East African Journal of Business and Economics, Volume 7, Issue 2, 2024
Article DOI: https://doi.org/10.37284/eajbe.7.2.2279

East African Journal of Business and Economics
eajbe.eanso.org
Volume 7, Issue 2, 2024
Print ISSN: 2707-4250 | Online ISSN: 2707-4269
Title DOI: https://doi.org/10.37284/2707-4269

EANSO
EAST AFRICAN NATURE & SCIENCE ORGANIZATION

Original Article

Leveraging Technological Research Methodologies to Improve Employee Performance in Organizations

Eucabeth Adoyo Kwasu[1*], *Dr. Kepha Andrew Ombui, PhD*[1] *& Eric Siele*[1]

[1] St. Paul's University, P. O. Box Private Bag - 00217, Limuru, Kenya
* Correspondence Email: adoyokwasu@gmail.com

Article DOI: https://doi.org/10.37284/eajbe.7.2.2279

Date Published:
08 October 2024

Keywords:
Employee Performance, Human Resource Management, Tech-Enhanced Research Tools

ABSTRACT

The effective management of human resources in organizations is imperative for attaining optimum performance and eventual profitability. The increasingly competitive marketplace has compelled organizations to work towards attaining operational excellence, which heavily relies on the performance of its human resources. The adoption of cutting-edge research techniques has emerged as a pivotal strategy as organizations endeavour to achieve operational excellence. However, human resource managers have had to grapple with various challenges associated with the management of employee data generated and managed through digital platforms and tools, including issues such as data safety and security. This paper explores the intersection between tech-enhanced, advanced research methodologies and employee performance that is geared toward sustainable economic growth at the organizational level. Notably, the paper examines big data analytics as a tech-enhanced research tool leveraged by organizations in a bid to understand their human resource and the best way they can be managed to ensure high performance, which translates into high productivity and competitiveness in their respective sector or industries. In particular, this paper conducts a comprehensive review of recent extant literature regarding the adoption of big data analytics, which has revolutionized how organizations collect and analyze vast amounts of data, thereby enhancing their decision-making process. The reviewed literature focused on human resource aspects such as recruitment and selection; employee development; employee performance management and compensation structures. The review revealed that big data has emerged as a critical tool for managing large volumes of data that are acquired via numerous digital tools as organizations grapple with the integration of technology into their human resource practices. The technologies have helped human resource managers with these structured and unstructured data, they gain insight that in turn, guides their decision-making processes and improves the overall operational efficiency. The review outlines the transformative potential of integrating big data tools with human resource management and recommends that organizations should invest in these tools to enhance their recruitment and

Article DOI: https://doi.org/10.37284/eajbe.7.2.2279

selection, employee development, performance measurement and upgrade their compensation structure.

APA CITATION

Kwasu, E. A., Ombui, K. A. & Siele, E. (2024). Leveraging Technological Research Methodologies to Improve Employee Performance in Organizations. *East African Journal of Business and Economics*, *7*(2), 51-65. https://doi.org/10.37284/eajbe.7.2.2279

CHICAGO CITATION

Kwasu, Eucabeth Adoyo, Kepha Andrew Ombui and Eric Siele. 2024. "Leveraging Technological Research Methodologies to Improve Employee Performance in Organizations". *East African Journal of Business and Economics* 7 (2), 51-65. https://doi.org/10.37284/eajbe.7.2.2279.

HARVARD CITATION

Kwasu, E. A., Ombui, K. A. & Siele, E. (2024) "Leveraging Technological Research Methodologies to Improve Employee Performance in Organizations", *East African Journal of Business and Economics*, 7(2), pp. 51-65. doi: 10.37284/eajbe.7.2.2279.

IEEE CITATION

E. A., Kwasu, K. A., Ombui & E., Siele "Leveraging Technological Research Methodologies to Improve Employee Performance in Organizations", *EAJBE*, vol. 7, no. 2, pp. 51-65, Oct. 2024.

MLA CITATION

Kwasu, Eucabeth Adoyo, Kepha Andrew Ombui & Eric Siele. "Leveraging Technological Research Methodologies to Improve Employee Performance in Organizations". *East African Journal of Business and Economics*, Vol. 7, no. 2, Oct. 2024, pp. 51-65, doi:10.37284/eajbe.7.2.2279.

INTRODUCTION

Employees make up the most invaluable resource that organizations have and therefore effective management of employees is imperative in ensuring the attainment of organization goals and objectives. Many organizations have adopted technology in the quest to effectively manage their human resource, which comes across as an obvious trend considering the pervasive integration of technologies into the operationalization of current organizations in facets other than human resource management.

This review, went further ahead to examine how tech-enhanced research methodologies informed the current human resource approaches and practices that have been adopted across the board to ensure that employees are equipped with the competencies they require and have the opportunity to contribute to the realization of organizational goals and objectives to the best of their capacity or competencies. In particular, the review focused on the use of big data technology in various aspects of human resource management.

Big data technology consists of an array of advanced frameworks, tools and techniques that are used for collecting, storing, processing and analyzing large volumes of data (Al-Dulaimi, & Ku-Mahamud, 2020; Batko, & Ślęzak, 2022; Favaretto, 2020; Rahul, 2023). The data collected via big data technology could either be unstructured, semi-structured or structured (Batko, & Ślęzak, 2022; Rahul,2023; Yaseen, & Obaid, 2020). Batko, & Ślęzak, (2022) observe that big data technology has become invaluable at a time when there is a proliferation of various digital data sources including smartphones, sensors, social media and other transactional systems. The massive volume of data that emanates from these sources makes it invaluable for organizations to adopt big data technologies that can help them handle the data sets (Rahul,2023), and therefore effectively overcome the limitation that traditional data processing mechanisms have failed to manage (Alwan, & Ku-Mahamud, 2020; Rahul, 2023). This is critical considering that the volume of data collected is large and diverse and continues to grow day after day. Batko, & Ślęzak, (2022) concur that while the data grows, they present complexities in terms of variety, volume and velocity, which traditional data management systems cannot handle effectively.

Article DOI: https://doi.org/10.37284/eajbe.7.2.2279

According to Yaseen, & Obaid (2020), big data technology is used in predictive modelling, machine learning (ML) and other analytic tools in making informed decisions or rather implementing evidence-based solutions to business problems (Alshehadeh, 2023; Rahul et al., 2023). Some of the six key Vs that are associated with big data technology include volume, variety, velocity, veracity, variability and value (Batko, & Ślęzak, 2022; Favaretto, 2020; Rahul et al., 2023; Yaseen, & Obaid, 2020). For one, big data is often associated with high volume which characterizes the large amounts of data that are collected from a broad scope of devices and sources regularly (Al-Sai et al., 2022; Batko, & Ślęzak, 2022); and which need to be effectively processed to inform understanding and decision-making in organizations (Batko, & Ślęzak, 2022). Rahul (2023) notes that despite its volumes, data needed to be assessed and analyzed in real-time to provide meaningful contributions to the operationalization of organizations needs adopting big data technologies.

Variety indicates the heterogeneity of data that is drawn from various devices and sources, which makes it semi-structured, unstructured and structured in form and content (Alshehadeh, 2023; Batko, & Ślęzak, 2022). Traditionally, organizations used relational databases or data spreadsheets to compile and assess data (Favaretto, 2020; Yaseen, & Obaid, 2020), which are rather tedious processes of handling structured data that are fraught with loopholes for making erroneous conclusions (Rahul, 2023). The old methodologies have been supplemented by big data technologies that can process even unstructured data such as video files, audio files, images and text (Curry et al., 2022; Rahul et al., 2023; Yaseen, & Obaid, 2020). Rahul et al., (2023) further point out that big data technologies can also handle semi-structured data formats such as those collected by sensors, which are difficult to organize through our fixed data schema.

Rahul et al., (2023) observe that big data can be noisy, messy and prone to error considering their volumes and this makes it increasingly difficult for those handling it to control its accuracy and quality. Besides, technology has enabled the establishment of large databases that are used in organizations spanning across physical borders or those with multiple departments (Batko, & Ślęzak, 2022; Favaretto, 2020; Ramasamy, & Chowdhury, 2020). Handling such data can be confusing and unwieldy, therefore presenting an incomplete image of the particular issues (Alshehadeh et al., 2023; Curry, 2022); as opposed to processing small data sizes. In this regard, big data technologies have proved invaluable in ensuring the veracity of data sets and acquiring trustworthy findings from them (Alshehadeh, 2023; Yaseen, & Obaid, 2020).

The element of variability refers to the constantly changing meanings of data that is collected within organizations, which could translate into inconsistency as time goes by (Batko, & Ślęzak, 2022; Rahul, 2023; Yaseen, & Obaid, 2020). Yaseen, & Obaid (2020) note that these changes do not only relate to context but also the interpretation of the data set. Rahul (2023) further notes that the changes also relate to the methods that are used in collecting data that an organization may want to capture and subsequently analyze. Big data technology can keep track of these changes and use them to cumulatively analyze data even as they change over time, thereby giving a more accurate (Alshehadeh,2023; Rahul,2023), albeit longitudinal picture that the data may portray.

Furthermore, businesses must ascertain the value of the data that they collect. This implies that feeding the right data to data technologies is necessary for acquiring the right insight that can drive the decision-making processes of the organization in the right direction (Curry, 2022; Rahul, 2023; Yaseen, & Obaid, 2020). Curry (2022) points out that data is one of the most valuable assets that organizations have particularly when it comes to understanding their past and present and also

Article DOI: https://doi.org/10.37284/eajbe.7.2.2279

determining the future course that they need to chart. This review focused on the use of big data technology in human resource management with this specific reference to practices including employee recruitment; employee selection; employee development; employee performance measurement; and employee compensation structure.

LITERATURE REVIEW

The reviewed literature indicated that the use of big data technologies is evident in various facets of human resource management including recruitment (Gravili, 2023; Hang, & Tat, 2023; Heliana, & Wahyuni, 2024; Nocker, & Sena, 2019; Pessach, 2020; Turulja, 2023); selection (Hang, & Tat, 2023; Heliana, & Wahyuni, 2024; Nowicka et al., 2024; Pessach, 2020; Turulja, 2023); employee development (Shabbir, & Gardezi, 2020) and performance measurement (Awan, 2020; Cvetkoska, 2023; Heliana, & Wahyuni, 2024; Maley, 2021; Neher, & Maley, 2019; Tanasescu, 2024; Yang, & Tang, 2023). Big data is also used in structuring compensation models in organizations (Cvetkoska et al., 2023; Maley, 2021; Sardi, 2020; Singh, 2022).

Employee Recruitment and Selection

Recruitment entails attracting, screening, and selecting individuals who are considered qualified for the vacant job position within an organization (Heliana, & Wahyuni, 2024). Therefore, during this process the job requirements are identified, the vacant position is advertised and the applicants are assessed for the vacancies to be filled effectively (Nowicka, 2024). Gravili (2023) argues that recruitment is an essential component of HR management since it offers an organization the opportunity to develop a robust employer brand; engage with and more importantly maintain its talent pipeline.

Recent extant literature reveals that big data analytics has become an invaluable tool in organizational recruitment processes. Organizations have leveraged big data to come up with predictive models for forecasting the performance of potential employees by examining their historical data, educational backgrounds, work experiences and other relevant predictors (Hang, & Tat, 2023; Heliana, & Wahyuni, 2024; Pessach, 2020). These studies reveal the enhanced decision-making capabilities that big data analytics provide HR teams since they can accept applications of prospective employees with demonstrable potential for advancing the goals and objectives of the organization. This further limits the costly errors that are associated with recruiting the wrong people for a particular job position. Organizations, in this case, use the insight gained from the findings of big data analysis to evaluate their recruitment processes and adopt approaches that have proved fruitful when it comes to recruiting talents that are the best fit for the available vacancies.

Big data analytics helped HR teams to effectively undertake targeted recruitment by analyzing their past recruitment data and therefore, better establish the sources of effective hires and also come up with more targeted recruitment strategies (Hang, & Tat, 2023; Heliana, & Wahyuni, 2024; Nocker, & Sena, 2019). In particular, big data analytics has made the recruitment process efficient in terms of time and cost. For instance, using big data HR teams streamline the process by automating the initial candidate screening and prioritizing applicants that are the best match for the advertised job profiles (Gravili et al., 2023; Hang, & Tat, 2023; Heliana, & Wahyuni, 2024; Nocker, & Sena, 2019; Pessach, 2020; Turulja, 2023).

Big data algorithms screen large volumes of applications and resumes from candidates and analyze them quickly based on the key terms that are related to the education, qualifications, skills and experiences that are outlined in the job descriptions (Hang, & Tat, 2023; Nowicka, 2024; Pessach,2020). The other benefit associated with the automation of the screening process is that it ensures that the candidates selected are only those

Article DOI: https://doi.org/10.37284/eajbe.7.2.2279

who meet the specified criteria for shortlisting (Gravili,2023; Turulja, 2023).

According to Hang, & Tat (2023) since big data is empowered with predictive analytics; it analyzes the previous hires; their retention rate and performance data and uses these to predict candidates who are highly likely to perform better in a particular role. Gravili (2023) notes the capacity of big data to correlate between certain job experiences or qualifications and the possible long-term performance of the candidate. Recruiters use these insights to screen out the candidates who have the potential to become a good fit for the advertised vacancy as informed by the predictive models (Nowicka, 2024; Turulja, 2023).

The screening process is also enriched by having a comprehensive picture of the applicants, which is made possible by the capacity of big data to integrate multiple sources of data about the candidates (Gravili, 2023; Nowicka,2024). Big data analytical tools aggregate applicants' information from social media (Gravili, 2023; Pessach et al., 2020), public records and professional networking platforms such as LinkedIn (Nowicka,2024; Pessach,2020; Turulja, 2023). Hang, & Tat, (2023) argue that recruiters leverage this automated cross-referencing to evaluate the skills, experience, network, character, and cultural feet of the applicants and come up with insights that are not readily available in the resume that they send during application.

Big data has eliminated bias in the screening process and therefore injected a significant amount of objectivity as well (Gravili, 2023; Pessach, 2020). According to Pessach, (2020), recruiters can now focus on data-driven metrics during the screening process and therefore focus on the qualification and Performance indicators of the applicants instead of relying on their subjective aspects such as gender, age, or ethnicity (Nocker, & Sena, 2019). In this way, big data has inevitably promoted fair practices and diversity in the hiring process.

Additionally, real-time screening has become increasingly possible as a result of adopting big data analytics tools such as automated questionnaires and chatbots (Gravili, 2023; Nowicka, 2024). These tools engage with the applicants seeking specific information from them regarding the qualification of the vacant positions and can filter out candidates who do not cut quite early in the recruitment process (Hang, & Tat, 2023). Therefore, organizations handling large volumes of applicants have benefited from these instant screening tools by quickly narrowing down to applicants who should be given more time to determine their suitability for particular advertised vacant positions (Turulja, 2023). As implicitly evident in the findings of these studies with regards to the cost and time efficiency of the initial screening of the process, the automatic screening also makes the process objective and impartial; thereby increasing the possibility of recruiting a more inclusive team.

However, these studies have also identified attendant challenges associated with the use of big data in the recruitment process (Gravili, 2023; Hang, & Tat, 2023; Turulja, 2023). Some of the limitations include the limited by the availability of quality data (Heliana, & Wahyuni, 2024; Nowicka, 2024; Turulja, 2023), which may introduce bias due to the biased data that is used to develop the model. Other identified limitations include the complexities involved in integrating diverse data sources (Heliana, & Wahyuni, 2024; Jaouadi, 2022; Nowicka, 2024); and the potential for using non-quantifiable factors such as cultural backgrounds to influence the hiring process (Gravili,2023; Heliana, & Wahyuni, 2024; Nowicka, 2024; Turulja, 2023).

The selection process entails evaluating and choosing qualified individuals from the pool of applicants taking into account the criteria predetermined to fill the job opening (Nowicka, 2024; Pessach, 2020). The process, therefore, includes conducting interviews, assessments and background checks of the selected applicant in a bid to determine whether they are the best fit for the

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advertised role and the goals of the organization at large (Gravili, 2023; Hang, & Tat, 2023; Nowicka, 2024; Turulja, 2023). This is a cost-intensive process and if improperly conducted it may translate into losses in terms of time and financial resources, which are associated with hiring the wrong people for a particular position. According to Heliana, & Wahyuni, (2024), this process ascertains whether the successful applicant has the requisite skills, attributes and experiences to effectively contribute to the goals and objectives of the organization.

Past studies underscore the invaluable contribution that big data analytics have brought about in selecting employees with the potential to deliver on the advertised roles and responsibilities (Heliana, & Wahyuni, 2024; Pessach, 2020; Nowicka, 2024). Big data analysis has enabled the HR team to conduct an in-depth analysis of the successful applicants taking into account their values, skills and experience (Hang, & Tat, 2023; Pessach et al., 2020), thereby enhancing the accuracy of the whole selection process (Turulja, 2023).

Besides, big data analysis is credited for bias reduction during the selection process, particularly in contexts where the models are based on objective data and algorithms, which invariably translates into fair selection practices (Heliana, & Wahyuni, 2024; Nowicka, 2024). Additionally, the use of big data has enabled HR teams to evaluate and align the applicants to the values and culture of their organization (Gravili, 2023; Pessach, 2020), and in the long run, improve the job satisfaction and retention of their employees.

However, the studies also revealed that the use of big data in selection results in some significant challenges that are worth noting (Heliana, & Wahyuni, 2024; Nowicka,2024; Turulja, 2023). Heliana, & Wahyuni, (2024) note that the accuracy of the selection process using analytics is often compromised by the incompleteness of the data that is used to develop the models. The other limitations include the difficulties involved in the assessment of applicants' soft skills and personal traits using technology (Hang, & Tat, 2023; Nowicka, 2024) and the need for human judgement in some particular aspects to select the right fit for a certain job position (Gravili, 2023; Heliana, & Wahyuni, 2024; Pessach, 2020).

Employee Development

Employee development is a continuous process through which organizations strategically enhance the skills, abilities and knowledge of their personnel to improve the prospects of their career growth and overall performance (Arulsamy,2023; Hosen, 2023; Núñez-Cacho Utrilla,2023; Shabbir, & Gardezi, 2020). Employee development also involves structured and strategic efforts that organizations put in place to ensure the learning and growth of their workforce (Dachner, 2021). In that regard, organizations identify the developmental needs of their employees; and provide resources for enhancing the required skills, thereby establishing pathways for career advancement within the organization (Dachner, 2021; Shabbir, & Gardezi, 2020). Some of the activities that are associated with employee development include on-the-job training programs (Dachner et al., 2021; Hosen, 2023; Mikołajczyk, 2022), workshops and seminars (Al-Tit, 2022; Núñez-Cacho Utrilla, 2023) mentoring or coaching (Al-Tit, 2022; Hosen, 2023; Núñez-Cacho Utrilla, 2023), and opportunities for professional growth (Al-Tit, 2022; Núñez-Cacho Utrilla, 2023).

The employee development processes in organizations have also benefitted from the use of big data analytics (Heliana, & Wahyuni, 2024; Manroop, 2024; Nowicka, 2024; Shabbir, & Gardezi, 2020; Zhao, 2024). Organizations have leveraged big data analytics to come up with customized training and development programs for their employees (Núñez-Cacho Utrilla, 2023), taking into account factors such as their strengths and weaknesses, including their career aspirations (Gravili, 2023; Manroop, 2024). Current employee training practices have tended towards personalization of the training courses in a bid to

Article DOI: https://doi.org/10.37284/eajbe.7.2.2279

specifically respond to the skills needs of individual employees (Al-Tit, 2022; Hosen, 2023; Núñez-Cacho Utrilla, 2023).

The approach is considered imperative in ensuring the effectiveness of training programs as opposed to the traditional one-fit-all approaches that were being used which benefited some employees rather than all (Başak, 2022; Núñez-Cacho Utrilla, 2023). In this quest, organizations have leveraged big data analytic tools to develop personalized learning programs by using employee data to generate their learning profiles (Cui, 2022; Mateo-Orcajada, 2023; Manroop, 2024; Zhao, 2024). These profiles are informed by employee details such as their current skills, learning preferences, career objectives and previous education and training (Başak, 2022; Cui, 2022; Núñez-Cacho Utrilla, 2023).

Organizations have adopted big data analytics tools in their quest to understand the competencies of their existing employees, and the skills gaps that they present as evident in their employee performance data (Cui, 2022; Zhao, 2024). The big data analytic tools aggregate this info from organizational documentation such as skill assessments, employee feedback reports and job reviews (Başak, 2022; Cui, 2022; Manroop, 2024); and use them to establish these skill gaps among the employees that could be redressed through training (Cui, 2022; Lukowski, 2021; Shabbir, & Gardezi, 2020).

This has involved the use of tools such as Udemy for Business (Bankovska, 2023) and Linkedin Learning (Hazzam, 2024), which analyze how employees interact with content and recommend courses that align with their career objectives and skill gaps (Cui et al., 2022; Hazzam, 2024). In the same vein, platforms such as Ed App have been adopted due to their micro-learning features, which adapt the personalized training content to the feedback and performance of employees in real-time (Cui, 2022; Manroop, 2024; Putra, 2023). Putra (2023) also found that data analytic tools such as IBM Watson aggregate data from various training interactions and upon analysis, they recommend learning paths that should be customized to individual employees taking into account their respective skill sets, career objectives and career trajectories.

Big data analytic tools such as ADP Workforce Now and SHL Talent Assessments provide human resource managers with a comprehensive profile of their employees' capabilities and therefore establish the specific areas where they lack proficiency (Manroop, 2024). The tools analyze data from various sources including job reviews, employee feedback reports, employee assessment reports and industry benchmarks (Başak, 2022; Manroop, 2024), thereby revealing any mismatch between the skills that the employees possess and the skills that they require to record optimal performance in their roles and responsibilities (Başak, 2022; Cui, 2022; Manroop, 2024). Upon identification of these skill gaps, human resource managers are better informed when it comes to developing training programs that are targeted at addressing the gaps (Cui, 2022; Lukowski, 2021; Manroop, 2024). The approach ensures the relevance of the training as it is tailored towards addressing the skills needs of the employees instead of providing generalized programs that may be irrelevant with regards to enhancing the competencies of this staff.

Furthermore, the use of big data has enabled HR teams to track the progress of their employees in the development programs, which thereafter inform how they adjust or improve the programs (Başak, 2022; Zhao, 2024). Human resource departments have found SAP Litmos invaluable when it comes to tracking the progress and learning style of the employees and recommending courses and learning materials that are tailored towards their specific profiles (Başak, 2022; Lukowski, 2021; Manroop, 2024). Zhao (2024) credits the personalized approach provided by the application for enhancing engagement between trainers and employees and also improving their knowledge retention since they

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are incentivized to acquire the targeted skills that are tailored to their learning styles and preferences.

The use of big data in human resources development has also translated into the establishment of continuous learning environments in organizations and ensuring the effectiveness of training programs. This is made possible considering that big data has enabled HR teams to identify employees' knowledge and skill gaps (Başak, 2022; Nowicka, 2024; Shabbir, & Gardezi, 2020); and address them accordingly by providing relevant training and development opportunities (Heliana, & Wahyuni, 2024; Lukowski, 2021). Big data analytic tools track employee performance metrics before training and during post-training duration to establish the effectiveness of the training programs that employees have been exposed to (Başak, 2022; Cui, 2022; Manroop, 2024). Through this data-driven approach, it becomes possible to evaluate or rather assess whether employees have acquired the targeted knowledge or skills they were exposed to during training, which needs to manifest in the form of enhanced productivity, and job performance, which often translate into increased organizational output (Başak,2022; Lukows, 2021; Shabbir, & Gardezi, 2020).

Some of the commonly used big data tools include Tableau and Power BI, which have been used to analyze the training outcomes of Kirkpatrick's Model of Training Evaluation (Alsalamah, & Callinan, 2022). This training program has been adopted by a broad scope of companies targeting employee satisfaction, knowledge retention, behavioural change and improved business goals (Alsalamah, & Callinan, 2021; Heydari, 2019; Manroop et al., 2024). The tools visualize the training data and point out the emergent trends, alongside the relationship between the training provided and stipulated performance metrics such as project completion, customer satisfaction, and sales figures (Alsalamah, & Callinan, 2022; Heydari, 2019).

Big data platforms such as On Demand and SAP Success Factors have been used to track employee's key performance indicators (KPIs) related to the training that they have been provided with at the workplace (Nahhas, 2023). These platforms collect data during the training process and can give reports about the engagement levels of the employees during the training, and their completion rates (Cui, 2022; Nahhas, 2023; Sathianathan, 2020). The platforms can also analyse the acquired competencies to the stipulated productivity metrics (Sathianathan, 2020), and therefore, determine the success of the provided training in terms of filling the identified skills gaps and boosting their performance (Nahhas, 2023; Sathianathan, 2020).

Additionally, learning analytic tools such as Learning Locker collect and analyze significant volumes of training data using algorithms that identify patterns in how the provided training content informs real-world applications at the workplace (Mateo-Orcajada, 2023; Nagy, 2023). Human relations managers use this insight to better their training program in a bid to maximize their effectiveness and also enhance the return on investment (ROI) (Mateo-Orcajada, 2023; Nagy, 2023; Shiri, 2023).

The evaluation of the effectiveness of training programs need not wait until the employees have expanded the skills and knowledge acquired and made it manifest in the form of improved outputs. Big data analytics tools make it possible for human resource managers to acquire real-time feedback on the training programs they have developed and provided to the employees (Lukowski, 2021; Zhao, 2024); and therefore, make any necessary adjustments to improve them based on how the employees interact with the learning material or stipulated pedagogies (Cui,2022; Lukowski, 2021; Manroop, 2024). In this way, the training programs are adjusted so that the employees are provided with the support they need to maximize their learning and development of their skills and competencies (Lukowski, 2021; Manroop, 2024).

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In that regard, big data analytic tools such as Adaptive and Axonify are used to track how employees engage with the training content in real-time and point out any areas in which they encounter difficulties (Cui, 2022; Mateo-Orcajada, 2023). In cases where the employees grapple with understanding particular concepts, the tools automatically adjust the training and also provide the trainees with alternative learning approaches or formats to reinforce key topics and additional resources such as quizzes, or videos (Cui, 2022; Lukowski, 2021; Mateo-Orcajada, 2023).

Big data analytics tools such as Ed Cast and Docebo have also proved effective in personalizing training for employees in real-time (Cui,2022; Lukowski, 2021; Nahhas, 2023). The tools track the performance of the employee in the training, monitor the amount of time they take to cover a particular model and analyze feedback, which cumulatively makes up the insight that they provide instantly (Cui,2022; Mateo-Orcajada ,2023; Nahhas, 2023). In cases where the employee performs better in the training but seems to lag in others, the platforms recommend targeted micro-learning sessions for addressing the identified weaknesses (Cui, 2022; Zhao, 2024).

Besides, the integration of Learning Experience Platforms (LXP) such as Degreed or Valamis has also enabled real-time knowledge of how employees engage with training programs or material (Lukowski, 2021; Mateo-Orcajada , 2023; Nahhas, 2023). Consequently, the instant feedback loops inform the refinement and improvement of the training content (Lukowski, 2021), making it relevant to the learning needs and an optimum learning experience for the employees (Lukowski,2021; Zhao, 2024).

Some of the challenges associated with the use of big data in the development of employees include the lack of accurate data on the performance of the employees (Gravili, 2023; Nahhas, 2023; Shabbir, & Gardezi, 2020), including the resources required to provide customized training (Heliana, & Wahyuni, 2024; Nahhas, 2023; Nowicka,2024).

Employee Performance Measurement

Performance management involves systematic evaluation, management and improvement of the employees' performance (Maley, 2021; Nowicka, 2024). Effective performance management entails outlining clear performance targets and providing employees with ongoing feedback (Maley, 2021). The process also involves undertaking performance appraisals to align the goals of individual employees to the objectives of the organization (Awan, 2020).

Extant literature demonstrates that tech-savvy organizations have leveraged big data to enhance their employee performance measurement processes (Awan, 2020; Maley, 2021; Neher, & Maley, 2019). Data-driven assessments translate into objective measures of employee performance, thereby ensuring precise and fair evaluations (Neher, & Maley, 2019). Employee surveys have been conducted using big data tools such as Survey Monkey and Qualtry, which capture data that is useful in understanding employee job satisfaction, employee engagement and their various perspectives about their performance (Cvetkoska, 2023; Tanasesc, 2024). HR departments have used the tools to consistently collect data about their employee performance and therefore keep track of their changing attitudes and compare them to their performance metrics (Cvetkoska, 2023; Tanasescu, 2024; Yang, & Tang, 2023).

Human relation managers have also used Workday and Bamboo HR to continuously monitor the performance of employees by tracking their individual and team goals (Cvetkoska, 2023; Sardi, 2020; Tanasescu,2024); the tasks they have completed and the progress they have made towards accomplishing their objectives (Sardi, 2020; Yang, & Tang, 2023). The resultant data is used to generate performance reviews and help HR managers determine the high performing and reward them accordingly, and also identify the low-

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performing employees and come up with measures to help them upgrade their performance (Cvetkoska, 2023; Tanasescu, 2024).

Big data tools such as Slack and Microsoft Teams have also presented collaborative features, which have helped HR managers measure the performance of teams in their organizations (Cvetkoska, 2023; Tanasescu, 2024). These platforms have enabled human resource managers to study communication patterns in the organization, provide timely responses to arising issues and facilitate smooth collaboration across projects with common goals (Yang, & Tang, 2023). HR managers gain insight from the analysis provided by these tools regarding the teamwork, productivity and individual contribution of each employee (Cvetkoska, 2023; Sardi, 2020).

Big data tools have enabled human resource departments to come up with more sophisticated performance metrics that are tailored to capture more aspects of performance that supersede the traditional annual reviews (Cvetkoska, 2023; Sardi, 2020; Tanasescu, 2024; Zhang, & Li, 2022). The use of big data tools such as Lattice and Leapsome have proved effective in establishing a 360 degrees feedback system in organizations whereby employee data is collected from a broad scope of sources that include customers, colleagues, subordinates and managers (Cvetkoska, 2023; Sardi, 2020). In this way, HR managers have a better overview of the contribution of an employee to the organizational goals and objectives and can adequately determine the areas which they need improvements (Sardi et al., 2020). The continuous feedback provided by the tools incentivizes HR managers to undertake real-time performance adjustments instead of waiting or relying on periodic evaluations (Gravili, 2023; Zhang, & Li, 2022).

Additionally, HR managers also use big data tools to track the quantitative and qualitative performance indicators of the employees (Cvetkoska, 2023; Zhang, & Li, 2022); based on metrics such as task efficiency, completion rates and customer satisfaction scores (Gravili, 2023; Sardi, 2020; Yang & Tang, 2023), which are integrated into performance management system tools such as Workday or Bamboo HR (Cvetkoska, 2023; Tanasescu, 2024). Using these tools, the managers access compiled performance data which they use to access the individual progress that employees make in comparison to the predefined targets or goals that they need to accomplish within specified durations.

Big data tools such as Google Analytics (for internal workflows) and Microsoft Power BI have also been used to visualize performance data (Cvetkoska, 2023; Sardi ,2020; Tanasescu, 2024). These tools have dashboard features that display the keep performance indicator for teams, departments or individual employees (Tanasescu, 2024); therefore, making it easier for HR managers to track performance in real-time, acquaint themselves with any emergency and respond to any issues that may arise (Gravili, 2023; Tanasescu, 2024).

Extant studies have also revealed significant challenges with using technology to manage and evaluate the performance of employees in organizations. These include the risk of employees' privacy violations, particularly in instances where sensitive personal data of the employees is analysed without putting in place adequate safeguards or acquiring their consent before analysis (Sardi, 2020; Nowicka, 2024; Yang, & Tang, 2023). Protecting vast amounts of employees' sensitive data from cyber breaches or threats is another risk factor considering the ever-evolving cyber-attacks that keep emerging (Gravili, 2023; Nowicka, 2024; Yang, & Tang, 2023). There is also the risk of the data analysis perpetuating existing bias of existing biases in cases where the historical data bear discriminatory patterns (Gravili, 2023; Tanasescu et al., 2024; Yang, & Tang, 2023). Additionally, the misinterpretation of data by the big data models or algorithms has resulted in flawed decision-making, which potentially harms the employees in particular

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and the organization at large (Cvetkoska, 2023; Nowicka,2024).

Compensation Structuring

Employee compensation structure is a critical aspect when it comes to attracting potential talented applicants since the primary motivation of employees is to earn from their work inputs (Cvetkoska, 2023; Maley, 2021; Yang, & Tang, 2023). Maley (2021) observed that traditional performance management systems relied solidly on qualitative rather than quantitative metrics, which often resulted in disconnected compensation that was at variance with the exact performance outcomes.

In this regard, data analytic models have provided alternative solutions that the HR team have found invaluable in their quest to identify significant patterns with their datasets (Maley, 2021; Tanasescu, 2024). In particular, data analytics are quite helpful in the identification of the performance of the employees, thereby supporting the decision-making process of the HR managers regarding particular employees (Cvetkoska, 2023; Maley, 2021; Sardi, 2020). The analytics may inform decisions such as transfers, training, retraining, demotion or promotions (Singh, 2022).

Organizations have employed big data tools such as Maley (2021) to monitor the keep performance indicators of the employees in real time; thereby gaining insight into the performance trend of their employees whether working as individuals or in teams or departments (Mateo-Orcajada, 2023; Tanasescu, 2024 Yang, & Tang, 2023). In this case, the performance metrics of interest have included aspects such as project completion rates (Shamim, 2020); customer satisfaction rating (Mateo-Orcajad, 2023; Yang, & Tang, 2023); sales figures (Cvetkoska, 2023; Yang, & Tang, 2023) and productivity (Tanasescu, 2024; Yang, & Tang, 2023). Big data tools have also enabled human resource managers to conduct sentiment analysis. Notably, the analysis is best on natural language processing (NLP) algorithms that are renowned for extracting insights from textual data (Sardi, 2020). The sentiment analysis is therefore conducted by examining the internal communication data, feedback forms and emails in a bid to understand the engagement levels and morale of the employees (Cvetkoska, 2023; Yang, & Tang, 2023).

More importantly, big data analysis has proved instrumental in predicting employee turnover. The tools are used by HR departments to analyze the behaviour and engagement levels of the employees (Mateo-Orcajada, 2023; Sardi, 2020); and also assess the external market conditions which can inform potential turnover (Cvetkoska, 2023; Yang, & Tang, 2023). In this way, human resource managers use the insight generated from these tools to come up with strategies for retaining high-performing employees and also counter dissatisfaction proactively (Sardi, 2020).

CONCLUSION AND RECOMMENDATIONS

In this review the transformative impact of big data technology in the management of human resources is made evident in consideration of specific roles including recruitment, and selection; employee development; performance management and compensation. Investment in big data Technologies facilitates easier analysis of large volumes of data which helps human resource departments to make informed decisions and improve efficiency in their HR processes. The review therefore reiterates the significance of big data Technologies across human resource practices and processes as a way of ensuring that employees perform at their optimum capacity and therefore help organizations attain their various goals and objectives. Based on this it is recommended for organizations to invest in big data tools as a way of ensuring successful harmonization of their HR processes and improved decision-making capabilities. More importantly, HR departments should ensure that the big data tools are fed with quality data that can guarantee substantive Analytics and therefore mitigate inaccuracies and biases that may negatively affect

Article DOI: https://doi.org/10.37284/eajbe.7.2.2279

the management of human resources in the organization. Additionally, while big data analytic tools have first ended up the analysis process and injected objectivity, the corporation of human insight is integral for assessing and calculating elements such as soft skills and culture of fit.

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