Artificial Intelligence in Employee Performance Evaluation and Its Managerial Implication

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ABSTRACT:

Since last decade usage of information technology has been increased drastically and artificial intelligence has taken a big leap absorbed into organizational culture of almost every department who surges to be updated and keep the competitive edge thus human resource management is not untouched too. Despite of tremendous research being done in the field of AI yet a dearth of proper research is found questioning the authenticity, rationality, and equability of AI/ML tools in business settings. This paper focuses on the perspective of relying on AI/ML in the process of employee performance management framing Artificial Intelligence performance measurement system integration using learning algorithms to make the evaluation a real-time process much easier, accurate, unbiased and fair. The managerial outlook of AI integrated performance appraisal results in strategic decision making, enhance levels of employee performance, employee commitment, satisfaction and reduced employee turnover behavior.

This is an empirical research which examines previous literature through content analysis from authentic writings of secondary resources.

KEYWORDS: artificial intelligence, machine learning, performance appraisal, artificial intelligence performance measurement system integration, AI tools, performance management.

INTRODUCTION:

Google CEO Sunder Pichai has stated that ''Artificial Intelligence is a core trans formative way by which we are rethinking how we are doing everything.''(Nikolaai,2015). Additionally, referred to as machine learning, artificial intelligence is a comprehensive field that simulate mortal capabilities and quick-witted conduct. "Artificial intelligence is the study of how to get computers to do things that humans are currently better at" (Rich, 1983).''It can swiftly retrieve the database, obtain information, resolve our queries correctly, and deliver the best solution immediately and logically while emulating the information process of human mind and reasoning.''Chen Y.W., Li R., Guo Y., Jia Q., and Li Y.R. (2018).The term called artificial intelligence is a group of technologies that enable devices and computers to collect information from sensors, mobile devices, and storage (including but not limited to speech recognition), scrutinize and comprehend the info through natural language processing, make wise decisions or suggest actions (expert systems), get lessons from acquaintances (M/L-machine learning), and react to the situation's necessities (robotics) (Leonidas et.al, (2022) Liu, Li, & Thomas, 2017).

Always being a vital process, in the past three decades, the HRM has undergone a significant evolution in both shape and function (P.Luukka and M.Collan, 2013). Business executives are quickly preparing for the digital age, and machine learning-based AI promises to alter the HR department on a variety of levels (Mitchell et,al.,2013). Several competencies form HRM and so their evaluation aims to establish intelligent workforce (O. Pektor, B. Walek, and I. Martinik,2018). Many AI support systems such as Artificial neural networks, fuzzy sets, and intelligent decision systems are employed in a variety of contexts (holland, 1992). Of these, the field of AI applications for HRM is still in the research stage (Sheila et al.,2018). The possible lack of a comprehensive platform for AI execution and a thorough extent of HRM to

investigate its particular operation (Nawaz & Gomes 2019: Van Esch et.al.,2019, zahir et al.,2019).

This paper mentions AI techniques used in performance evaluation process like artificial neural network, fuzzy logic script, learning algorithms such as decision tree, naive Bayes, ensemble classifier, text sentiment analysis, as per the accuracy and inclusiveness of employment related data and performance analysis from different levels inside the organization. It also proposes artificial intelligence and performance measurement system integration (AIPMSI) model and managerial viewpoint of the AIPMSI to offer direction and practical implications for organizations in better utilization of AI in HRM and people analytics. My objectives of this study are:

1. To identify AI techniques used in process of employee evaluation.
2. To develop a model for performance assessment.

3. To identify managerial implications of AIPMSI model.
4. To identify possible advancements and uses of AI in performance measuring system.

RESEARCH METHODOLOGY:

To conduct descriptive research on role of AI in employee measurement system, I collected secondary data for that I set out to search for scholarly articles that were published during last
10 years (from 2013- 2022) on the topic AI and PMS. Searched on multidisciplinary publication databases including Google Scholar, Web of Science, IEEE, Elsevier, Emerald publication, ResearchGate, Wiley and Jstor. Moreover, non-journal content includes books, case studies, conference papers, seminars, Scopus indexes, abstracts, Web page and book series.

After all the inclusion and exclusion criteria being met by eliminating duplicate articles or since they weren't part of the JQL, JCR, or SCR above Q4. A total of 20 articles are included in this study according to significance to the topic.

LITERATURE REVIEW:

HUMAN RESOURCE PERFORMANCE EVALUATION:

Onset of appraisal time and one of the most debated questions of completing the fair-and- square evaluation revolves around ''what is measured and what is achieved''. The first step in the performance appraisal process is the identification of specific performance appraisal goals and secondly, performance criteria or standards communicated to employees (Mondy & Martoschio, 2016). Performance Appraisal is an essential process observed by companies to evaluate the employees' performances against well-defined benchmarks/objectives and to provide them with feedback. One of the most crucial elements of controlling the performances may be the content of the performance evaluation itself (Murphy & Cleveland, 1995).

As illustrated in Cardinal's work 2001, Specific aims were inversely correlated with innovation while greater production expectations were linked to innovation in a positive way and objective concentrate on success may decrease the chance of risk taking, creativity and initiation. Therefore '' **don't just reward success, reward intelligent efforts"** stated Paul Cook, CEO Ray chem corporation (Taylor 1990, p.99). **Social Facility Theory** explains employees perform better when they know that they are being observed. However, given a complex task the presence of others impacts negatively on their performances. In contrast similar outcomes were found with electronic presence (Bhave 2014). Therefore, procedural consideration becomes essential.

People are evaluated on the basis of various aspects primarily job position, commitment towards the work and values, ability to identify problems at technical, non-technical and strategic level, task performance, professional attitude, initiative and innovative skills, punctuality, attendance, work engagement, interpersonal relationship, customer feedback, goals achieved or success of actions identified by quality of results (services or products), productivity inferred by competitiveness of company in market economy and economic indicators. Ranking method, critical incident method, graphic rating scale, narrative essays are relatively older methods of evaluation while Management by Objectives, behaviorally anchored rating scale, 360 degrees' evaluation method, assessment centre and human resource analytics are some traditional but modern assessment techniques which include self-evaluation, peer review, evaluation by superior. These techniques are mainly used by many companies but when it comes to big firm's managers may find it difficult to assess large team of employees frequently and fairly. This is where AI has an important role to play gathering huge database, knowledge base, mitigate mistakes and evaluate employees fairly without any biasness. Greater validity for AI/ML techniques could be obtained via organizations by using advanced algorithms to access new sources of data and analyze those sources (eg., Sajjadani, Sojourneur Kanmeyer-Muller & Mykerezi, 2019). Inside limited create domains and environments, Researchers have discovered that algorithmic techniques like NLP and human ratings for quality are equivalent (Campion et al., 2016; Park et.al.,2015) NLP analysis is standardized, faster and work in automated manner (considering the reliability of human judgement fluctuated inconsistently between and among people) Organizations may utilize these text data to reward scores on psychological traits (such as verbal fluency, honesty, emotionalism, and aggression), keeping in mind the context and ethical considerations of AI applications: 2010 Tauzsik & Pennebaker) to predict important employees and companies' outcomes. (Gonzaler, Manuel F, Capman, John F, Oswald Fedrick L, Theys, et al.,2019). AI is free from bias, works on logic and reasoning, has no personal likes and dislikes therefore reducing human error and help managers give objective feedback.

Leading the way, IBM is integrating artificial intelligence (AI) into its HR division to perfo rm a range of functions, including monitoring worker happiness, fostering communication, improving employee edification, modifying and designing employment new positions, and seeking additional, best talents (Verne, 2018). Despite the controversy over the collaboration of humans and machines, future trend of AI for HRM is continued. As per the McKinsey Global Institute, artificial intelligence can replace more than 30% of jobs in 60% of occupations (Chui & Francisco, 2017).

The AI integrated performance assessment can be evaluated differently, depending on type of the job of employees, need of the company, organizational culture and demographic boundaries for e.g.., local, international and multinational companies have different AI mediated performance evaluation system having different employees with their own job skills, different needs and demands as per their organizational culture depending on demographic areas, also willingness and affordability to choose AI systems within their capabilities and management process. Such outlooks compel us to consider that design and implementation of AI/ML applications is an important managerial concern, not only from the economic and technological viewpoint, but also with social effects which points toward education and carrier's development for betterment of the nation.

ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN EMPLOYEE PERFORMANCE MEASUREMENT

SENTIMENT ANALYSIS:

Sentiment analysis is one of the sub fields of "affective computing," which encompasses all the study of how individuals perceive about various things including events, problems, products, and other things. More specifically, this field tries to gather beliefs, sentiments, and feelings via observations of people's behavior that can be documented through their writings, facial expressions, voice, music, movements, and other behaviors. (Ali Yadollahi, Osmar R. Zaiane, and Ameneh Gholipour Shahraki 2017.)

TEXT MINING:

The technique of extracting intriguing and complex patterns or knowledge from unstructured text documents is referred to as text mining. It can be seen as a development of knowledge discovery from (structured) databases or data mining. Information access, text analysis, information extraction, aggregation, sorting, visualization, database technology, machine learning, and data mining are all included in the multidisciplinary topic of text mining.

FUZZY LOGIC APPROACH:

Businesses utilize a range of criteria to evaluate personnel, which makes the process more complicated because every standard has its own set of guidelines and standards. As such, computing an employee's total performance metric while accounting for all variables is a laborious process. Fuzzy logic considers many factors and proposes easier technique to execute the combined calculation based on supplied norms, which is difficult to achieve in the conventional method. This is a challenge that fuzzy rule- based decision making could readily address.

Additionally, by creating a model wherein employees' performances are rated in line with evaluation scales, for somedefined factors to determine an employee's overall performance index. Provided the company's performance statistics and rating based on opinion and perception are accessible, fuzzy logic aids in determining a person's performance index.{https://www.researchgate.net/publication/23685825 Employee_Performance_Evaluation_A_Fuzzy_Approach}

NAÏVE BAYES:

Naïve Bayes (NB) is a popular data mining techniques for categorization. The Nave Bayesian algorithm is a data mining technique that uses an estimation procedure to display relationships between data elements. It improves performance by removing co related features, based on probability theorem, eliminate zero observation, handle text data and continuous variables, retrain the model and thus parallelizing the model with new data.

ENSEMBLE CLASSIFICATION:

A generic meta-machine learning approach called ensemble classification combines the predictions from various models in an effort to improve forecasting performance. A group of classification algorithms is a cluster of classifiers whose distinct conclusions are combined in a way to provide a consensus decision as an output. The central objective of this

method is to aggregate the outputs of given models, also known as base classifiers, to produce a single output that performs better compared to each of the base classifiers separately. The process of creating a classifier ensemble begins with the creation of a group of base classifiers. When creating your predictive modeling project, it is imperative that you thoroughly understand and consider each of the three types of ensemble learning methods—bagging, stacking, and boosting.

- The process of bagging involves averaging the results of multiple decision trees that are applied to different samples of the identical datasets.

- Stacking comprises using a distinct model to determine the optimal amalgamation of projections by adapting a variety of models to the same data.

- Boosting is the process of methodically integrating elements to an ensemble to rectify the forecasts made by earlier models and provide a cumulative average of the projections..**{-A Gentle Introduction to Ensemble Learning Algorithms** by **Jason Brownlee** on April 19, 2021}

Also, in this method, the basic tactic is to keep a changing collection of classifiers. New models are introduced to the ensemble while removing outdated and underperforming models when a fall in efficacy is seen. The ensemble's categorization selections are aggregated, typically using a weighted voting system (Wang, H., Fan, W., Yu, P.S., Han, J. (2003); Martin Scholz, R.K. (2007); Kolter, J., Maloof, M. (2003); Street, W.N., Kim, Y. (2002)). In the streaming data classification task, weighted ensembles have been shown to be superior to individual classifiers both theoretically and practically [Wang, H., Fan, W., Yu, P.S., Han, J., 2003; Kolter, J.Z., Maloof, M.A., 2005].

ARTIFICIAL NEURAL NETWORK:

In order to obtain an accurate evaluation, ANN are proven to have stronger pattern detection and learning skills (Attalla & Hegazy, 2003). ''Given a collection of data reflecting the mapping, a computing system is able to procure, encode, and visualize the mapping from a multi modal domain of data to another." is how the term "artificial neural network" (ANN) is defined. (Buggmann, Rafiq, & Easterbrook, 2001). Artificial neural networks (ANNs) employ algorithms that aim to do a neurologically analogous task, like reading from experiences, extrapolating from comparable circumstances, and evaluating states where subpar outcomes have previously been attained (Meireles.et. al.,2003). Organizations use ANN to tackle challenges ranging from functional prediction and system modeling to pattern recognition engines and robust classifiers. ANN can generalize and make conclusions based on vague and loose input data. The size and complexity of the problem are not necessarily connected to how well an ANN learns and approximates correlations between input and output [S. Haykins, 1995].

DECISION TREE ALGORITHMS:

Artificial intelligence/Machine learning algorithms are used almost every sector of organizations health sector, banking, retail, academics, etc, to achieve goals and build models acquiring information derived from earlier data. With the use of techniques like Decision Trees (ID3, C4.5, C5.0, CART), Support Vector Machines (SVM), Neural Networks, Naive Bayes, Linear Regression, and K-Nearest Neighbor (KNN), it is possible to address problems relating to classification, regression, clustering, and optimization. The C4.5 and Iterative Dichotomiser 3(ID3) decision tree algorithms are highly likeable among these methods (Anuradha and Velmurugan, 2014).

A comprehensive evaluation model for the performance appraisal system is constructed using the decision tree algorithm. C collected data have an impact on the performance appraisal metrics. The information gathered is categorized and weighted. Once the data computation is done, the C4.5 algorithms is applied. A decision tree is built using the categorized and bonded key data. A performance evaluation system is then developed using the decision tree. For instance, the algorithm's precision prior to optimization is approximately 92%, and the preciseness of the algorithm post optimization is enhanced to 95% when the system needs to analyze 300 indicators. This reduces the amount of repeatedly quantified indicators used to generate decision trees, improving overall assessment reliability and proficiency (Yi Yan,2022)

EMPLOYEE PERFORMANCE EVALUATION VIA AI TECHNOLOGY INTEGRATION

Smither and London (2009) found numerous ways that technology can enhance the performance management process through a thorough examination of the literature. Future performance management is a flexible, ongoing process with the

aim of fostering personal growth, powered by big data. (Schrage et al.,2016).
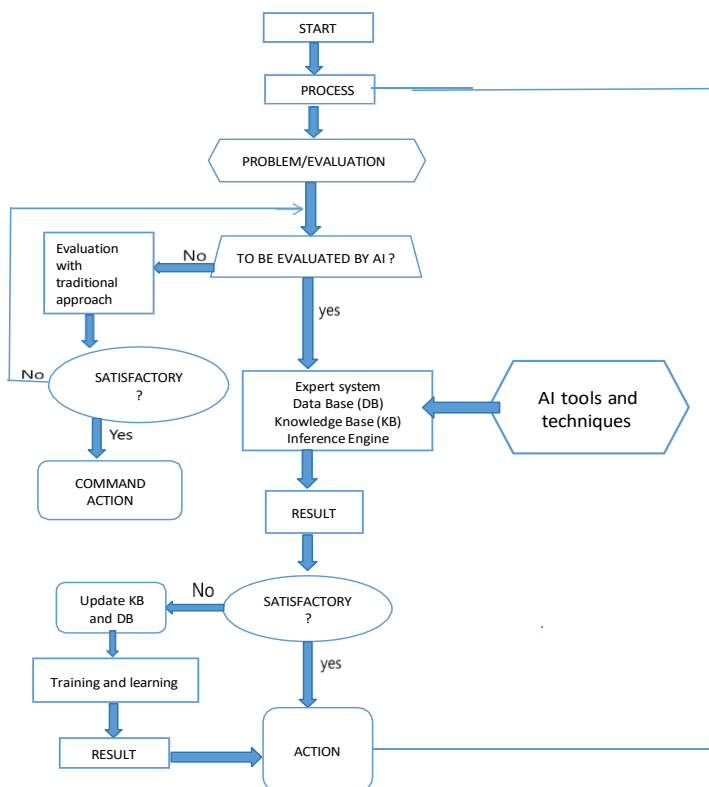
Artificial intelligence and performance measurement system integration model Source: Author

Different AI tools and techniques can be used in combination to make the performance assessment easier like sentiment analysis scrutinize text based data such as emails, employees feedback and behavior through facial expression, voice, chat interactions and gauge their believes, sentiments and feelings. Text mining extracts insights and complex patterns from unstructured data, includes information access, extraction, aggregation, sorting, visualization and data mining.

Fuzzy logic is rule based algorithm which considers multiple factors handles uncertainty, imprecision in evaluation process by assigning degrees to each factor, carry out combined calculation based on set of rules to determine employees' performance index which is not possible with traditional assessment methods. While topic modelling identifies weaknesses and strengths through recurring patterns and topics in performance reviews.

Random forest, ensemble classifiers, logistics regression, decision trees, artificial neural network, naive bayes, support vector machine, are all classification algorithms to address classification, regression, clustering and optimization of employee performances. Social network analysis maps communication networks from social media platforms like linked in, Facebook, twitter, etc within the organization to identify influential people to behold them or those who may need help. While reinforcement learning clearly defines beneficial and non- beneficial actions, positive feedback are given to desired actions and negative feedback to non- desired ones. This strategy saves time and resources optimize individual employee goals. Provides real time feedback.

Natural language generation automatically generates performance report card based on data collected from various AI based evaluation models and facilitates communication between managers and employees. For effective employee performance measurement there has to be transparency, privacy, ethical and legal compliance to ensure accurate, fair and unbiased performance evaluation.

Managerial outlook of AIPMSI:

With the application of right type of AI technology within organization the right type of expertise of work can be recognized via job evaluation. Also, it makes possible effective communication at different levels and enhance employee

participation at the planning phase or while defining essential responsibilities. Employee participation to desired outcomes is strengthened if managers and subordinates work together throughout the preliminary stages because they were involved in goal setting (London & Smither, 2009). Real time assessments bridges communication, identify and grasp top performing employees. Performance appraisal online database facilitates long-term growth resulting from improved employee productivity and well-being, job satisfaction and motivation reducing employee turnover behaviour. AI can identify areas of underpperformance and provide appropriate training programs or assist staff members (Kellogg and colleagues (2020); Cappelli and colleagues (2019); Tambe and colleagues (2020); recommend appropriate courses or assist staff members in furthering their professional development. AI's tangibility, transparency reliability & immediacy solutions keep employee active & focused on performance review process as compared to traditional evaluation and mitigates errors and biases.

Here is a managerial outlook of the artificial intelligence and performance measurement system integration (AIPMSI) framework for successful appraisal, implementation and its full potential needs to be realized within the organizations.

AI technologies considered	Role of AI in Appraisal process	Outcomes	Practical implications
• AI in general • data mining • big data analytics • machine learning • natural language processing • fuzzy logic • text sentiment analysis • artificial neural network • random forest • social network analysis • decision tree algorithms • naive bayes • essemble classifiers • mutual memory system	• AI an important antecedant. • develop skills and competncies to improve productivity. • right type of AI for different business sectors • evaluate employees past performances, strength and weaknesses effectively. • intelligent knowledge management system enhance competitive strength and mangement ability of employees and employers. • combat biasness. • Big data analytics helps keeping pace with unfolding social growth. • AI's tangibility, transparency, reliability & immediacy solutions keeps employee active & focused on performance review process • removes boredom from traditional appraisal cycle	• bridges communication. • grasp the use of good people. • increased employee productivity and wellbeing. • accurate and effective feedback by managers. • better employee engagement. • job satisfaction. • employee motivation. • reduced employee turnover behaviour. • identify learning and development needs.	• optimizing performance evaluation • aligned individual objectives & business goals • reform appraisal system • data driven projections free from biasness. • real time assessments • smart (intelligent) workplace environment help users to learn from their previous mistakes review and povide personalised services and focus more towards AI mediated skills. • An online system of training activities can be linked to a person's personal growth strategy to encourage long-term improvement. • automate HRP,giving hiring, firing advice and reward employees.

Managerial outlook of Artificial Intelligence Performance Measurement System Integration Framework.
(AIPMSI). Source: Author

Artificial intelligence systems can construct problems, make out the root problem, and deliver a solution (Chowdhury et al., in press) which helps managers to focus on future activities rather than past performances and able to take decisions from automatically generated rewarding, hiring and firing advice.

DISCUSSION

Approximately 244,000 employees, according to Delloite, devote more than 2 million hours a year on performance reviews (yellow.ai) which is plenty of time spent on the process which is not reliable based on people's opinion and past performances. It is impossible to access unbiased and fair data manually which is tedious process end up in negative experiences and nullifies the process's objective.

Real time AI-driven assessments not only allow incentives and praise for good performances immediately but also ring alarm in case targets are not being met timely or performance standards are declining thus managers 'early precautions and interventions can dilute problems before it gets bigger and unmanageable. Further, Cappelli and Travis (2016) discovered that many businesses no longer doing annual evaluations and are instead aiming to provide instant real-time feedback while focusing on the advancement of upcoming endeavors rather than on past behavior.

CONCLUSION

This paper discusses different AI techniques like fuzzy logic, ANN, NLP, decision tree algorithms, text sentiment analysis, classification committees such AI can tell managers when performance is slipping and encourage skill growth by identifying trends in employee behaviour and connecting them to performance. AI also command managers when work engagement is low by pro-actively prodding them.

AIPMSI model mentioned in this paper proposes employee's performance evaluation process to make the evaluation a real-time process much easier, accurate, unbiased and fair. This model applies various AI techniques such as natural language process, sentiment analysis, artificial neural network, fuzzy logic, decision tree, naive Bayes, social network analysis and ensemble classifiers which seeks to give collective strategies of each used tool to result in appraisal process which does not depend merely on one classifier but gives collective feedback from different techniques applied in the best possible way to give conclusive opinion which leads to fair employee's final performance evaluation.

Further **managerial AIPMSI framework** explains what AI techniques are used in the process of employee evaluation, its role and outcomes and further the managerial implications are explained in. AI generated feedback will provide continue data collection for giving broader picture of performance appraisal.AI mediated performance evaluation combine strength and minimize weaknesses of each used methodologies imparting fair employees' final evaluation. Achieve strategic objectives of the company aligned with individual objectives, Optimizing performance evaluation. AI's tangibility, reliability, transparency and immediacy solutions based on real time assessments build positive experiences, minimize human errors and biases. It also establishes or promotes enterprise system reforms. Data driven predictions are further used in HRP and human analytics giving hiring, firing advice and reward employees. Smart (intelligent) workplace environment help stakeholders (employees, employers and managers) to learn from their previous mistakes. Reviews provide personalized services, focus more on AI mediated skills.

In addition to their line managers, peers and customers also evaluate employees. AI makes it possible to boost human capabilities while also automating repetitive tasks to reduce costs. According to research, augmentation—putting people first and maximizing their potential— holds the greatest potential for generating value for firms. Automation of regular management tasks will undoubtedly remain crucial, but largely it gives managers and staff members more opportunity to concentrate on activities that add more value, like those related to judgment work. (2016 Accenture Technology Vision).

LIMITATIONS OF AI IN EMPLOYEE PERFORMANCE MANAGEMENT

AI will replace administrative management work leaving traditional administrative workforce to lose their jobs.

Artificial intelligence elicits passionate reactions, with some people applauding its seemingly limitless potential and others seeing it as a sign of impending doom. According to our survey, 84 percent of managers predict that AI would increase the effectiveness and enjoyment of their work, but 36 percent are concerned that it may endanger their careers (Vegard, Kolbjørnsrud, Richard Amico and Robert J. Thomas, 2016).''It is a manager's responsibility to coordinate activities across numerous organizational divisions and to comprehend the context of work so that he can influence it. manager's role will be redefined, if such context can be proactively revealed and changes that quickly.'' Jon Webster, chief information officer for digital and transformation at Lloyds Banking Group, says. (Kolbjørnsrud, Richard Amico and Robert J. Thomas, 2016). Clearly, there is a new division of labour and in the long run, more jobs will be automated and will terminate office management tasks, potentially resulting in job losses for those who are technically behind.

AI enabled PMS can create phantom of control and selling the risk short.

AI mediated PMS can overrate digital data quantifying workforce activities and employees' KSAs. However, it might encourage a phony perception of assurance about the information (Gal et al., 2017), resulting in uncritical faith in the methods, outcomes, and capacity of algorithms to anticipate accurate outcomes (Leicht-Deobald et.al.,2019; Mayer et.al., 2020). These aptitudes of both managers and employees could be exaggerated to affect decisions which they can't control much (Kellogg et al., 2020; Newell & Marabelli 2015), underestimating risk. Such overconfidence in AI fosters an illusion of power among employees and supervisors (Durand 2003).

Marginalize HR reasoning and abrade managerial competence.

Human cognitive and decisive capabilities are the capitals of HR are not comparable to AI thus technologies when not applied properly can marginalize human reasoning and abrade managerial competencies.

Predictions resulting from AI-integrated PMS in human analytics may be inevitable:

Deployed algorithms in people analytics make only hypothetical probabilities that an event will occur, not the actual event (faraj et. Al.,2018). AI therefore evaluates likelihood of employees exhibiting specific behaviors rather than actual behavior (Brayne 2017; faraj et.al.,2018; Mayer Schonberger & Cukier, 2012)

Legal and ethical issues

Every organization is nowadays looking towards AI and big data for their growth and success thus rampantly growing AI and big data capabilities can be utilized for good or ill. Leaders must exercise caution and keep an eye on the use of AI and sensitive data in their organizations for reasons of law, ethics, and trust. Make Policy taking care of stakeholders ' privacy and grievances if any.

RECOMMENDATIONS:

To increase generalization of findings researchers should use larger sample sizes and longer time frames to assess long term effect of AI on people performance.

Focus on a wider range of tasks to gain a better understanding of how AI can be used to measure employee performance holistically, should develop methods to address bias in AI systems.

This AIPMSI framework can be used by researchers in specific industry or context for further research work in other functions of human resource management.

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