture is supplied with revenue which can be ploughed back into resource expansion or capability development for the business organization. Nevertheless, market share growth is dependent on

product or service availability by the business to readily have products and services to sell to customers on demand.

Theoretical Framework

Although it is a common practice for an academic field to be guided and identified by the corresponding theories, the field of artificial intelligence (AI) seems to be an exception. Hence, there is no established unifying *theory* or paradigm that guides artificial intelligence research. Researchers disagree about many issues. However, we shall consider the following theories: unifying grand theory, theory of innovation and computation theory of socio-economic evolution.

Socio-Economic Development

The theory of socio-economic development was propounded by Joseph Alois Schumpeter (1883 - 1950). A renowned economist who ranked amongst the greatest intellectuals of the 20th century. This theory elaborates that in the cyclical development of the economy, long waves, which result in increase in production volumes, higher productivity, improved product quality, lower prices and increase in income is driven by advancement in the technological revolution as part of the socio-economic evolution which consists of an incessant process of creative destruction that modernizes the modus operandi of the society as a whole, including its economic, social, cultural, and political organization. This cyclic development was described by the theorist as "creative destruction", during which there is a continuous updating of the productive apparatus and the transition to a higher stage of development. The major focus of this theory is its main provisions and its relationship with new and emerging markets focusing on both technological and economic evolution. Thus, artificial intelligence which is a trending technology aimed at automating and improving technological advancement of the business to deliver more economic values to the shareholders quickly comes to mind. The socio-economic evolution theory takes a multi-dimensional approach of contemporary society, explaining the principles of operation and the laws of evolution of the economy at all levels. Thus, creating a "synthesized" theoretical system, taking the best from existing modern and past economic thoughts.

New combinations of factors of production are called "innovations". An innovation, according to the theorist, is the basis of a new type of competition, which is much more effective than price competition. Thus, innovations represent an opportunity to change not only the technology and products, but to influence the structure of demand, conditions of formation costs and prices. Creation of a new product: the use of new technologies of production; use the new organization of production; opening new markets and sources of raw materials. Unfortunately, Schumpeter deems innovation as the main cause of economic development which might be distinct from actuality because economic development of a business may not depend on innovations only but also on many other economic and social factors. More so, the theory could be found to be inadequate for underdeveloped countries as the class of innovators is very small because of the small size of markets and low expectation of profits.

This theory ties artificial intelligence to innovative activities with the problem of recurrence, as it believes that the process of innovation does not flow evenly, characterized by leaps and bounds of various durations. The reason for fluctuations is that an entrepreneur seeks new ways of making profit and consequently tends to innovate. Initial innovations are followed by a series of innovations introduced by other entrepreneurs, which determines the growth capacity of investment and leads to long-term prosperity which is the focus of this study.

In view of the above discussions, this present study is anchored on theory of socio-economic evolution as it is more related to the present study.

Artificial Intelligence and Market Share

Salfano and Robert (2014) investigated the relationship between artificial intelligence and market share in selected companies in Sri Lanka. With the use of a survey research design, 89 companies were involved in the study, and data were collected through a questionnaire administered on the marketing managers of the companies. The data for the study were analysed with simple mean and hypotheses were tested with t-test. The findings from the study revealed that artificial intelligence impacts significantly on the market share of companies and recommended the adoption of artificial intelligence in Sri Lanka companies. This is much related to the present study as it has demonstrated the relationship between artificial intelligence and market share.

Ishak (2010) also conducted an empirical investigation on artificial intelligence and competitive advantage measured by market share of US companies. Questionnaire was used to elicit responses from 105 firms from Business Weeks America's 1000 most valuable companies. A quasi experimental design was adopted in the study and data were analysed with spearman's rank correlation coefficient. Findings of the study indicated that better performing firms gain a competitive advantage by using artificial intelligence technologies. This is related to the present study for further evidence.

Bolloju (2002) conducted an empirical study on the impact of integrated online analytical system artificial intelligence software on market share of commercial banks in New Zealand. The study covered a period of five years from 1997 - 2000. Panel data were generated from the study from the records of the banks, which were analysed with the ordinary least square (OLS) regression technique. The findings show r-squared of 0.72, which means that an application of the software (integrated online analytical system) brought about 72% changes in market share of the selected banks. This is closely related to the present study as it has demonstrated the relationship between artificial intelligence and market share.

Koonce and Tai (2007) conducted a study titled "data mining and market behavior. The purpose of the study was to apply data mining to assist managers in understanding customers' behavior. The researchers developed a software tool called DB Mine using Bacons algorithm and applied it to finding pattern in customer scheduling generated by genetic algorithm. The study was conducted in Jordan using 36 companies selected through convenience sampling technique. The data for the study, which were analysed with simple percentage, were generated through observation method. The findings revealed that data mining, which is a dimension of artificial intelligence, is useful to managers for predicting customers' behavior, and this has brought about increase in the companies' market share. Data mining was therefore recommended for use among companies in Jordan. The implication of this study is that it provides empirical evidence related to our study.

METHODOLOGY

The explanatory survey research design was adopted. The population for the study comprised of 98 manufacturing companies in Port Harcourt. The entire population was used as the sample size since the number is manageable and can be reached by the researcher. Thus, the General Managers of the companies were considered as the respondents for this study as they represented their organizations. Since the researcher used the entire population as the respondents, the study therefore adopted the census method. Data was analyzed and interpreted using descriptive statistics such as percentages, mean and standard deviation. In testing the stated hypotheses in this study, regression analysis was adopted by the researcher and the significance of the effect was tested at 5% level of significance. These analyses were conducted with the aid of the Statistical Package for Social Sciences (SPSS) version 25.

Hypotheses Testing

Hypothesis One

Robotics has no significant effect on market share of manufacturing companies in Rivers State.

ANOVA^a

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	178.825	1	178.825	2.329	.003 ^b
	Residual	7371.267	96	76.784		
	Total	7550.092	97			

a. Dependent variable market share

b. Predictors: (Constant) Robotics

Table 1 shows that the effect of robotics on market share is significant (F = 2.329, df = 1, 97, p < 0.05). Therefore, H₀₁ is rejected, indicating that robotics has significant effect on market share in manufacturing companies in Rivers State.

Regression Coefficient

Model		Unstandardized Coefficient		Standardized Coefficients	T	Sig
		β	Std Error	Beta		
1	(Constant)	54.101	3.069		17.631	.000
	Robotics	.273	.093	.146	2.946	.003

a. Dependent Variable: Market Share

Table 4.12b shows that for every increase by 1 unit in the robotics, there will be an increase of 0.15 unit in market share of manufacturing companies in Rivers State.

Hypothesis Two

Machine learning has no significant effect on market share of manufacturing companies in Rivers State.

Table 2: ANOVA Associated with Simple Regression on the Effect of Machine Learning on Market Share of Manufacturing Companies

ANOVA^a

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	294.252	1	294.252	3.842	.007 ^b
	Residual	7361.513	96	76.582		
	Total	7655.765	97			

a. Dependent Variable: Market Share

b. Predictors: (Constant) Machine Learning

Table 2 indicates that the effect of machine learning on market share in manufacturing companies is significant (F = 3.842, df = 1, 97, p < 0.05). Therefore H₀₄ is rejected, indicating that machine learning have significant effect on market share in manufacturing companies in Rivers State.

Table 2b Regression Coefficients^a

Model		Unstandardized Coefficient		Standardized Coefficients	T	Sig
		β	Std Error	Beta		
1	(Constant)	58.305	3.082		19.014	.000
	Machine Learning	.296	.105	.164	3.121	.003

a. Dependent Variable: Market Share

Table 2b reveals that for every increase by 1 unit in the score on machine learning, there will be an increase of 0.16 unit in market share of manufacturing companies in Rivers State.

Hypothesis Three

Data mining has no significant effect on market share of manufacturing companies in Rivers State.

Table 3: ANOVA Associated with Simple Regression on the Effect of Data Mining on Marketing Share of Manufacturing Companies

ANOVA ^a						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	385.321	1	385.321	4.974	.002 ^b
	Residual	6765.042	96	77.469		
	Total	7150.363	97			

a. Dependent Variable: Market Share

b. Predictors: (Constant) Data Mining

Table 3 shows that the effect of data mining on market share in manufacturing companies in Rivers State is significant (F = 4.974, df = 1, 97, p < 0.05). Therefore, H₀₇ is rejected, indicating that data mining have significant effect on market share in manufacturing companies in Rivers State.

Table 3b Regression Coefficients^a

Model		Unstandardized Coefficient		Standardized Coefficients	T	Sig
		β	Std Error	Beta		
1	(Constant)	68.004	2.112		28.046	.000
	Data Mining	.338	.044	.454	3.691	.002

a. Dependent Variable: Market Share

Table 3b indicates that for every increase by 1 unit in the score on data mining, there will be an increase of 0.45 unit in market share of manufacturing companies in Rivers State.

Discussion of Findings

The result of the study revealed that artificial intelligence variables such as robotics, machine learning and data mining are not widely adopted or utilized by manufacturing companies in Rivers State. The responses of the respondents show that majority of the manufacturing companies disagree that they utilize artificial intelligence in Rivers State. Thus, the idea of the use of robots in manufacturing companies although not widespread now will increase with time. This finding is not in agreement with the International Federation of Robotics who predicted that there is a worldwide increase in the use of Industrial Robots and estimated 1.7 million new robot installations in factories worldwide by 2020 (IFR, 2017). This finding is supported by Malik and Jeswani (2018) who maintained that leaders of advanced industries have been working hard at developing new artificial intelligence and machine learning technologies over the past decade. In this wise, many well-known companies are adopting artificial intelligence to optimize companies' processes and operations in ways that might have been deemed science fiction a few decades ago.

The result of the study indicated that there is a very low or little effect of robotics on market share of manufacturing companies in Rivers State; the result of the study also revealed that there is a low or little effect of machine learning on market share in manufacturing companies in Rivers State; the result of the study revealed that there is low or little effect of data mining on market share of manufacturing companies in Rivers State.

CONCLUSION

An appraisal of the effect of Artificial Intelligence on market share of manufacturing companies in Rivers State was undertaken using primary data. The objectives of the study sought to establish the effects of the dimensions of the independent on the measures of the dependent variable. The analysis revealed that all the dimensions of the independent variables had effect on measures of the dependent. Similarly, the test of hypotheses revealed that robotics, machine learning and data mining all have positive significant effect on market share of manufacturing companies in Rivers State. Hence, the study concluded that Artificial Intelligence has positive significant effect on b of manufacturing companies in Rivers State Nigeria.

RECOMMENDATIONS

Sequel to the findings and conclusion, the following recommendations were made.

1. To improve the market share of manufacturing companies, Artificial Intelligence should be adopted and used in the manufacturing companies to enhance operations, design and the production system.
2. The use of Artificial Intelligence should be applied to improve the growth of business and help companies diversify in their various product lines as well increase patronage.
3. Manufacturing companies should promote the use of Machine Learning in picking up cyber security threats, detecting manufacturing hitches as well as fraud as this will help improve their market share through customers patronage and business growth.
4. In order to ensure quality of products, manufacturing companies should adopt data mining which will improve their performance, help to diversify and increase their market share as well as improve growth of their business.
5. Government should work with the various industries and experts to establish AI Council to help coordinate and grow AI in Nigeria.

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