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MANAGEMENT OF ARTIFICIAL INTELLIGENCE AND THE PERFORMANCE OF MANUFACTURING FIRMS IN ENUGU STATE NIGERIA

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Abstract

The study examined the effect of the Management of artificial intelligence on the performance of manufacturing firms in Enugu State Nigeria. The specific objectives are to; examine the effect of infrastructural development on the performance of manufacturing firms and evaluate the effect of workforce skills on the performance of manufacturing firms in Enugu State Nigeria. A descriptive research design was adopted for the study. A structured questionnaire was used to collect data for the study. The data was analyzed using Simple percentages, the mean and standard deviation of the measurement items, and a one-sample t-test analysis were the statistical approaches employed for the data analysis. The study revealed that there is a significant effect of infrastructural development has a significant effect on the performance of manufacturing firms with a t-test value of 12.308 and a probability value of 0.000 while there is a significant effect of workforce skill on the performance of manufacturing firms with a value of (0.000<0,05) in Enugu state, Nigeria. We

concluded that the Management of artificial intelligence has a significant effect on the performance of manufacturing firms in Enugu State Nigeria. We recommended among others that, Government authorities and relevant stakeholders should prioritize investment in infrastructural development to provide a conducive environment for AI implementation in manufacturing firms.
Keywords: Artificial, Intelligence, Management, Performance

1.1 Introduction

Artificial Intelligence (AI) has emerged as a transformative force reshaping industries worldwide, with its potential to revolutionize the manufacturing sector being particularly profound. In recent years, the integration of AI technologies into manufacturing processes has garnered significant attention due to its promise of enhancing efficiency, productivity, and overall performance. As a result, understanding how the management of AI influences the performance of manufacturing firms has become a critical area of research and interest, especially in developing regions like Enugu State, Nigeria. The management of AI encompasses multifaceted dimensions, spanning from strategic planning and resource allocation to talent development and operational integration. Effective AI management practices are pivotal in unlocking the full spectrum of benefits that AI technologies offer, including improved operational efficiency, enhanced customer experiences, and innovative product/service offerings. However, the successful implementation and utilization of AI within organizations necessitate careful consideration of various factors, including organizational culture, leadership commitment, and ethical implications.

Enugu State, situated in the southeastern region of Nigeria, boasts a diverse industrial landscape, with manufacturing playing a pivotal role in its economy. With the rapid advancement of AI technologies globally, Enugu State's manufacturing firms face opportunities and challenges in adopting and effectively managing AI-driven solutions. However, despite the potential benefits, the adoption of AI in the manufacturing sector remains relatively nascent in Enugu State, highlighting the need for empirical research to explore its implications on firm performance. The management of AI encompasses various aspects, including strategic planning, resource allocation, talent development, and technology integration. Effective management practices can determine the extent to which AI technologies are leveraged to optimize manufacturing processes, enhance product quality, reduce costs, and ultimately improve firm competitiveness. Therefore, investigating the strategies, challenges, and outcomes associated with AI management in Enugu State's manufacturing firms is essential for policymakers, industry stakeholders, and academics seeking to foster sustainable economic growth and development. This research aims to contribute to the burgeoning literature on AI management by exploring its effects on the organizational performance of manufacturing firms in Enugu State, Nigeria from a comprehensive perspective.

1.2 Statement of the Problem

The integration of Artificial Intelligence (AI) technologies into manufacturing processes holds immense potential for enhancing efficiency, productivity, and competitiveness. However, despite

the global trend towards AI adoption in manufacturing, its impact on firm performance remains context-dependent and underexplored, particularly in regions such as Enugu State, Nigeria. Thus, the research problem centers on understanding the effect of AI management on the performance of manufacturing firms in Enugu State, Nigeria, with a focus on elucidating the specific challenges, opportunities, and implications within this unique socio-economic context. The Enugu State's manufacturing sector faces distinct challenges and opportunities regarding AI adoption, including issues related to lack of infrastructure, workforce skills, and regulatory frameworks. Understanding the current state of AI adoption and management practices within manufacturing firms is essential for assessing the readiness and capacity for leveraging AI technologies to enhance performance.

1.3 Objective of the study

The main objective of this study is to examine the effect of the Management of artificial intelligence and the performance of manufacturing firms in Enugu State Nigeria. The specific objectives are to;

i. Examine the effect of infrastructural development on the performance of manufacturing firms in Enugu State Nigeria.
ii. Evaluate the effect of workforce skills on the performance of manufacturing firms in Enugu State Nigeria.

1.4 Hypotheses of the study

i. Infrastructural development has no significant effect on the performance of manufacturing firms in Enugu State Nigeria.
ii. Workforce skills have no significant effect on the performance of manufacturing firms in Enugu State Nigeria.

2.0 Review of Related Literature

2.1 Conceptual Review

2.1.1 Artificial Intelligence

Intelligence is an integrated combination of many abilities such as thinking, reasoning comprehension, learning, judgment, and inference. Thanks to intelligence, people can carry out activities such as learning from experience, producing solutions to different and uncertain problems encountered, and responding to new situations as soon as possible. These activities are the core of AI approaches (Celebi, 2021). AI can be defined as the “ability of computers to perform cognitive functions associated with human minds, such as perceiving, reasoning, learning, and problem-solving (Arinez et al., 2020). Artificial intelligence is the whole of techniques that can produce solutions with similar designs to solve problems and try to imitate humans' intelligence or other living organisms in the computer environment in this process. The main benefit of these approaches for business and individual life is their success in problems that are very difficult to solve with classical methods called NP-Hard. In this context, a wide range of artificial intelligence

approaches is used, from multi-purpose to non-linear solutions, from estimation to classification and clustering (Celebi, 2021).

AI used to be a concept with several main areas of application. Natural language processing, robotics, computer vision, automatic theorem proving, intelligent data retrieval, etc. were a few of such topics. These days, these application areas are so broad that they may all be regarded as separate fields. AI is today best defined as a collection of fundamental concepts that support several applications (Nilsson, 2014). The aim of artificial intelligence (AI) is to create a computer that is capable of human-like perception, reasoning, learning, planning, prediction, and other human behaviors. One of the primary traits that sets humans apart from other animals is intelligence. The constant occurrence of industrial revolutions has led to the displacement of human labour in all spheres of life by a growing number of machines kinds; the next major obstacle to be addressed is the impending replacement of human resources by machine intelligence. The fact that so many scientists are concentrating on AI means that the field's research is vast and varied. Search algorithms, knowledge graphs, expert systems, natural language processing, evolution algorithms, machine learning (ML), deep learning (DL), etc. are some of the areas of AI study (Xu et al., 2021).

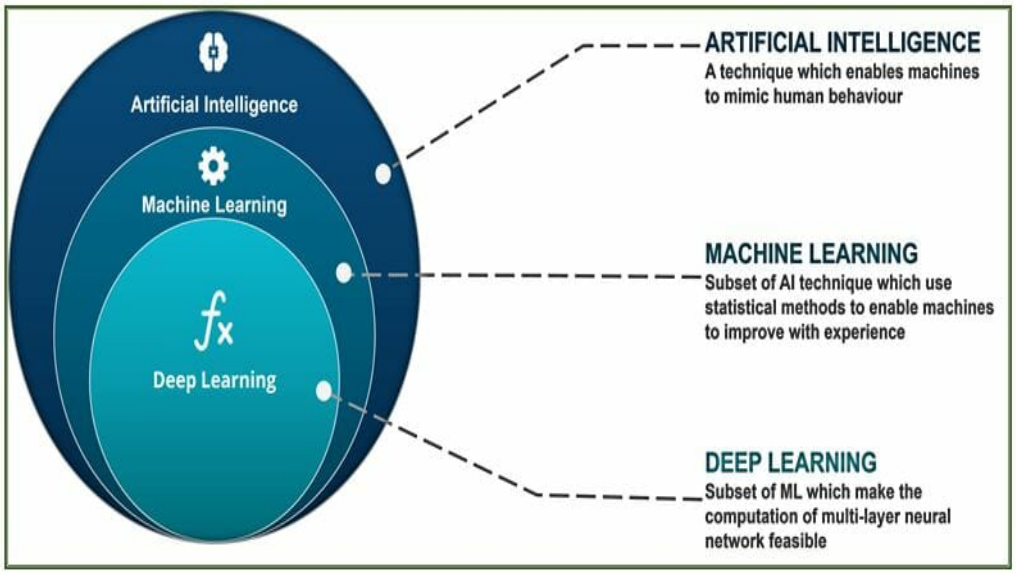

Figure 2.1 An overview of Artificial Intelligence

AI is now best described as a group of core ideas that underline many of these applications. The development of AI in organizations has been strongly influenced by the production of intelligent hardware, the growth of algorithms, and the emergence of big-data science. AI such as deep learning, machine learning, and natural language processing, aid in the planning, management, and operation of different factors and systems within institutions (Chen, Li and Chen, 2021). Machine learning is a feature of AI that is often used to perform duties that could only be undertaken by human beings, such as the filing of information, which can now be completed by

smart electronic record systems that eliminate all the drawbacks of the traditional forms of filing (Alotaibi, 2022).

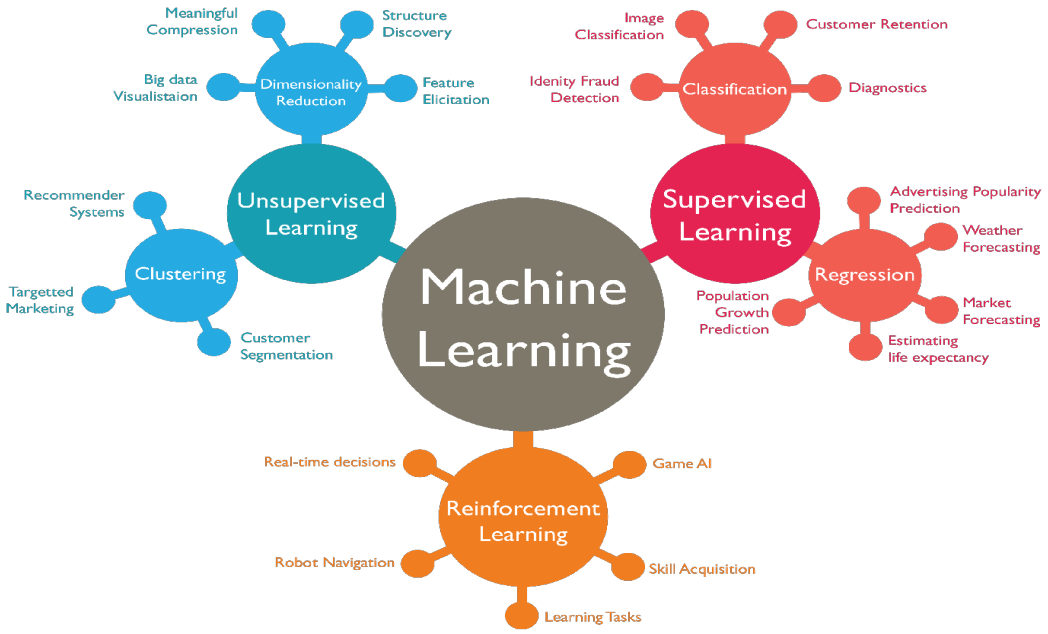

Figure 2.2 Machine Learning and How It Can Be Leveraged in Organisations

2.1.2 Infrastructural Development

Infrastructure development is an important part of public investment in social and physical infrastructures (Ogun, 2010). Investment in infrastructure is a long-term process that involves outlays and yields. The market system will not necessarily provide the optimum level because private individuals seek high returns in the short term. This means that their investment decisions are influenced by high discount rates even if the problems of non-excludability and non-rivalry can be overcome. According to Johnson (2001), both private and public investments have discount rates set by the market system. Therefore, it would be reasonable to use market-determined discount rates in infrastructure investments when capital markets operate efficiently, with full knowledge of risks and returns. There is always a bias in private discount rates as short-term returns are preferred. A short payback period is when firms tend to seek investment (Siyan and Adegoriola, 2017). Electricity infrastructure has been in a state of comatose over the years and this has affected the citizens physically and psychologically thereby affecting economic growth. Massive interruption in the power sector usually disrupts ongoing business activities thereby impeding growth. Another problematic channel through which poor infrastructure impedes economic growth is through transportation. Poor road networks, underdeveloped rail lines, oligopolistic airline market have hindered the transportation of goods around the country (Aworinde and Akintoye, 2019). Also is the decay of health infrastructure in the country. Health infrastructure deficits ultimately lead to huge capital flight in the sector since the rich seek better healthcare in advanced economies thereby expanding what should have been retained in the

economy. Apart from this channel, another channel through which health infrastructure deficit hampers economic growth is the status of the labour force. A healthy population is an active population and since most workers are not insured, their health is compromised and this ultimately hinders productivity in the economy (Aworinde and Akintoye, 2019).

2.1.3 Workforce skills

Skill was defined as the integration of muscular performances (Pear, 1948). Welford (1968) defined skill as an integration of accurate, rapid, and competent performance focused on perceptual-motor performance. Generally, the term skill was defined as a degree of accurate and rapid performance (Winterton et al., 2006). Robbins and Coulter (2002) grouped employee skills into three categories, namely, interpersonal, technical, and problem-solving skills. Technical skills include basic skills, which can be summarized as the ability to read, write, and do computations, as well as job-specific competencies. Interpersonal skills consist of interaction with managers and coworkers. Problem-solving skills involve activities such as problem definition, alternative development, and a section on optimal solutions.

Carnevale et al. (1990) categorized workplace skills as learning, 3Rs (reading, writing, computation), motivation, career development, organizational effectiveness, problem-solving, creative thinking, interpersonal, teamwork, self-esteem goal setting, negotiation, and leadership. According to them, individuals and employers view skills differently; one side identifies skills for providing earnings and opportunities in the workplace, and the other side focuses on the measurement of the level of skills for hiring the most suitable candidate. These skill categories are redefined according to the industrial job demands. Employers also realize the importance of developing their human assets. Therefore, the categories are used not just for hiring but for all human resources practices for making job descriptions, offering training programs, planning career management activities, and performance evaluation (Ada, Ilic, and Sagnak, 2021). According to the most contemporary report for the new skills set, four main skills are used in this study for the development of a decision tool for human resources managers. These skills can be grouped as follows (Deloitte, 2018):

Firstly, workforce readiness skills that show foundational abilities come from traditional educational systems and development programs such as Resume Writing, Self-Presentation, and Time Management. These fundamental skills include both cognitive skills and non-cognitive skills. Non-cognitive skills are related to behavioral skills, which enhance an individual's job performance, interactions, and work discipline (Short and Keller-Bell, 2019).

According to Robbins and Judge (2015), cognitive skills are abilities such as problem-solving and critical thinking skills. The second group includes essential human skills commonly called soft skills such as leadership, communication, collaboration, and empathy. Having employees with good interpersonal skills is likely to make the workplace more pleasant (Robbins and Judge, 2015). According to Burris (2012), employees who know how to relate to others well with supportive dialogue and proactivity will find their ideas endorsed more often leading to workplace satisfaction.

Thirdly, technical skills are categorized such as computer programming, coding project management, etc. coming from new job designs. Industry 4.0 self-managing intelligent systems with autonomic features will provide new manufacturing ecosystems. Thus, advanced manufacturing and industrial processes with cyber-physical systems in modular "smart factories" create machine-human cooperation and symbiotic product realization (Thames and Schaefer, 2016). Romero et al. (2016) also indicated that these near-future manufacturing enterprises, referred as to 'smart factories' with modern manufacturing workforce will need abilities for using advanced digital and industrial enabling technologies. These developments require more technical skills and targeted training.

2.1.4 Performance

In recent decades, the concept of performance has gained significant attention and has become pervasive in almost all areas of human activity. It is a subjective perception of reality, leading to numerous critical reflections on the concept and its measuring instruments. The global financial crisis has also contributed to the multitude of international studies on performance, as the need for improvement in entity performance continues. While the concept of company performance is frequently discussed in scholarly literature, it is rarely defined. This is due to the use of various concepts in defining performance, resulting in confusion surrounding the term. Organizational performance is often mistaken for other notions such as productivity, efficiency, effectiveness, economy, earning capacity, profitability, and competitiveness. Therefore, there is a growing emphasis on a clear and unambiguous definition of performance (Elena-Iuliana and Maria. 2016). Lebans and Euske (2006) provided a set of definitions to illustrate the concept of organizational performance:

i. Performance is a set of financial and non-financial indicators that offer information on the level of accomplishment of objectives and results.
ii. Performance is dynamic, requiring judgment and interpretation.
iii. Performance may be illustrated by using a causal model that describes how future results can be affected by current actions.
iv. Performance may be understood differently depending on the person involved in the assessment of the firm performance.
v. To define the concept of performance, it is necessary to know its fundamental characteristics in each area of responsibility.
vi. To report a firm's performance level, it is necessary to be able to quantify the results.

It is said that a firm is performant when it is at the same time efficient and effective. Therefore, the performance is a function of two variables, efficiency and efficacy. The word performance is considered a broad word because it covers various and different notions such as growth, profitability, return, productivity, efficiency, and competitiveness (Taouab and Issor, 2019).
Bartoli and Blatrix (2015) believed that the definition of performance should be achieved through items such as piloting, evaluation, efficiency, effectiveness, and quality.

2.2 Theoretical Framework

2.2.1 Rough Set Theory of Artificial Intelligence

Rough set theory by Pawlak (1982) is another mathematical approach to vagueness. In the rough set approach, vagueness is due to the lack of information about some elements of the universe. Rough set theory seems to be well-suited as a mathematical model of vagueness and uncertainty. Vagueness is a property of set concepts and is strictly related to the existence of the boundary region of a set, whereas uncertainty is a property of elements of sets. In the rough set approach, both concepts are closely related due to the indiscernibility caused by insufficient information about the world we are interested in. Rough set theory has many interesting applications. The rough set approach seems to be of fundamental importance to AI and cognitive sciences, especially in the areas of machine learning, knowledge acquisition, decision analysis, knowledge discovery from databases, expert systems, inductive reasoning, and pattern recognition. It seems of particular importance to decision support systems and data mining. The main advantage of rough set theory is that it does not ne e d any preliminary or additional information about data} i.e., like probability in statistics, basic probability assignment in the Dempster Shafer theory, grade of membership, or the value of possibility in fuzzy set theory. Rough set theory has been successfully applied to many real-life problems in medicine, pharmacology, engineering, banking, financial and market analysis, and others

2.3 Empirical Review

Klimpova (2012) carried out an exploratory study to reveal employers' views on problems related to workforce human capital (skills and qualifications). Where do employers themselves view the core of difficulties with ensuring an adequately skilled workforce? Do they assign them to technological and organizational changes (a functional concept of job-specific human capital obsolescence), or do they see these problems as a result of other circumstances, such as macro-structural conditions or institutional settings? To answer these questions selected employers in mechanical engineering and information technology sectors in the Czech Republic were interviewed. The results show that the employers see the problems: 1) on the side of the workforce – insufficient abilities and skills, exaggerated demands, and low motivation; 2) as inadequate capacities and capabilities of the organization itself; 3) at the macro-level as institutional shortcomings in the initial educational system and social benefits system.

The problems related to workforce skills and qualification cannot be, thus, interpreted only in the functionalist view as job-specific human capital obsolescence, but the formulation of the problems is significantly affected by the institutional framework. Using Ordinary Least Squares and Granger Causality econometric techniques, Owolabi-Merus (2015) investigated the infrastructural development-economic growth nexus in Nigeria over the period 1983 to 2013. His empirical results reveal that infrastructure (measured by Gross Fixed Capital Formation) has a positive and statistically significant impact on Nigeria's economic growth. However, the Granger Causality test

connotes that there is no mutual correlation between both variables in Nigeria in the period under review.

Using both primary and secondary data, Siyan, Eremionkhale, and Makwe (2015) examined the impact of road transportation on economic growth in Nigeria. The probit model was used to analyze the primary data while the multivariate model was used to analyze the secondary data to determine the long-run relationship between growth and road transportation. Their results show that the transport sector has a positive impact on the economic growth in Nigeria.

Abosede and Adesanya (2017) conducted a study that aimed to determine the contributions of self-efficacy and problem-solving skills to the job performance of secretaries. The study also ascertained the relationship among self-efficacy, problem-solving skills, and job performance of the Secretaries. The study employed a descriptive research design. Ten (10) Secretaries were selected from thirty (30) government parastatals through simple random sampling techniques. Out of the 300 questionnaires distributed only 294 were returned. Three sets of instruments were used in collecting data, the General Perceived Self-Efficacy Scale (GPSS), Problem-Solving Inventory (PSI), and Annual Performance Evaluation Report (APER) Form. The data collected were analyzed using Pearson Product Moment Correlation (PPMC), Multiple Regression, and Analysis of Variance (ANOVA). The result obtained indicated that the predictor variables (self-efficacy and problem-solving skills) accounted for 61.1% of the variance in the job performance of Secretaries in the public service of Ogun State which implies that there is a significant combined contribution of self-efficacy and problem-solving skills in the prediction of job performance of Secretaries in the public service of Ogun State. Also, there are significant and positive relationships among self-efficacy, problem-solving skills, and job performance.

Emeasoba and Nwatarali (2020) conducted a study that sought to assess the problem-solving and self-management skills required of business education students for job performance in colleges of education in South East, Nigeria. It adopts the descriptive survey design. Two research questions and two hypotheses tested at a .05 level of significance were used. The population consisted of 147 Business Educators in public colleges of education in South East, Nigeria. A validated questionnaire with reliability coefficients of 0.78 was used for data collection. Mean and standard deviation were used to analyze research questions while t-test statistics were used to test the hypotheses. Based on the data analysis, it was found that itemized problem-solving skills and self-management skills were required by business education students for job performance in an organization. The findings of the study showed that there is no significant difference between the mean ratings of male and female business education lecturers on the identified problem-solving skills and self-management skills required of business education students for job performance in an organization.

3.0 Methodology

The research design for this study was mostly descriptive to assess the problem statement that was the subject of the investigation. Descriptive research is any type of study that outlines the features

of a specific event. It uses a methodical approach to situational explanation. It is anticipated that this kind of research will support decision-making. They are necessary conditions for generalizations and conclusions. The research investigates the management of artificial intelligence and the performance of manufacturing firms in Enugu state Nigeria.

The target population for the study comprised mostly of personnel/staff, who are experts of manufacturing firms situated in Enugu state, Nigeria. The sample size for the study consisted of 243 personnel/staff as shown by the Taro Yamane formula. The sample allocation for the different firms was estimated using the Kumar allocation formula.

Table 3.2.1: Population and sample size table

S/N	Firms	Population (N)	Percent (%)	Sample size allocation	Percent (%)
1	Wood Willing	213	34.3%	83	34.2%
2	Juhel Nig Limited	348	56%	137	56.4%
3	Sonnac Nig Limited	36	5.8%	14	5.7%
4	Dulex	24	3.9%	9	3.7%
	Total	**621**	100%	243	100%

The pertinent questions found in the study and the concept gleaned from the literature review served as the foundation for the questionnaire's development. The questionnaire comprised eighteen questions in total. Its purpose was to gather data on the management of artificial intelligence and the performance of manufacturing firms. It was intended only for employees at different levels who, due to their roles and responsibilities, are qualified to respond to the questions. When we refer to a research tool's validity, we mean the extent to which it accomplishes its goals or measures what it is supposed to measure. Expert validity was used by the researcher to make sure that the questionnaire item questions were pertinent to the research questions. This individual is a recognized expert in the subject and a practicing professional. Copies of the questionnaire were distributed to respondents from the sampled units using the test-retest process, which established consistency and confirmed the validity of the instrument. Then they were collected and distributed once more. The result was determined using Cronbach's alpha test coefficient, and its reliability was confirmed by the related reliability coefficient of 0.809, which is higher than the required threshold of 0.7. A structured questionnaire was utilized to gather data because of the scope of the investigation. The investigator gave the respondents hard copies of the questionnaire in person. There were twelve measurement items in the questionnaire. A total of 243 surveys were sent out to the manufacturing companies; 208 of those were returned, yielding an 85.6% response rate. Simple percentages, the mean and standard deviation of the measurement items, and a one-sample t-test analysis were the statistical approaches employed for the data analysis to address the study's premise.

4.0 RESULT AND DISCUSSION

This section covers the data collection, presentation, and analysis for this study. In line with the various study objectives, the study's findings are presented and debated. This part also contains the results of the objectives and hypothesis test. Tables were used to present and analyze the gathered data, along with other widely used statistical techniques including sample t-test and basic percentages. To improve comprehension, tables also offer succinct explanations.

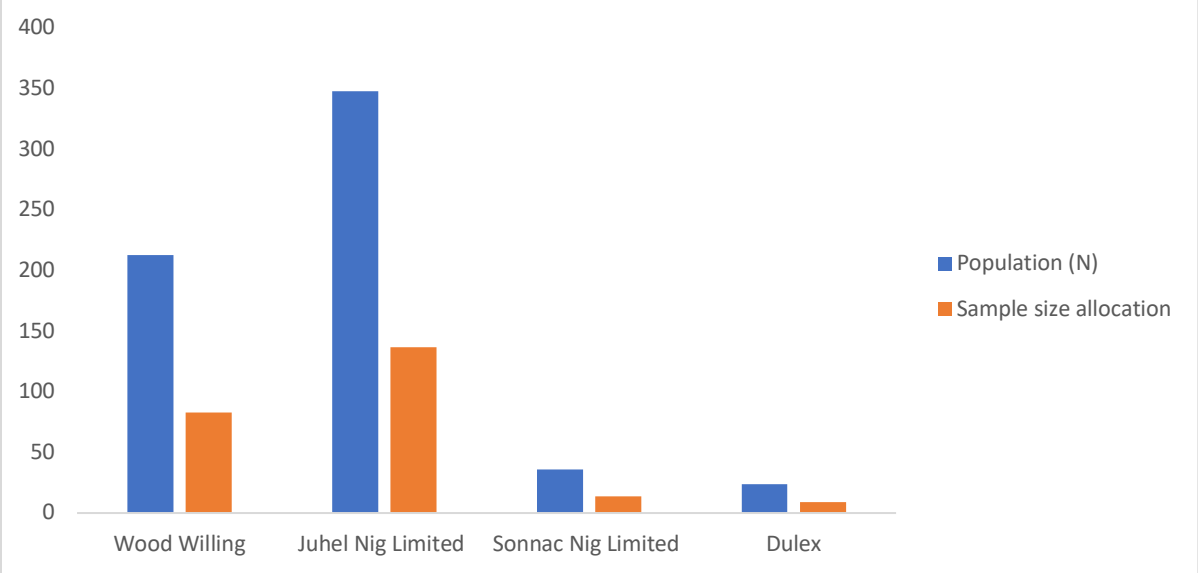

Fig 1: A bar chart represents the distribution of the firm's population and sample size

4.0 RESEARCH QUESTIONS

4.1 Research Question One: What is the effect of infrastructural development on the performance of manufacturing firms in Enugu State Nigeria?

Table 4.1.1: Mean and standard deviation of the effect of infrastructural development on manufacturing firms' performance

S/N	Measurement Items	SA	A	UD	D	SD	Mean ± Std
1	Infrastructural improvements have led to cost savings for our firm	108 [50.5%]	84 [39.3%]	3 [1.4%]	5 [2.3%]	8 [3.8%]	4.34±.923
2	Infrastructural development has positively impacted our firm's productivity	112 [53.8%]	76 [36.5%]	2 [1.0%]	7 [3.4%]	11 [5.3%]	4.30±1.035
3	There have been recent infrastructural development	95 [45.7%]	88 [42.3%]	10 [4.8%]	6 [2.9%]	9 [4.3%]	4.22±.985

	projects (e.g., roads, ports, airports) in your region.						
4	There have been any recent improvements in energy infrastructure (e.g., power plants, grid upgrades) in your region.	82 [39.4%]	75 [36.1%]	7 [3.4%]	12 [5.8%]	32 [15.4%]	3.78±1.416
5	I believe that infrastructural development has improved our firm's competitiveness in the market.	101 [48.6%]	68 [32.7%]	9 [4.3%]	14 [6.7%]	16 [7.7%]	4.08±1.221
6	I would say that most of my firm's overall performance in the past year was largely due to infrastructural development.	91 [43.8%]	72 [34.6%]	6 [2.9%]	17 [8.2%]	22 [10.6%]	3.93±1.322
	Aggregate						**4.11±1.150**

The above table 4.1.1 reveals an analysis of the measures of the variable instrument for the effect of infrastructural development on manufacturing firms' performance. The descriptions in the table show the mean and standard deviation generated for all the statements on the questionnaire. The results indicate that all of the respondents agreed with the instruments. This is based on the aggregate mean score and standard deviation which is above the minimum acceptance mean of 3.0 obtained from the usage of five Likert scales.

4.2 Research Question Two: To what does workforce skill affect the performance of manufacturing firms in Enugu State Nigeria?

Table 4.2.1: Mean and standard deviation of workforce skill and performance of manufacturing firms

S/N	Measurement Items	SA	A	UD	D	SD	**Mean ± Std**
7	I am satisfied with the skill level of the workforce in the manufacturing firm.	107 [51.4%]	75 [36.1%]	4 [1.9%]	9 [4.3%]	13 [6.3%]	4.22±1.107
8	The manufacturing firm effectively addresses challenges	92 [44.2%]	84 [40.4%]	6 [2.9%]	10 [4.8%]	16 [7.7%]	4.08±1.164

	and adapts to changes in the industry.						
9	Overall, I am satisfied with the leadership and support provided within the organization.	76 [36.5%]	58 [27.9%]	9 [4.3%]	25 [12.0%]	40 [19.2%]	3.50±1.545
10	The skills acquired by employees align well with the needs of the manufacturing processes.	63 [30.3%]	54 [26.0%]	13 [6.3%]	30 [14.4%]	48 [23.1%]	3.26±1.576
11	The manufacturing firm encourages continuous learning and development among its workforce.	7 [3.4%]	5 [2.4%]	3 [1.4%]	78 [38.0%]	115 [54.8%]	1.62±.904
12	There is effective communication among different departments within the manufacturing firm.	5 [2.4%]	6 [2.9%]	1 [0.5%]	92 [44.2%]	105 [50.0%]	1.63±.840
	Aggregate mean						**3.05±1.189**

The result from the field survey in Table 4.2.1 revealed an analysis of the measures of the variable instrument to what extent workforce skill affects the performance of manufacturing firms in Enugu state, Nigeria. The descriptions in the Table show the mean and standard deviation generated for all the statements on the questionnaire. It indicates that the majority of the respondents agreed with the instruments except for measurement items 11 and 12 where the respondents disagreed with the instruments being formulated. This is based on the aggregate mean score and standard deviation of [3.05±1.189] which is above the minimum acceptance mean of 3.0 obtained from the usage of five Likert scales.

4.3 Hypothesis Testing

4.3.1 Hypothesis one

H_{11}: Infrastructural development has no significant effect on the performance of manufacturing firms in Enugu State Nigeria.

H_{12}: Infrastructural development has no significant effect on the performance of manufacturing firms in Enugu State Nigeria.

Table 4.4.1a: One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Hypothesis one	6	4.1083	.22058	.09005

Table 4.4.1b: One-Sample Test						
	Test Value = 3.0					
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Hypothesis one	12.308	5	.000	1.10833	.8768	1.3398

Interpretation and Decision

Table 4.3.1b is the one-sample t-test result, with a t-test value of 12.308 and a probability value of 0.000, suggesting a significant impact of infrastructural development on the performance of manufacturing firms. The high t-test value indicates a substantial difference between the observed mean performance of manufacturing firms and the hypothesized mean performance in the absence of infrastructural development. Additionally, the extremely low probability value suggests that the likelihood of observing such a large difference in performance purely due to chance is virtually zero.

Decision:

At a 5% level of significance; there is a significant effect of infrastructural development has a significant effect on the performance of manufacturing firms in Enugu state, Nigeria.

4.3.2 Hypothesis Two

H_{31}: Workforce skills have no significant effect on the performance of manufacturing firms in Enugu State Nigeria.

H_{32}: Workforce skills have no significant effect on the performance of manufacturing firms in Enugu State Nigeria.

Table 4.3.2a: One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Hypothesis three	6	4.2500	.28517	.11642

Table 4.3.2b: One-Sample Test						
	Test Value = 3.0					
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Hypothesis three	10.737	5	.000	1.25000	.9507	1.5493

Interpretation and Decision

The analysis in Table 4.3.1b shows that the probability associated with the calculated significance level value was 0.000, which is less than 0.05. This implies that it was significant. In other words, the null hypothesis should be rejected.

Decision:

At a 5% level of significance; there is a significant effect of workforce skill on the performance of manufacturing firms in Enugu state, Nigeria.

4.4 Discussion of Findings

In the context of assessing the influence of infrastructural development on manufacturing firms' performance, this result implies that there is a statistically significant relationship between the two variables. It suggests that infrastructural improvements, such as better transportation networks, utilities, or communication systems, may lead to notable enhancements in manufacturing firms' productivity, efficiency, or profitability. This finding has significant implications for policymakers, investors, and business leaders, indicating that investments in infrastructure could yield tangible benefits for the manufacturing sector, potentially boosting economic growth and development. Further analysis and exploration may be warranted to understand the mechanisms through which infrastructural development influences manufacturing firm performance and informs strategic decision-making and policy formulation.

Similarly, In the context of assessing the impact of workforce skill on manufacturing firms' performance, this result implies that there is a statistically significant association between the two variables. It suggests that having a skilled workforce, equipped with relevant knowledge and expertise, positively influences manufacturing firms' productivity, quality, and overall effectiveness. This finding underscores the importance of investing in training and education programs to enhance the skills of the workforce within the manufacturing sector. Policymakers, industry leaders, and human resource managers may use this insight to prioritize initiatives aimed at improving workforce skills, which could lead to competitive advantages and sustained success for manufacturing firms. Further research and analysis may be necessary to understand the specific skill sets that drive performance improvements and to devise targeted strategies for workforce development within the manufacturing industry.

5 Conclusion

In conclusion, the management of artificial intelligence (AI) undoubtedly plays a crucial role in shaping the performance of manufacturing firms in Enugu State, Nigeria. This study has highlighted the significant impact of both infrastructural development and workforce skills on the overall efficiency and productivity of manufacturing operations in the region. The findings suggest that effective management of AI technologies can enhance manufacturing processes, streamline operations, and optimize resource utilization. However, the extent to which AI contributes to firm performance is heavily influenced by the availability and quality of infrastructure in Enugu State. Investment in robust infrastructural development, including reliable power supply, transportation networks, and communication systems, is imperative to harness the full potential of AI in manufacturing. Moreover, the study underscores the importance of a skilled workforce equipped with the necessary technical competencies to leverage AI technologies effectively. Training and upskilling initiatives aimed at enhancing the technological proficiency of employees are vital for driving innovation, maintaining competitiveness, and achieving sustainable growth in the manufacturing sector. We concluded that the Management of artificial intelligence has a significant effect on the performance of manufacturing firms in Enugu State Nigeria

Recommendation

Based on the significant findings regarding the management of artificial intelligence (AI) and its impact on the performance of manufacturing firms in Enugu State, Nigeria, as well as the crucial role played by infrastructural development and workforce skills, the following recommendations are proposed:

1. Government authorities and relevant stakeholders should prioritize investment in infrastructural development to provide a conducive environment for AI implementation in manufacturing firms. This includes improving power supply reliability, enhancing transportation networks, and ensuring access to high-speed internet connectivity. Such infrastructural improvements are essential to support the seamless integration and operation of AI technologies, thereby boosting overall manufacturing performance.
2. Efforts should be made by the manufacturing firm to enhance workforce skills through education and training programs tailored to the needs of the manufacturing sector in Enugu State. Initiatives aimed at building technical competencies in AI-related fields, such as data science, machine learning, and robotics, should be encouraged. By investing in the continuous upskilling and reskilling of employees, manufacturing firms can effectively leverage AI tools and platforms to optimize productivity, quality, and innovation.

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