

Impact of Artificial Intelligence on Workforce Management of Nigeria National Petroleum Corporation (NNPC), Rivers State

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Abstract

The study evaluated the Impact of Artificial Intelligence on workforce management of Nigeria National Petroleum Corporation (NNPC). The specific objectives are to: Evaluate the impact of machine learning on output and Examine the impact of Natural language processing (NLP) on tracking work hours of Nigeria National Petroleum Corporation (NNPC). The area of the study was Nigeria National Petroleum Corporation (NNPC) Rivers state. The study used the descriptive survey design approach. The primary source of data was the administration of questionnaire. A total population of 5042 staff was used. The adequate sample size of 357, using Freund and William's statistic formula at 5 percent margin of error was used. 281 staff returned the questionnaire and accurately filled. Data was presented and analyzed using Likert Scale and the hypotheses was tested using Z - test. The findings indicated Machine learning had significant positive impact on output. $Z = 10.738, P. = 0.05$ and Natural language processing (NLP) had significant positive impact on Tracking work hours of Nigeria National Petroleum Corporation (NNPC). $Z = 11.737, P. = 0.05$. The study concluded that Machine learning and Natural language processing (NLP) had significant positive impact on output and Tracking work hours of Nigeria National Petroleum Corporation (NNPC). The study recommended among others that Nigeria National Petroleum Corporation (NNPC) should invest in the adoption and integration of **machine learning** tools to enhance data-driven decision-making, predictive maintenance, and workforce performance analytics

Keywords: Artificial Intelligence, Machine Learning, Natural Language Processing, Workforce Management, Organizational Performance, Oil and Gas Industry.

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Introduction

The integration of Artificial Intelligence (AI) into workforce management has become a pivotal strategy for organizations aiming to enhance operational efficiency and maintain a competitive edge. The Nigerian National Petroleum Corporation (NNPC), as a central entity in Nigeria's oil and gas sector, has increasingly adopted AI technologies to optimize its operations and workforce management practices. NNPC's adoption of AI in workforce management reflects a strategic move towards enhancing operational efficiency and maintaining competitiveness in the evolving oil and gas industry. While the integration of AI offers numerous benefits, it also necessitates addressing challenges related to workforce adaptation, data security, and change management. Continuous investment in employee training and the development of comprehensive policies are essential to maximize the advantages of AI while mitigating associated risks. Artificial Intelligence (AI) started gaining attention in Nigeria's oil and gas sector in the early 2010s, but real traction at NNPC began in the mid-to-late 2010s, particularly after the global downturn in oil prices, which forced oil companies to seek more efficient operational methods (Adedeji et al., 2020). NNPC began exploring AI and data-driven decision-making through its Research, Technology, and Innovation (RTI) division. AI technologies such as machine learning, predictive analytics, and robotic process automation (RPA) began impacting workforce roles at NNPC by: Automating repetitive and low-skill tasks (e.g., payroll, scheduling), enhancing data analysis for asset management and exploration, changing the skills needed by workers (more digital fluency required). Ugonna et al. (2023) noted that AI has brought a shift from "manual manpower dependency" to "tech-assisted decision systems" at NNPC. The demand for AI-integrated operations pushed NNPC to initiate internal training programs aimed at reskilling engineers in AI applications like predictive maintenance, training administrative staff on the use of AI tools for planning and scheduling and collaborating with local universities for AI and data science education (Muhammad, et al., 2023). Artificial Intelligence (AI) is increasingly becoming a transformative force across various sectors globally, and its application in public service and governance is gaining significant attention in Nigeria, a nation characterized by a rapidly growing population and complex socioeconomic challenges. The integration of AI into public services and governance holds the potential to address key issues such as ineffectiveness, inefficiency, corruption, and service delivery gap, (Nwosu et al., 2024).

A workforce management (WFM) solution is a software solution that helps organizations streamline and automate the processes that manage workers' time, organize and deploy their labor force efficiently, enable employee and manager self-service, and ensure employee safety. Effective workforce management encompasses all of the activities needed to maintain a productive and cost-effective workforce. This covers all the tasks and processes involved in efficiently staffing projects to ensure that the right labor mix is available at the right time and cost. It also includes automating time tracking for all employees (including contingent and hourly shift workers) and managing absences and leave with consideration to regional labor laws and reporting requirements. A workforce management system reduces manual processes and enables you to provide better management of a full array of policies governing time and attendance. With improved visibility into hours worked, availability of workers, and safety incidents, overall workforce productivity improves and managers can ensure that staffing needs are covered and respond quickly if things change (Oracle, 2025).

The critical role of effective workforce management practices in enhancing employee engagement, performance, and organizational productivity within NNPC. Implementing clear performance management systems, robust human capital development policies, supportive organizational practices, strategic succession planning, and embracing workforce diversity are essential strategies for NNPC to achieve its objectives and maintain a competitive edge in the global petroleum industry. Also, a low level of leadership commitment is another obstacle to the performance management system. The commitment of leadership and assistance is a must for the smooth execution of PMS. Leaders must drive the procedure to make performance management an inherent portion of the administration of the organization to efficiently engage workers,(Ismaila et al.,2022). As noted by Armstrong (2018), leaders play a complex role in advancing the company's procedures and policies which can guarantee huge performance in the company. Thus, while executing the Performance Management System, leaders are responsible for timely and guiding employees on why PMS is needed in the organization and why each engaged employee will make the organization grow, (Ismaila et al., 2022).

The implementation of AI in personnel management within dynamic societies, highlighting its potential to automate routine tasks, facilitate data-driven decision-making, and improve overall workforce management. NNPC has also recognized the importance of digital skills development. Initiatives such as the establishment of innovation hubs aim to cultivate expertise in areas like data science, AI, and machine learning, which are essential for modernizing operations and maintaining competitiveness in the evolving energy sector. Today's workforce must be adept at innovative technology, data analytics, digital tools, and sustainable practices. This transition involves extensive skill development programmes that can close the gap between existing capabilities and future demands (Banjo,2024). This has necessitated the study the Impact of Artificial Intelligence on workforce management of Nigeria National Petroleum Corporation (NNPC).

Statement of the Problem

The adopted AI technologies in NNPC have enhanced exploration and production processes. The adoption increase operational efficiency, Improve workforce productivity, Reduce costs and risk, Ensure accurate timely data, Create a safer workplace and minimize environmental impact, positioning Nigeria's oil and gas sector at the forefront of innovation. AI-powered tools have automated repetitive tasks, allowing employees to focus on strategic activities that add value. This shift has led to a reevaluation of job roles and responsibilities within the organization. The adoption of AI has necessitated upskilling programs to equip employees with the competencies required to work alongside advanced technologies.

However, AI also introduces significant challenges in workforce management. While AI brings efficiency, it also raises concerns about potential Workforce resistance due to fear of job loss, Data governance and security issues, and Infrastructure and investment deficits for real-time AI deployment. AI systems, particularly automation and robotics, may replace certain manual or repetitive roles. Many employees, especially those who have worked traditionally for decades, may resist AI adoption due to: Fear of the unknown, Limited digital literacy, Skepticism about technology. This resistance can slow down AI integration and reduce organizational efficiency. NNPC may face challenges in recruiting and retaining personnel with the necessary skills in Machine learning, Natural language

Processing, Data science, AI ethics and governance. This skills gap can hinder the development and maintenance of AI systems. AI adoption often demands restructuring departments, redefining job roles, and creating new performance metrics. This transition period can be stressful and disruptive to normal operations if not properly managed.

The consequence of the above issues if not tackled might lead to Inefficient Recruitment and Talent Management, Manual recruitment processes may lead to bias, longer hiring times, and mismatched candidates. Difficulty in identifying skill gaps and training needs due to lack of AI-powered analytics. There will be poor succession planning, output and talent retention strategies. Without AI-driven automation, HR tasks like payroll, scheduling, and performance tracking become time-consuming and error-prone. Delay in decision-making due to lack of real-time data analysis. Inability to forecast workforce needs, turnover rates, or future skill demands and reduced Employee Engagement and Satisfaction. Based on this, the study evaluates the Impact of Artificial Intelligence on workforce management of Nigeria National Petroleum Corporation (NNPC).

Objectives of the Study

The main objective of the study was to evaluate the Impact of Artificial Intelligence on workforce management of Nigeria National Petroleum Corporation (NNPC) in Rivers State. The specific objectives are to:

- i. Evaluate the impact of machine learning on output of Nigeria National Petroleum Corporation (NNPC) in Rivers State
- ii. Examine the impact of Natural language processing (NLP) on tracking work hours of Nigeria National Petroleum Corporation (NNPC) in Rivers State

Research Questions

The following research questions guided the study

- i. What is the impact of machine learning on output of Nigeria National Petroleum Corporation (NNPC) in Rivers State?
- ii. What is the impact of Natural language processing (NLP) on Tracking work hours of Nigeria National Petroleum Corporation (NNPC) in Rivers State?

Statement of Hypotheses

The following Hypotheses guided the study

- i. Machine learning has impact on output of Nigeria National Petroleum Corporation (NNPC) in Rivers State
- ii. Natural language processing (NLP) has impact on Tracking work hours of Nigeria National Petroleum Corporation (NNPC) in Rivers State

Scope of the study

The study focused on impact of artificial intelligence on workforce management of Nigeria National Petroleum Corporation (NNPC). The key issues was on machine learning and Natural language processing (NLP) as independable variables while output and tracking work hours as dependable variables of Nigeria National Population Corporation (NNPC) in Rivers State, Nigeria.

Review of Related Literature

Conceptual Review

Artificial Intelligence

Artificial intelligence (AI) refers to computer systems capable of performing complex tasks that historically only a human could do, such as reasoning, making decisions, or solving problems. Today, the term “AI” describes a wide range of technologies that power many of the services and goods we use every day – from apps that recommend TV shows to chatbots that provide customer support in real time (Coursera, 2024). Artificial intelligence (AI), the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience (Copeland, 2025). Artificial intelligence (AI) is technology that enables computers and machines to simulate human learning, comprehension, problem solving, decision making, creativity and autonomy, (Stryker & Kavlakoglu, 2025).

Components of Artificial Intelligence

Machine learning

Machine learning (ML) is the subset of artificial intelligence that focuses on building systems that learn and improve as they consume more data. Artificial intelligence is a broader term that refers to systems or machines that mimic human intelligence. Machine learning and AI are often discussed together, and the terms are sometimes used interchangeably, but they don't mean the same thing. Machine learning is a technique that discovers previously unknown relationships in data by searching potentially very large data sets to discover patterns and trends that go beyond simple statistical analysis. Machine learning uses sophisticated algorithms that are trained to identify patterns in data, creating models. Those models can be used to make predictions and categorize data, (Chen,2024). Machine Learning, often abbreviated as ML, is a subset of artificial intelligence (AI) that focuses on the development of computer algorithms that improve automatically through experience and by the use of data. In simpler terms, machine learning enables computers to learn from data and make decisions or predictions without being explicitly programmed to do so, (Crabtree, 2025).

Natural language processing

Natural language processing (NLP) is a branch of artificial intelligence (AI) that enables computers to comprehend, generate, and manipulate human language. Natural language processing has the ability to interrogate the data with natural language text or voice, (Eppright, 2021). Natural language processing (NLP) is a subfield of computer science and artificial intelligence (AI) that uses machine learning to enable computers to understand and communicate with human language. NLP enables computers and digital devices to recognize, understand and generate text and speech by combining computational linguistics the rule-based modeling of human language together with statistical modeling, machine learning and deep learning. NLP makes it easier for humans to communicate and collaborate with machines, by allowing them to do so in the natural human language they use every day. This offers benefits across many industries and applications. Automation of repetitive tasks, Improved data analysis and insights, Enhanced search and Content generation (Stryker & Holdsworth, 2025).

Workforce

"Workforce" in the context of the Nigerian National Petroleum Corporation (NNPC) refers to all the employees who work for the organization across its various divisions, subsidiaries, and operational units. In other words, it is the collective human resource that drives all the activities of the state oil company. The workforce includes individuals working at the corporate headquarters as well as those employed in refineries, joint ventures, engineering departments, commercial divisions, and support services across the country. This encompasses roles in operations, management, technical and administrative functions. The reported number of employees has varied over time. For example, a report released in April 2020 cited a workforce of about 6,621 staff, covering all subsidiaries, divisions, and offices nationwide. More recent updates following restructuring efforts have indicated figures around 5,700 employees. These variations are influenced by restructuring initiatives, changes in operational strategy, and efforts to improve efficiency (The Business Intelligence Africa, 2020).

Management

"Management is defined as a dynamic process of planning, organizing, leading, and controlling activities to achieve organizational goals, continuously adapting to internal and external environmental changes." This modern definition includes adaptability, reflecting current business realities like globalization and technological change (Jones & George, 2020). Management is the process of coordinating and integrating work activities so that they are completed efficiently and effectively with and through other people." Robbins and Coulter highlight two key dimensions: efficiency (doing things right) and effectiveness (doing the right things), stressing interpersonal collaboration (Robbins & Coulter, 2018). The Nigerian National Petroleum Corporation (NNPC), now known as NNPC Limited, has undergone significant transformations in its management structure and practices, particularly following the enactment of the Petroleum Industry Act (PIA) in 2021. This legislation restructured NNPC from a public corporation into a commercially focused entity, aiming to enhance efficiency and transparency in Nigeria's oil and gas sector (Ibrahim et al., 2022).

Workforce management

Workforce management within the Nigerian National Petroleum Corporation (NNPC) encompasses a range of human resource practices aimed at enhancing employee performance and organizational productivity. Key components include performance management systems, feedback and reward structures, human capital development policies, and internal corporate social responsibility initiatives. Effective performance management is pivotal in NNPC's workforce strategy. Ibrahim et al. (2022) examined the impact of performance management on employee engagement within NNPC, highlighting the significance of clear objective setting, regular feedback, and fair reward systems in fostering employee commitment and productivity.

The implementation of robust feedback and reward mechanisms has been shown to positively influence employee engagement. Timely feedback and equitable reward systems are crucial for maintaining high levels of employee motivation and performance in NNPC (Ismaila et al., 2022). NNPC's workforce management strategies, encompassing performance management, feedback and rewards, human capital development, and internal CSR, are integral to enhancing employee engagement and organizational productivity.

Components of Workforce management

Output

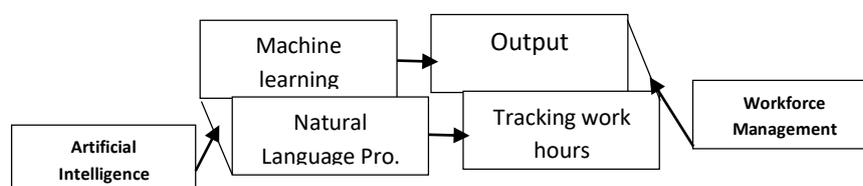
In output refers to the total value of goods and services produced by an economy or a sector within a given period. "Output, in economic terms, denotes the total production of goods and services expressed in terms of value or quantity. It reflects the productive performance of a firm, industry, or economy as a whole" (Mankiw, 2020). The Nigerian National Petroleum Company (NNPC) is responsible for overseeing Nigeria's oil and gas production. In 2023, Nigeria's average daily oil production was approximately 1.5 million barrels per day (bpd), reflecting an increase compared to the previous year. According to the Nigerian Upstream Petroleum Regulatory Commission (NUPRC), there was a 6.5% increase in cumulative oil production and a 1.5% decrease in cumulative condensate production in 2023 compared to 2022. (ResearchGate Publication, 2023)

Tracking works hours

Tracking work hours in an organization like the Nigerian National Petroleum Corporation (NNPC) involves the systematic recording and monitoring of employees' time spent on work-related activities. This process is critical for productivity analysis, payroll accuracy, project management, and ensuring compliance with labor laws. Work hour tracking in NNPC, a large and complex organization in the oil and gas sector, is vital for: Operational efficiency, Payroll management, Project cost allocation and Performance evaluation. Compliance with national and international labor standards. Methods of Tracking Work Hours: Manual Timesheets: Employees manually record their hours, often using spreadsheets or paper logs. Digital Time Clocks: Use of biometric or card-based systems to clock in and out. Automated Time-Tracking Software: Integrated into enterprise resource planning (ERP) systems like SAP, which is reportedly used by NNPC. Effective work hour tracking in large public enterprises in Nigeria, including NNPC, is significantly enhanced by deploying digital solutions that integrate with payroll and HR systems (Okeke & Ibrahim, 2019). Tracking work hours in NNPC is a vital component of organizational effectiveness and accountability. While traditional methods exist, the shift toward digital and biometric systems is seen as more reliable and efficient. Despite the benefits, there are concerns related to employee privacy and the digital divide in some remote operational areas.

Conceptual Framework

A conceptual framework is an analytical model or structure that represents and simplifies complex ideas or systems by organizing key concepts and explaining how they function in the real world (Vicki et al., 2023). The conceptual framework of the study: The machine learning and Natural language processing (NLP) as independent variables while output and tracking work hours as dependable variables of Nigeria National Petroleum Corporation (NNPC) in Rivers State, Nigeria.



Source: Field Survey, 2025

Theoretical Framework

The Technology Acceptance Model theory (TAM), developed by Fred Davis in 1989, guided the study

The Technology Acceptance Model (TAM), developed by Fred Davis in 1989, is a theoretical framework that explains how users come to accept and use a technology. The model is especially relevant when analyzing how organizations, like the Nigerian National Petroleum Corporation (NNPC), adopt and implement Artificial Intelligence (AI) in workforce management.

Overview of the Technology Acceptance Model (TAM), TAM identifies two primary factors that influence technology acceptance: Perceived Usefulness (PU): The degree to which a person believes that using a particular system would enhance their job performance. Perceived Ease of Use (PEOU): The degree to which a person believes that using the system would be free from effort. These factors shape a user's attitude toward using the system, which in turn affects their behavioral intention to use, and ultimately, their actual usage of the technology.

Application of TAM to AI Workforce Management at NNPC

How TAM can be used to understand and enhance the acceptance of AI systems in managing the workforce at NNPC:

- i. Perceived Usefulness in AI Workforce Management. Employees at NNPC are more likely to adopt AI-based workforce tools if they believe these tools: Improve decision-making in hiring, deployment, and training. Enhance productivity through automation of routine HR tasks. Provide real-time insights into employee performance and workforce planning and help in predicting and managing skill gaps using data analytics. AI tools that automatically assign engineers to critical projects based on expertise and availability might be seen as highly useful.
- ii. Perceived Ease of Use. For effective adoption, AI systems should: Have user-friendly interfaces. Require minimal training to operate. Integrate smoothly with existing HR systems (e.g., SAP, Oracle HRMS). Provide clear instructions and support. Example: A chatbot that assists HR staff in managing employee leave requests should be intuitive and quick to learn.
- iii. Attitude Toward Use and Behavioral Intention: The attitudes of managers and employees toward AI will influence their intention to use it. These attitudes are shaped by: Trust in AI decision-making. Perceived threat to job security, Past experience with digital systems and Organizational culture regarding innovation.
- iv. Organizational Implementation Factors (Extending TAM). While TAM focuses on individual acceptance, organizational dynamics at NNPC may require considering: Top management support – Endorsement by executives can boost confidence in AI. Training programs – Investing in training can reduce resistance. Change management strategies. Proper communication and phased implementation reduce fear and increase adoption. Cultural context – Employees in Nigeria may have unique expectations and apprehensions regarding automation and AI.

Empirical Review

Machine learning on output

Lather et al. (2019) conducted a study on the prediction of employee performance using machine learning techniques. The study sought to analyze the performance of employees in an organization on the basis of various factors. The study adopted Support Vector Machines, Random Forest, Naive Bayes, Neural Networks and Logistic Regression. The finding showed that support vector machines prove to be the most efficient in terms of accuracy.

Pap et al. (2022) conducted a study on the modeling organizational performance with machine learning. The study was conducted at Bayelsa State. The study sought to investigate the essential intra- and extra-organizational factors in determining the performance of firms. The study adopted multiple regression method. The finding showed that work organization and innovation are essential in improving firm performance well-being, and that the variables of collaboration and outsourcing, as well as job complexity and autonomy, have the greatest role in improving firm performance.

Nayem and Uddin (2024) conducted a study on the unbiased employee performance evaluation using machine learning. The study was conducted at Bangladesh. The purpose was to explore an unbiased AI algorithmic solution to predict future employee performance considering physical, social, and economic environmental factors that affect employee performance. The sample size of 1109 was used. The study adopted descriptive survey design. The finding showed that the workplace environment is a significant factor affecting employees' performance.

Nahar et al. (2024) conducted a study on the impact of artificial intelligence on the human resources management. The study was conducted at Bangladesh. The study sought to assess the influence of music education on cognitive development in children. The study employed a mixed-methods approach. The findings showed that music education, with its structured learning, practice, and performance elements, could actively contribute to the cognitive growth of children. The study concluded that children engaged in music education demonstrated higher levels of cognitive performance compared to their non-musical peers.

Zhang et al. (2024) conducted a study on the impact of artificial intelligence on organizational justice and project performance: A Systematic Literature and Science Mapping Review. The study sought to explore the impact of artificial intelligence (AI) on organizational justice and project performance. The study was analyzed using systematic review. The finding showed that the annual publication is relevant peer-reviewed journals in the studied domain.

Natural language processing (NLP) on tracking work hours

Bernabei et al. (2022) conducted a study on the natural language processing applications in manufacturing: a systematic literature review. The study sought to identify the mature NLP applications, transversally implemented in several production process phases. The study adopted Meta-Analyses (PRISMA) statement methodology. The finding showed that automation of these activities moves workers to more meaningful and value-added activities; it improves efficiency in searching for and extracting information, with benefits for decision-making processes. The study concluded that extract information and useful knowledge results in a long and tedious task with limited added value.

Lawson-Body et al. (2022) conducted a study on the impact of natural language processing on CRM and trust: An integrated framework. The study sought to examine customer relationship management (CRM) empowered by NLP that offers a new way of building trust with customers effectively. The study adopted Sentiment analysis method. The finding showed that an integrated framework showing pillars of artificial intelligence such as machine learning, deep learning, and NLP. The study concluded that data warehouse and Hadoop feed the framework which relates CRM to Trust. The study recommended that, future research can be used to test the framework using statistical inferences.

Liu (2023) conducted a study on the enhancing organizational performance: Harnessing AI and NLP for user feedback analysis in product development. The study sought to explore the application of AI and NLP techniques for user feedback analysis in the context of heavy machine crane products. The study adopted regression method. The finding showed that promising AI and NLP techniques in user feedback analysis offer organizations a powerful tool to understand customers, improve product development, increase satisfaction, and drive business success.

Chen et al. (2023) conducted a study on the artificial intelligence methods in natural language processing: A comprehensive review. The study was conducted at China. The study sought to offer a comprehensive review of AI's role and methods in NLP, serving as a detailed guide for future research and practical applications. The study adopted sentiment analysis. The finding showed that the remarkable advancements and persistent challenges in NLP, such as language ambiguity and contextual understanding, and underscores the need for diverse and representative labeled data for training.

Harris (2024) conducted a study on the role of natural language processing (NLP) in sentiment analysis for investment decisions. The study sought to explore the transformative role of natural language processing (NLP) ability to process vast amounts of financial text and derive actionable insights for investors. The study adopted logistic regression. The finding showed that harnessing the power of natural language processing (NLP) allows market participants to extract valuable insights from vast amounts of unstructured financial data, such as news articles, social media posts, earnings call transcripts, and more. The study concluded that recognizing sentiment trends in real time, investors can gain a competitive advantage, making data-driven decisions that respond to shifting market dynamics.

Gap in knowledge

The studies done were carried outside the Impact of Artificial Intelligence on workforce management of Nigeria National Petroleum Corporation (NNPC) and did not focus to best of my knowledge on the machine learning on output and Natural language processing (NLP) on tracking work hours of Nigeria National Petroleum Corporation (NNPC). Most of the studies reviewed analyzed their data through, Descriptive statistics and appropriate inferential statistics, Pearson Moment Correlation Coefficient, , Partial Least Square Structural Equation Modeling (PLS-SEM), Multiple Regression Analysis (MRA) method, Simple linear regression and Pearson correlation coefficient (r) to test their hypotheses while the present study made use of Z-test. Therefore, the study aimed at filling this research gap by evaluating the Impact of Artificial Intelligence on workforce management of Nigeria National Petroleum Corporation (NNPC).

Methodology

Research Design

Research design serves as a road map or plan or action showing what and how the researchers will carry out step by-step procedure of accomplishing the research endeavour. Succinctly put, it consists of the blue print for collection, evaluation and analysis of the necessary data for a study. For the study, the descriptive sample survey was employed. Descriptive analysis entails the systematic collection and prescription of data to give a clear picture of a particular situation.

Sources of Data

Sources of data for the empirical study were primary and secondary source.

Primary Sources

Questionnaire: - Data were obtained from information supplied by the respondents to questions contained in the questionnaire distributed to them and the questions are framed in the most simple and unambiguous ways to enable respondents answer those questions accurately.

Secondary Data

Secondary data are the already existing data collected by the investigator agencies and organizations. Secondary data include government publications, websites, books, journal articles, internal records etc.

- (i) Government Publications: The government publications collection consists of publications produced by the federal government and state government.
- (ii) Libraries: The study consulted different libraries of the studied organisation in the state.

Area of the study

The area of the study was Rivers State. The organisation understudy was Nigeria National Petroleum Corporation,(NNPC).

The Population of the Study

The population of the study consists of five thousand and forty two (5042) employees capable of giving of information required. (See table for population distribution of the employees under study). For ease of questionnaire administration and proximity.

Table 3.1 Population of the banks understudy

S/N	Names of the Banks	Staff Strength	Percent
1	Management	163	3
2	Senior Staff	2 154	43
3	Field Workers	2147	42
4	Supervisors	578	12
Total		5042	100

Source: Human Resources Department in February 2025

Sample Size Determination

The study was drawn from the employees in these organizations under study using a stratified sampling method. To determine the adequate sample size, the study used Freund and William's statistical formula as quoted by (Uzoagulu, 2009).

$$n = \frac{Z^2 N(pq)}{N(\epsilon)^2 + Z^2(pq)}$$

Where n = Sample Size
N = The population

p = Probability of success/proportion
q = Probability of failure/proportion
Z = Standard (error of mean) normal deviate
e = Limit of tolerable error (or level of significance)
N = 5042
p = .5
q = (1 - .5) = .5
Z = 95 percent = 1.96
e = 0.05percent

$$= \frac{(1.96)^2 \times 5042 \times .5 \times .5}{5042(0.05)^2 + (1.96)^2 \times .5 \times .5}$$

$$\frac{3.8416 \times 5042 \times .25}{12.605 + 3.8416 \times .25} = \frac{4842.3368}{13.5654} = 356.96 \approx \underline{357}$$

Bowley's (1976) proportional allocation formula for stratified sampling was used to allocate the samples:

$$nh = \frac{n(Nh)}{N}$$

Where:

Nh = Group population from each stratum

n = overall sample size

N = the overall population

nh = sample size from each stratum, in this case each state.

Table 3.2 Computation/Allocation of Sample Size

S/N	Employees	Sample Size	Total
1	Management	$\frac{163 \times 357}{5042}$	12
2	Senior Staff	$\frac{2154 \times 357}{5042}$	153
3	Field Workers	$\frac{2147 \times 357}{5042}$	152
4	Supervisors	$\frac{578 \times 357}{5042}$	40
Total			<u>357</u>

Source: Field Survey, 2025

Sampling Techniques

A stratified random sampling procedure was used for selecting the participants in this study. This technique was employed to ensure a fairly equal representation of the variables for the study. Within each section, selection of staff was by simple random sampling. This was achieved by writing out the names of the staff in piece of paper which was folded and put in a basket. After thorough reshuffling, the researcher selects an element, records it and puts it back in the basket until the required number is obtained. That is, study applied sampling with replacement.

Instrument for Data Collection

The questionnaire was designed and administered on the selected respondents in the **organisations**. The responses generated were used thereafter for data analysis. The responses from the participants were measured using 5-likert scale as follows: Strongly Agree [SA] –5 points, Agree A – 4 points, Undecided UN – 3 Points, Disagree [D] – 2 points and strongly Disagree SD – 1 point.

Validity of the Instrument

To ascertain the validity of the research instrument, the researcher subjected the instrument to face validation by giving it to a panel of judges comprising of three internal assessors, and two management experts that examined the items, and agreed that they were in line with the objectives of the study. The structure and language of the instrument was modified in the light of their corrections.

Reliability of the Instrument

To test for reliability of the instrument, the study distributed 10 copies of the questionnaire to other **organisations** outside the study and, the Cronbach Alpha method was used to compute the internal consistency reliability estimate of the items. The instrument had an overall reliability Cronbach Alphaco-efficient of 0.81 which indicated that the instrument was reliable and, therefore, considered appropriate for use.

Table 3.3a Cronbach Alpha Reliability Test

		N	%
Cases	Valid	10	100.0
	Excluded	0	.0
	Total	10	100.0

a. Listwise deletion based on all variables in the procedure.

Table 3.3b Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	NO of Items
.83	.83	10

SPSS 20.0 Output

Methods of Data Analyses

Data was collected, coded, grouped into frequencies, and arranged into tables for ease of reference. Data from the questionnaire was collected and analyzed using simple percentages and mean. To determine the nature and strength of relationship between the research variables, Z – test was used to test the hypotheses with aid of Special Package for Statistical Software (SPSS). For the 5-point likert scale questions, the scale and decision rule stated below was used in analysing the findings. **Scale:** Strongly Agree (SA) – 5, Agree (A) – 4, Neutral(N) - 3, Disagree (D) – 2, Strongly Disagree(SD) -1.

Decision Rule: If Mean >3.0, the respondents agree, however, If mean ≤3.0, the respondents disagree.

Data Presentation and Analyses
Distribution and Returned Questionnaire

The chapter presents and analyzes the data collected for the study. The presentation and interpretation of data were based on the questionnaire administered to the staff of the selected manufacturing firms in Rivers State

Table 4.1 Distribution and Return of the Questionnaire

Firms	Distributed	No Returned	percent	No not Returned	Percent
1. Management	12	10	3	2	1
2.Senior Staff	153	133	37	20	7
3.Field Workers	152	98	28	54	15
4.Supervisors	40	40	11	-	-
Total	357	281	79.0	76	24

Source: Field Survey, 2025

Table 4.1 shows that of the 357 distributed copies of the questionnaire, 281(79 percent) were returned and used while 76(24 percent) were not returned and were not used.

Data Presentation

The impact of machine learning on output of Nigeria National Petroleum Corporation (NNPC)

Table 4.2.1.1: Responses on the impact of machine learning on output of Nigeria National Petroleum Corporation (NNPC)

		5	4	3	2	1	ΣFX	-	SD	Decision
		SA	A	N	DA	SD		X		
1	Machine learning automates repetitive and low-cognition tasks, freeing up human workers to focus on creative work.	895	204	78	26	12	1215	4.32	1.095	Agree
		179	51	26	13	12	281			
		63.7	18.1	9.3	4.6	4.3	100.0			
2	Machine learning can help optimize processes leading to reduced costs and increased efficiency.	900	204	12	20	38	1174	4.16	1.411	Agree
		180	51	2	10	38	281			
		64.1	18.1	.7	3.6	13.5	100.0			
3	Machine learning can predict equipment failures, predict demand, and identify potential bottlenecks, allowing for proactive measures to be taken and prevent downtime or inefficiencies.	700	204	183	20	19	1126	4.01	1.213	Agree
		140	51	61	10	19	281			
		49.8	18.1	21.7	3.6	6.8	100.0			
4	Machine learning significantly reduce operational costs and improve profitability	700	368	60	4	27	1159	4.12	1.205	Agree
		140	92	20	2	27	281			
		49.8	32.7	7.1	.7	9.6	100.0			
5	Machine learning is a powerful tool that can significantly enhance production efficiency	785	236	36	18	44	1119	3.98	1.465	Agree
		157	59	12	9	44	281			
		55.9	21.0	4.3	3.2	15.7	100.0			
Total Grand mean and standard deviation								4.114	1.2778	

Source: Field Survey, 2025

Table 4.2.1.1, 230 respondents out of 281 representing 81.8 percent agreed Machine learning automates repetitive and low-cognition tasks, freeing up human workers to focus on creative work with the mean score of 4.32 and standard deviation of 1.095. 231 respondents representing 82.2percent agreed that Machine learning can help optimize processes leading to reduced costs and increased efficiency with a mean score of 4.16 and standard deviation of 1.411. 191 respondents representing 67.9 Percent agreed that Machine learning can predict equipment failures, predict demand, and identify potential bottlenecks, allowing for proactive measures to be taken and prevent downtime or inefficiencies with mean score of 4.01 and standard deviation of 1.213. 232 respondents representing 82.5 percent agreed that Machine learning significantly reduce operational costs and improve profitability with mean score of 4.12 and standard deviation of 1.465. 216 respondents representing 57.9 percent agreed that Machine learning is a powerful tool that can significantly enhance production efficiency with a mean score of 3.98 and standard deviation 1.465.

The impact of Natural language processing (NLP) on tracking work hours of Nigeria National Petroleum Corporation (NNPC)

Table 4.2.1.1: Responses on the impact of Natural language processing (NLP) on tracking work hours of Nigeria National Petroleum Corporation (NNPC)

		5	4	3	2	1	ΣFX	-	SD	Decision
		SA	A	N	DA	SD		X		
1	Natural Language Processing (NLP) analyze textual data to extract relevant information like task completion status, potential delays.	465 93 33.1	400 100 35.6	36 12 4.3	72 36 12.8	40 40 14.2	1013 281 100.0	3.60	1.421	Agree
2	NLP analyzes time spent on specific projects, offering a more comprehensive view of work progress than traditional time tracking methods	580 116 41.3	440 110 39.1	36 12 4.3	4 2 .7	41 41 14.6	1101 281 100.0	3.92	1.340	Agree
3	NLP analyze communication patterns to identify trends and patterns in work processes, offering valuable insights for optimizing workflows	690 138 49.1	496 124 44.1	36 12 4.3	8 4 1.4	3 3 1.1	1233 281 100.0	4.39	.734	Agree
4	The NLP system tracks the completion status of individual tasks by analyzing language related to task descriptions	600 120 42.7	588 147 52.3	21 7 2.5	12 6 2.1	1 1 .4	1222 281 100.0	4.35	.670	Agree
5	NLP help reduce manual errors associated with traditional time tracking methods, leading to more accurate work hour records	485 97 34.5	532 133 47.3	21 7 2.25	60 30 10.7	14 14 5.0	1112 281 100.0	3.96	1.117	Agree
Total Grand mean and standard deviation								4.044	1.0564	

Source: Field Survey, 2025

Table 4.2.1.1, 193 respondents out of 281 representing 68.6 percent agreed that Natural Language Processing (NLP) analyze textual data to extract relevant information like task completion status, potential delays with the mean score of 3.60 and standard deviation of 1.421. 226 respondents representing 80.4 percent agreed that NLP analyzes time spent on specific projects, offering a more comprehensive view of work progress than traditional time tracking methods with a mean score of 3.92 and standard deviation of 1.340. 264 respondents representing 93.2 Percent agreed that NLP analyze communication patterns to identify trends and patterns in work processes, offering valuable insights for optimizing workflows with mean score of 4.39 and standard deviation of .734. 267 respondents representing 95. percent agreed that The NLP system tracks the completion status of individual tasks by analyzing language related to task descriptions with mean score of 4.35 and standard deviation of .670. 230 respondents representing 81.8 percent agreed the NLP help reduce manual errors associated with traditional time tracking methods, leading to more accurate work hour records with a mean score of 3.96 and standard deviation 1.117.

Test of Hypotheses

Hypothesis one: Machine learning has impact on output of Nigeria National Petroleum Corporation (NNPC)

One-Sample Kolmogorov-Smirnov Test

	Machine learning automates repetitive and low-cognition tasks, freeing up human workers to focus on creative work.	Machine learning can help optimize processes leading to reduced costs and increased efficiency.	Machine learning can predict equipment failures, predict demand, and identify potential bottlenecks, allowing for proactive measures to be taken and prevent downtime or inefficiencies.	Machine learning significantly reduce operational costs and improve profitability	Machine learning is a powerful tool that can significantly enhance production efficiency
N	281	281	281	281	281
Uniform Parameters ^{a,b}	Minimum	1	1	1	1
	Maximum	5	5	5	5
Most Extreme Differences	Absolute	.637	.641	.498	.576
	Positive	.043	.135	.068	.096
	Negative	-.637	-.641	-.498	-.576
Kolmogorov-Smirnov Z	10.678	10.738	8.352	9.649	9.366
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000

- a. Test distribution is Uniform.
- b. Calculated from data.

Decision Rule

If the calculated Z-value is greater than the critical Z-value (i.e $Z_{cal} > Z_{critical}$), reject the null hypothesis and accept the alternative hypothesis accordingly.

Result

With Kolmogorov-Smirnon Z – value of $8.352 < 10.738$ and on Asymp. Significance of .000, the responses from the respondents as display in the table is normally distributed. This affirms that Machine learning had significant positive impact on output of Nigeria National Petroleum Corporation (NNPC)

Decision

Furthermore, comparing the calculated Z- value of $8.352 < 10.738$ against the critical Z- value of .000 (2-tailed test at 95% level of confidence) the null hypothesis were rejected. Thus the alternative hypothesis was accepted which states that Machine learning had significant positive impact on output of Nigeria National Petroleum Corporation (NNPC)

Hypothesis two: Natural language processing (NLP) has impact on Tracking work hours of Nigeria National Petroleum Corporation (NNPC)

One-Sample Kolmogorov-Smirnov Test

	Natural Language Processing (NLP) analyze textual data to extract relevant information like task completion status, potential delays.	NLP analyzes time spent on specific projects, offering a more comprehensive view of work progress than traditional time tracking methods	NLP analyze communication patterns to identify trends and patterns in work processes, offering valuable insights for optimizing workflows	The NLP system tracks the completion status of individual tasks by analyzing language related to task descriptions	NLP help reduce manual errors associated with traditional time tracking methods, leading to more accurate work hour records
N	281	281	281	281	281
Uniform Parameters ^{a,b}	Minimum	1	1	1	1
	Maximum	5	5	5	5
Most Extreme Differences	Absolute	.437	.554	.682	.700
	Positive	.142	.146	.011	.004
	Negative	-.437	-.554	-.682	-.700
Kolmogorov-Smirnov Z	7.323	9.291	11.439	11.737	9.530
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000

a. Test distribution is Uniform.

b. Calculated from data.

Decision Rule

If the calculated Z-value is greater than the critical Z-value (i.e $Z_{cal} > Z_{critical}$), reject the null hypothesis and accept the alternative hypothesis accordingly.

Result

With Kolmogorov-Smirnon Z – value of $7.323 < 11.737$ and on Asymp. Significance of .000, the responses from the respondents as display in the table is normally distributed. This affirms that Natural language processing (NLP) had significant positive impact on Tracking work hours of Nigeria National Petroleum Corporation (NNPC).

Decision

Furthermore, comparing the calculated Z- value of $7.323 < 11.737$ against the critical Z- value of .000 (2-tailed test at 95% level of confidence) the null hypothesis were rejected. Thus the alternative hypothesis was accepted which states that Natural language processing (NLP) had significant positive impact on Tracking work hours of Nigeria National Petroleum Corporation (NNPC)

Discussion of Findings

Machine learning had significant positive impact on output of Nigeria National Petroleum Corporation (NNPC)

From the result of hypothesis one, the calculated Z- value of $8.352 < 10.738$ against the critical Z- value of .000 which implies that Machine learning had significant positive impact on output of Nigeria National Petroleum Corporation (NNPC). In support of the result in the literature review, *Lather, Malhotra, Saloni, Singh & Mittal (2019) conducted a study on the prediction of employee performance using machine learning techniques*. The study adopted Support Vector Machines, Random Forest, Naive Bayes, Neural Networks and Logistic Regression. The finding showed that support vector machines prove to be the most efficient in terms of accuracy. Pap, Mako, Illessy, Kis and Mosavi (2022) conducted a study on the modeling organizational performance with machine learning. The study adopted multiple regression method. The finding showed that work organization and innovation are essential in improving firm performance well-being, and that the variables of collaboration and outsourcing, as well as job complexity and autonomy, have the greatest role in improving firm performance.

Natural language processing (NLP) had significant positive impact on Tracking work hours of Nigeria National Petroleum Corporation (NNPC)

From the result of hypothesis two, the calculated Z- value of $7.323 < 11.737$ against the critical Z- value of .000 which implies that Natural language processing (NLP) had significant positive impact on Tracking work hours of Nigeria National Petroleum Corporation (NNPC). In support of the result in the literature review, *Bernabei, Colabianchi & Costantino (2022) conducted a study on the natural language processing applications in manufacturing: a systematic literature review*. The study adopted Meta-Analyses (PRISMA) statement methodology. The finding showed that automation of these activities moves workers to more meaningful and value-added activities; it improves efficiency in searching for and extracting information, with benefits for decision-making processes. Liu (2023) conducted a study on the enhancing organizational performance: *Harnessing AI and NLP for user feedback analysis in product development*. The study adopted regression method. The finding showed that promising AI and NLP techniques in user feedback analysis offer organizations a powerful tool to understand customers, improve product development, increase satisfaction, and drive business success

Summary of Findings, Conclusion and Recommendations

Summary of Findings

- i. Machine learning had significant positive impact on output of Nigeria National Petroleum Corporation (NNPC). $Z = 10.738$, $P. = 0.05$.
- ii. Natural language processing (NLP) had significant positive impact on Tracking work hours of Nigeria National Petroleum Corporation (NNPC). $Z = 11.737$, $P. = 0.05$.

Conclusion

The study concluded that Machine learning and Natural language processing (NLP) had significant positive impact on output and Tracking work hours of Nigeria National Petroleum Corporation (NNPC). The integration of Artificial Intelligence into workforce management at the Nigeria National Petroleum Corporation (NNPC) has significantly enhanced operational efficiency, decision-making, and talent optimization. While AI offers transformative potential, it also demands a proactive approach to workforce reskilling, change management, and ethical implementation. For NNPC to fully harness the benefits of AI, it must balance technological advancement with human development, ensuring a future-ready workforce that aligns with its strategic objectives.

Recommendations

- i. Nigeria National Petroleum Corporation (NNPC) should invest in the adoption and integration of **machine learning** tools to enhance data-driven decision-making, predictive maintenance, and workforce performance analytics.
- ii. Natural language processing (NLP) should be employed to improve internal communication, streamline employee feedback systems, and automate routine HR tasks such as recruitment and employee queries. These technologies, when strategically implemented, can significantly improve workforce efficiency and adaptability in a rapidly evolving energy sector.

References

- Adedeji, O. A., Akinwale, Y. O., & Aluko, O. (2020). Emerging Technologies and the Future of Oil and Gas Industry in Nigeria. *African Journal of Science, Technology, Innovation and Development*, 12(2), 235–246. <https://doi.org/10.1080/20421338.2019.1631609>
- Armstrong, M. (2018). *Armstrong's handbook of reward management practice*. Kogan Page
- Banjo, T., (2024), Building a future-ready workforce: Prioritising skills development and innovation in Nigeria's Oil and Gas industry. <https://businessday.ng/opinion/article/building-a-future-ready-workforce-prioritising-skills-development-and-innovation-in-nigerias-oil-and-gas-industry/>
- Bernabei M., Colabianchi S. and Costantino F. (2022). *Natural Language Processing applications in manufacturing: a systematic literature review*.
- Chen, M., (2024), What Is Machine Learning? <https://www.oracle.com/ng/artificial-intelligence/machine-learning/what-is-machine-learning/>
- Chen, Y., Wang, H., Kaiwen Y. & Ruoshui Z. (2023). Artificial intelligence methods in natural language processing: A comprehensive review. *Highlights in Science, Engineering and Technology*, 85,1-6.
- Copeland, (2025), What is artificial intelligence?
- Coursera, (2024). What Is Artificial Intelligence? Definition, Uses, and Types. <https://www.coursera.org/articles/what-is-artificial-intelligence>
- Crabtree, M., (2025), What is Machine Learning? <https://www.datacamp.com/blog/what-is-machine-learning>
- Eppright, C., (2021), What Is Natural Language Processing (NLP)?
- Harris, L. (2024). *The role of natural language processing (nlp) in sentiment analysis for investment decisions*. <https://www.oracle.com/ng/artificial-intelligence/what-is-natural-language-processing/>
Human Science. 6(1), 1-18, www.ijmhs.org
- Ibrahim, A. Y., Lawal, N., & Musa, I. (2022). Performance management and employee engagement in the Nigerian National Petroleum Corporation (NNPC). *International Journal of Management and Human Sciences (IJMHS)*, 6(1), 45–55. <https://ejournal.lucp.net/index.php/ijmhs/article/view/2328>
- Ibrahim, M., Ismaila, A., & Lamino, L. (2022). Effect of Performance Management on Employee Engagement in Nigerian National Petroleum Corporation (NNPC).
- Ismaila et al. (2022), Effect of Performance Management on Employee Engagement in Nigerian. *International Journal of Management and Human Science (IJMHS)*. 6(1). DOI: <https://doi.org/10.31674/ijmhs.2022.v06i01.001>
- Ismaila, A., Usman, M., & Adebayo, J. (2022). Effect of feedback and reward systems on employee motivation in Nigerian oil and gas companies: A study of NNPC. *IOSR Journal of Business and Management (IOSR-JBM)*, 24(1), 20–32. <https://www.iosrjournals.org/iosr-jbm/papers/Vol24-issue1/Ser-1/D2401012032.pdf>
- Jones, G. R., & George, J. M. (2020). *Essentials of Contemporary Management* (9th ed.). McGraw-Hill Education.
- Lather, A.S., Malhotra, R., Saloni, R., Singh, P. & Mittal, S. (2019). Prediction of employee performance using machine learning techniques. *Proceedings of the 1st International Conference on Advanced Information Science and System*, 30:1-6.

- Lawal, O. R. & Alaka, N. S. (2024). Digital transformation systems and employee performance in selected public health facilities in Lagos State, Nigeria. *Lead City Journal of the Social Sciences (LCJSS)*, 9(2).
- Lawson-Body, A., Lawson-B, A., Abdou, I. and Willoughby, L. (2022). Impact of natural language processing on CRM and trust: An integrated framework. *Issues in Information Systems*, 23(1); 306-315.
- Liu, Z. H. (2023). *Enhancing Organizational Performance: Harnessing AI and NLP for User Feedback Analysis in Product Development*, Papers 2405.04692,
- Mankiw, N. G. (2020). Principles of Economics (9th ed.). *Cengage Learning*.
- Muhammad, A. M., Yusuf, I. O., & Olalekan, T. S. (2023). AI and Workforce Transformation in Nigeria's Oil and Gas Sector: A Case Study of NNPC. *Journal of Technical and Innovative Education*, 4(2), 101–118. <https://www.jescae.com/index.php/jtie/article/view/466>
- Nahar, K., Akhter, S. and Shaturaev, J. (2024). Impact of artificial intelligence on the human resources management. *Forthcoming in: Journal of Human Resource and Sustainability Studies*, 2(12), 28-40.
- Nayem, Z. and Uddin, A. (2024). Unbiased employee performance evaluation using machine learning. *Journal of Open Innovation: Technology, Market, and Complexity*, 10: 100243 .
- Nwosu, C. C., Obalum, D. C., & Ananti, M. O. (2024). Artificial intelligence in public service and governance in Nigeria. *Journal of Governance and Accountability Studies*, 4(2), 109-120
- Okeke, T.C., & Ibrahim, H. (2019). Enhancing Productivity in Nigerian Public Enterprises: The Role of ICT in Work Time Management. *African Journal of Business Management*, 13(7), 212-220.
- Oracle,(2025),What is Workforce Management (WFM)? <https://www.oracle.com/nq/human-capital-management/workforce-management/what-is-wfm/>
- Pap, J., Mako, C., Illessy, M., Kis, N., Mosavi, A., 2022. Modeling Organizational Performance with Machine Learning. *J. Open Innov.: Technol., Mark., Complex.* 8(4), 177. <https://tbiafrica.com/tag/nnpc-has-6621-staff-strength>
- Robbins, S. P., & Coulter, M. (2018). Management (14th ed.). *Pearson Education*.
- Stryker, C. and Kavlakoglu, E., (2025). What is AI? <https://www.ibm.com/think/topics/artificial-intelligence>
- Stryker, C. and Holdsworth, J., (2025), What is NLP (natural language processing)? <https://www.ibm.com/think/topics/natural-language-processing>
- The Business Intelligence Africa (2020). "NNPC has 6,621 staff strength – Report".
- Ugonna, B. C., Okeke, P. U., & Ibe, C. C. (2023). Artificial Intelligence Deployment in Oil and Gas: Implication for Workforce Dynamics in Nigeria. *Journal of Energy Systems and Policy*, 11(1), 45–59.
- Zhang, Antwi-Afari, Zhang and Xing (2024). *Impact of artificial intelligence on organizational justice and project performance: A Systematic Literature and Science Mapping Review*.