ASIAN BULLETIN OF BIG DATA MANAGMENT
Vol. 4. Issue 4 (2024)
https://doi.org/ 10.62019/abbdm.v4i4.296

ASIAN BULLETIN OF BIG DATA MANAGEMENT
http://abbdm.com/
ISSN (Print): 2959-0795
ISSN (online): 2959-0809

Role of Machine Learning and Immersive Technologies in Modern Management with Trends, Applications, and Risks

Muhammad Hammad U Salam, Shujaat Ali Rathore*, Dr. Nasrullah, Sayyid Kamran Hussain, Tahir Abbas*

Chronicle

Article history
Received: 1st December, 2024
Received in the **revised format:** 12th December, 2024
Accepted: 30th December, 2024
Available online: 31st December, 2024

Muhammad Hammad u Salam and Shujaat Ali Rathore are currently affiliated with Department Computer Science &Information Technology, University of Kotli, Azad Jammu and Kashmir, Pakistan.
Email: hammad.salam@uokajk.edu.pk

Dr. Nasrullah is currently affiliated with Department of Computer Science & IT, University of Jhang, Pakistan.

Sayyid Kamran Hussain and Tahir Abbas are currently affiliated with the Department of Computer Science, TIMES Institute, Multan, Pakistan.
Email: drtahirabbas@t.edu.pk
Corresponding Author*

Abstract

This paper analyzes the transformation that immersion technologies and machine learning (ML) invoke on modern management, particularly regarding its application in the core functions of an organization including recruitment, employee training, talent management, motivation, and corporate culture build up. In recruitment alone, ML algorithms facilitate organizational decision-making by predicting candidate suitability, behavior and optimizing hiring processes. Furthermore, immersion technologies like virtual reality (VR) can be employed to solve training and development problems by providing high-quality learning opportunities for active engagement and improvement of staff's productivity and effectiveness. These advancements, however, pose new risks such as privacy, ethics, and data discrimination. This paper covers the opportunities and challenges provided by ML and immersive technologies in management with an emphasis on its utilization in the organization performance and satisfaction of employees. In summary, while the benefits of adopting these technologies with regard to improving efficiency as well as effectiveness of business operations is evident, the policies governing adoption and utilization will require a great deal of retrieval on the ethical borders and implications of such actions.

Keywords: Machine Learning, Immersive Technologies, Virtual Reality, Employee Training, Predictive Analytics, Recruitment

INTRODUCTION

The world has entered the era of digitalization, and global revolutionary changes are occurring in the field of economics. Cross-cutting technologies, i.e., technologies that can be applied across various economic sectors, are developing more rapidly and gaining greater scale. Due to their high cost, access to these technologies has been obtained by the largest corporations and development companies worldwide. However, based on successful results, new participants are increasingly joining the process, focusing on narrower niches and addressing specific tasks. The consequences of this process and the challenges the global economic system and governments will face are mainly discussed in developed countries. Europe has already realized the depth of the problem and has launched pilot experiments on the introduction of basic income in Germany and Finland. The same number of people as before will not be needed in production. Almost all new factories are being launched either fully automated or with a high degree of automation. As robotics prices decrease, the share of such production will only increase. The higher the level of labor compensation in a specific country, the more companies will be

interested in labor automation. This process, on the one hand, increases the efficiency of companies, but on the other hand, it undermines demand due to job losses or reduced income for citizens. The possibility of maintaining a job or successfully finding employment in the future will partly become a privilege due to the reduction in the number of jobs. Developed countries are at the first stage of labor market transformation, but the effectiveness of these technologies themselves directs business along this development vector. Only national governments or international agreements can stop or redirect these processes. PwC's "Red World" development scenario, which assumes the most radical changes, suggests that by 2025, there may be a peak in restructurings and the division of industrial companies over the next decade. By 2030, only 9% of Americans will work full-time. About 60% of respondents in a sociological survey conducted by the company believe that there is a risk that a significant portion of employees will lose their jobs due to technological development and automation. This economic chaos makes it increasingly difficult to make management decisions, so managers and investors are increasingly seeking informational support through digital solutions. The stock market is only a small part where such tools have already been applied, and the share of robots conducting trade transactions in the U.S. stock market has surpassed 75%.

Major investment funds are creating specialized recommendation systems based on information that guide their investment decisions. Large corporations are increasingly relying on digital tools in various areas of management. Often, this involves monitoring employees. Some developers are focusing on solving problems in human resource management, while others are creating smart devices like badges that track employee activity. Others are working on automating business processes, enabling entire departments to be replaced by robots, voice assistants, chatbots, and other services. Still others are addressing security issues. These directions of technological development are discussed further. In fact, the classical capitalist system, in its financial representation, ceased to function in the classical way in 2020 during the economic downturn caused by the pandemic, and some of its elements had ceased functioning even earlier (negative interest rates from central banks, the U.S. Federal Reserve's quantitative easing programs, etc.). Central banks began to fill their balances with stocks and corporate bonds, which is not a common practice. Instead of a new economic crisis that would wipe out weak and external-financing-dependent "zombie companies," the world economy found itself in a situation of a growing stock market amid a severe economic decline. The cause of this is the large-scale monetary stimulus of the U.S. economy.

Such a situation, where the value of stock market assets exceeded the global GDP, has historically ended with stock market crashes (e.g., the Great Depression of 1929, the dot-com bubble of 2000). Over the last eight years, the stock market has been in a state of overvaluation, with the current level being the highest in history. Currently, one of the main factors driving the continued growth of stock markets is the liquidity flowing into the markets, as well as the decline in yields from other financial instruments, which pushes economic agents to invest in securities markets. With the expansion of negative interest rate policies by central banks around the world, investment, hedge, pension funds, and banks have nowhere to invest their assets to generate income almost all of them are invested in the stock markets. This only exacerbates the situation. The so-called "smart money" has been using share buybacks to exit stocks at their maximum values over the past year. A significant number of private investors, on the other hand, have been investing in the market, and many have even seen good returns from its growth. According to a report from the Central Bank of the Russian Federation, the number of

clients with brokerage accounts in Russia increased by 27% in the third quarter of 2020 compared to the same period in the previous year.

LITERATURE REVIEW

The rise of machine learning (ML) technologies has now introduced new ways to enhance organizational performance and manage employees. Various predictive ML models have been developed for different aspects of management, like forecasting employee behavior and productivity, which could potentially improve recruitment processes [14]. Virtual and augmented reality (VR/AR) technologies have now become indispensable in improving the overall quality of employee training and the safety environments in which employees work [15]. More so, the integration of AI tools like artificial neural networks (ANNs) with immersive systems labeled training simulators make it possible to sharpen skills more efficiently and prepare employees for their roles, increasing productivity for the entire organization [16]. Nevertheless, these emerging technologies, when adopted, might incur additional risk for the employee's privacy and control. The implementation of employee attendance systems based on wearables and other sensors has triggered discussions on the boundaries and appropriateness of such surveillance and potential abuse [17].

This has resulted in the controversies that arise from the testing of policies meant to protect organizational objectives while ensuring that the employee's rights are not infringed upon [18]. AI Models in HR, such as those employed in Predictive Analytics for Recruitment and even talent management, while may improve overall hiring productivity, may also cultivate biases which could be detrimental to some employees and discriminatory towards others [19]. Therefore, businesses need to understand the consequences of excessive reliance on automated systems, especially when it comes to Human Resource Management moves [20]. Besides managing human resources, both ML and immersive technologies are being embedded in other business functions. Employing AI for business intelligence, such as emerging market analysis and supply chain management optimization, has been promising in enhancing efficiency and profit margins [21]. These companies must, however, be careful about the integration's technology supplanting traditional frameworks, considering the security threats that come with sensitive information being processed within the system [22].

Although the advances in AI offer unique advantages such as utilizing historical data to steer projections, the ever-demanding accuracy of these predictions is a challenge that many will have to grapple with [23]. Dozens of enterprises are already looking into how immersive technologies can boost engagement levels, collaboration among teams, and company culture as a whole. With virtual reality, employees can actively take part in interactive and more progressive learning processes, which are normally highly passive and ineffective using traditional approaches, in a simulated environment [24]. These technologies are prophesied to be at the forefront of an increase in employee performance and satisfaction, giving organizations productive new ways to inspire and keep their talents [25]. The combination of machine learning with management immersive technologies (MTE) has attracted great interest because of its possible innovation in organizational processes. When companies invest in cutting-edge technologies, they become more effective in managing human resources, decision-making, and workforce engagement. Machine Learning Models have firmly established within the scope of

predictive analytics, employee engagement, recruitment, and performance management [25]. Research conducted demonstrate that ML models are capable of predicting employee behavioral model patterns such as retention risks and likelihood of a promotion, hence enabling businesses to make data-backed decisions that are far more accurate and less influenced by human biases [26]. Virtual and augmented reality (VR/AR), among other immersive technologies, are gaining popularity as main components of employee training and development. Employees can participate in skill-based activities through VR simulations without risk of negative real world consequences. This technology has been extremely beneficial in high risk areas like manufacturing, healthcare, and construction, where workers need to be exposed to complicated scenarios without endangering themselves or others.

Several studies have compared the efficiency of different immersive methods with traditional training approaches, and results showed that learners in a VR environment tend to have better knowledge retention and perform better than those who do not [27]. At the same time, immersive technology enables employees to work from different locations while allowing for interaction within collaborative teams, which ultimately enhances productivity across borders [28]. In addition to enhancing training and recruitment, the integration of AI and immersive technologies in management has led to the development of more efficient business processes. By applying predictive analytics and automation to routine tasks, companies can streamline operations, reduce costs, and improve productivity. However, the widespread use of these technologies introduces challenges, particularly concerning employee privacy and surveillance. The application of wearable devices and sensors for monitoring employee activities has raised concerns about over-surveillance and its implications for workers' rights and autonomy [29]. Despite these concerns, businesses continue to embrace these technologies, recognizing their potential to foster innovation and drive organizational growth.

Table 1:
Applications of ML and Immersive Technologies in Management

Technology	Application Area	Impact on Management	Risks and Challenges	References
Machine Learning	Predictive Analytics in HR	Improves recruitment, retention predictions, performance evaluations	Potential for bias in predictions, privacy issues	[26], [27]
Immersive VR/AR	Employee Training and Development	Enhances learning retention, reduces real-world risks	High initial investment, accessibility issues	[28], [29]
AI-Powered Analytics	Business Process Automation	Reduces operational costs, improves decision-making	Security risks with data integration, over-dependence on automation	[26], [29]
Wearable Technology	Employee Monitoring and Health Tracking	Improves productivity by tracking physical and emotional states	Invasion of privacy, stress due to constant monitoring	[29], [27]

The comparative Table.1 above illustrates the various applications of machine learning and immersive technologies in management. It highlights the broad impact of ML on human resources management, where predictive analytics helps businesses optimize their hiring practices and improve employee retention strategies. However, the potential for bias in automated systems remains a significant challenge, which can undermine fairness in decision-making processes [26]. Similarly, the training of employees has been transformed with the use of immersive VR/AR technologies as skill practice can now be undertaken without any risks being taken. These new technologies offer a significant

improvement over conventional practices for other areas such as manufacturing and healthcare which need a practical approach [28]. Nonetheless, the expense and availability of these systems is stymying widespread enactment, especially in small and medium-sized companies. The use of AI analytics and automation is on the rise for the purpose of enhancing strategic organizational operation through task automation and better decision making. Although these systems lower operational expenditure and increase productivity, they create security issues when sensitive employee data is started to be moved between applications [29]. Now, wearable technologies that track the health and performance of employees are becoming more popular in different sectors. These devices help to increase productivity and general well-being but also intensify the ever-waning privacy issues associated with instant monitoring and access to sensitive information, which can be abused and cause stress on the user.

Areas of Application of Machine Learning Technologies and Immersive Technologies in Management

Management is always associated with challenges related to the psychology of individuals. A person is a nonlinear system, and predicting their behavior with 100% accuracy is impossible. The uniqueness of personality development, its psycho-emotional traits, form the basis for the fact that in situations such as job termination, different people will behave in different ways. One person may cry and quietly leave the company, another might return to the office and confront management, while a third might commit suicide due to depression, medication effects, or a mental illness. Naturally, such issues are rare, but the challenges of recruitment, selection, hiring, firing, career growth management, staff training, talent development, realizing employee potential, motivating employees, developing corporate culture, and others remain relevant management questions, where the application of new tools can enhance the overall management effectiveness of the company and free up financial resources for further development.

A few terms used in the research require explanation. Deep machine learning refers to machine learning algorithms that model high-level abstractions using numerous nonlinear transformations [Deng and Yu, 2014]. In essence, these are algorithms that can modify themselves to complete tasks. At the initial stage of machine learning, specialists label and structure the data, helping the program understand whether it is performing a task correctly. Later, it can operate autonomously in performing repetitive tasks. Multilevel deep machine learning algorithms, which are responsible for analyzing different data and performing various operations, are similar to neurons in the human brain and are called artificial neural networks. These networks can classify information at different levels and match it. The further development of this direction may lead to the creation of artificial intelligence. The applications of machine learning (ML) and immersive technologies in management are presented. It shows how ML, particularly deep learning algorithms, is used to improve autonomy in repetitive tasks and how employee management is optimized with artificial neural networks (ANNs) for turnover predictions and other analytic forecasting. Moreover, the Figure.1 previews the disruption ML can cause to businesses with particular attention on its use in credit scoring and approvals as well as RPA (Robotic Process Automation) in banking. Figure 1 traces the relationship between machine learning, immersice technologies, and their interfaces within the context of management

with emphasis on multilevel and multi-dimensional applications. It illustrates that the use of deep learning neural networks is one of the most sought developments which aid automation in mundane tasks as well as managerial decision making.Usage of advanced automation technologies, also known as Artificial Intelligence, further expands and facilitates the range of autonomic functions achievable in previously labor-intensive activities such as data capturing and manipulation. The core components of most modern machine learning systems in management greatly depend on artificial neural networks (ANNs) which are the dominating IT soft in contemporary management science.

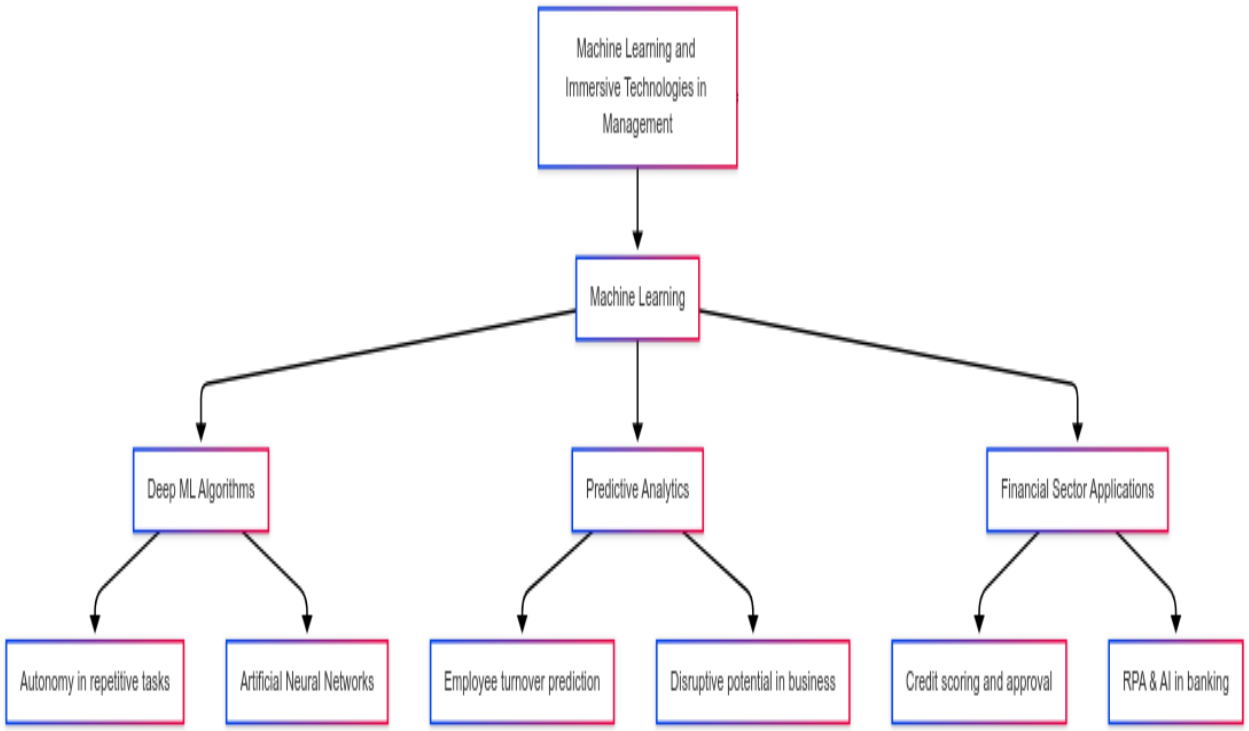

Figure 1:
Machine Learning and Immersive Technologies in Management

In addition, predictive analytics helps management notice possible employee turnover long before it occurs so that they can take necessary remedial steps to retain top talent. The figure summarizes how ML is continuing to disrupt business by uncovering opportunities and inefficiencies across, and particularly in, the finance industry. Industry applications, such as credit scoring and even credit decisions, are already being made with a high degree of accuracy and speed because of machine learning. Also, RPA and AI in banking are paradigm shifts as they eliminate mundane functions and, in turn, decrease expenditures and improve performance efficiency. The diagram demonstrates the wide range and increasing importance of AI and ML in modern management practices. Deep machine learning algorithms are disruptive revolutionary inventions that will lead to epoch-making changes in nearly every area of human activity. The practical significance of applying these technologies is vast and will grow as their implementation expands. One of the areas where machine learning technologies are applied in business is predictive (forecasting) analytics for personnel – analyzing data using scientific methods such as game theory, statistics, sensor data, video cameras, etc. This allows for uncovering hidden relationships with machine learning algorithms for predictive purposes. For example, the system can signal that an employee is considering leaving the company before the

employee actually quits or informs management of their intentions. For many companies, employee turnover is a major issue. Each time a good employee leaves, the company loses a lot, starting with the costs of finding a new employee, training them, the time spent on adaptation, and ending with the loss of the employee's developmental potential. Additionally, in any company, there are always links that disrupt its smooth operation. There are people who hold important positions but perform minimal useful work. In large companies, there are employees who, although they are subordinates, effectively act as managers. They independently initiate their own projects, collaborate with other departments to solve current tasks, and maintain constant communication with colleagues, who assess them as high-level professionals. These hidden patterns, often invisible to company management, can be revealed through predictive analytics tools. Machine learning is most widely used in the financial sector for "scoring" clients – assessing their creditworthiness. Systems autonomously analyze credit history, income, and other factors connected to the system. As a result, automated systems with artificial intelligence elements independently make decisions about credit approval.

At a forum dedicated to the development of artificial intelligence, the head of Sberbank revealed that in 2019, all applications from individuals received by the bank were processed automatically. For legal entities, the credit approval process is less automated, with the percentage of automation being below 35%. The company's goal is to increase this to 70% by 2022. Sberbank's specialized laboratories for RPA (Robotic Process Automation) and artificial intelligence manage this direction.VTB Bank has established a department for advanced machine learning algorithms in its data analysis and modeling department. The bank uses machine learning systems in most of its business processes. These systems are used to generate loan proposals and make automated decisions about credit approval. Similar to Sberbank, VTB has launched voice assistant services that have replaced many call center employees, as well as chatbots. These technologies are also used for document recognition and processing. The effectiveness of predictive systems for employee behavior is based on past data. The system relies on analogies with previously occurring situations, but when situations deviate from the norm, the system may become ineffective and require human intervention.

In 2020, the Russian developer of information systems, Skillaz, implemented a joint project with VTB Bank in the field of intelligent recruiting technologies. The introduction of intelligent systems allowed the bank to switch to mass automated recruitment for entry-level positions. The system evaluates candidates based on predefined criteria and profiles them for the most suitable position. The system is trained based on the digital profiles of the bank's top employees in various positions, and it builds predictive models for candidate performance in specific positions over time. According to the bank's official website, in 2020, more than 1,000 candidates were hired using the automated recruitment system, accounting for 35% of the new employees in the bank's regional network. For VTB, the mass recruitment of entry-level employees is an important issue, as over 4,000 employees are hired annually. Automation of the recruitment process allowed the bank to accelerate hiring more than twice and reduce time costs. The company's future strategy includes integrating this system into a unified information space to solve other management tasks. The "33 Elephants" real estate agency also uses automated systems for recruiting interns to the training center. Using traditional methods, they would have to spend many man-hours calling thousands of applicants to invite them for interviews. The

essence of predictive analytics is to identify factors and parameters that influence predicted events based on diagnostic information. For example, in car insurance, these may include driving experience, age, and gender. Recently, based on statistical information, Russian insurers tried to implement discriminatory coefficients for women, as statistically, they were more often involved in accidents. This shows that technologies can bring not only increased efficiency but also social risks, as the spread of digitalization will inevitably lead to general citizen scoring. Similar systems have been developed and applied in China to create social credit ratings for citizens. If events in this sphere develop negatively, society may face a "digital concentration camp," and these risks must be considered when implementing such technologies. Citizens in China who received low social ratings due to various life circumstances lost the ability to travel abroad, purchase tickets for planes and trains, enroll their children in private schools, and other opportunities. In other Russian real estate agencies, robotic process automation (RPA) systems were used to automate the verification of documents prepared by sales managers. Previously, a separate department was responsible for checking the correctness of these documents.

After automation, this department was replaced by a robot that works once a month and completes all the necessary tasks in a few hours. According to a study conducted by the Moscow Department of Information Technology in 2019, 79% of small businesses and 86% of medium-sized businesses are aware of robotic process automation (RPA). More than half of the medium-sized companies (52%) and 41% of small businesses have implemented this technology in their operations. According to KPMG, the number of businesses in Russia that adopted RPA since 2017 has doubled. Additionally, 54% of surveyed Russian organizations plan to implement RPA in the next two years. In marketing, these technologies help companies segment customers by geolocation, make advertising more effective, and predictive systems recommend products in online stores, movies in online cinemas, or music in streaming services. This trend will soon extend to dating services, potentially allowing people to choose a spouse based on automated information. Companies like Amazon, Alibaba, Netflix, Spotify, and others already fully leverage predictive analytics and will continue to refine these systems to extract new value from accumulating data.

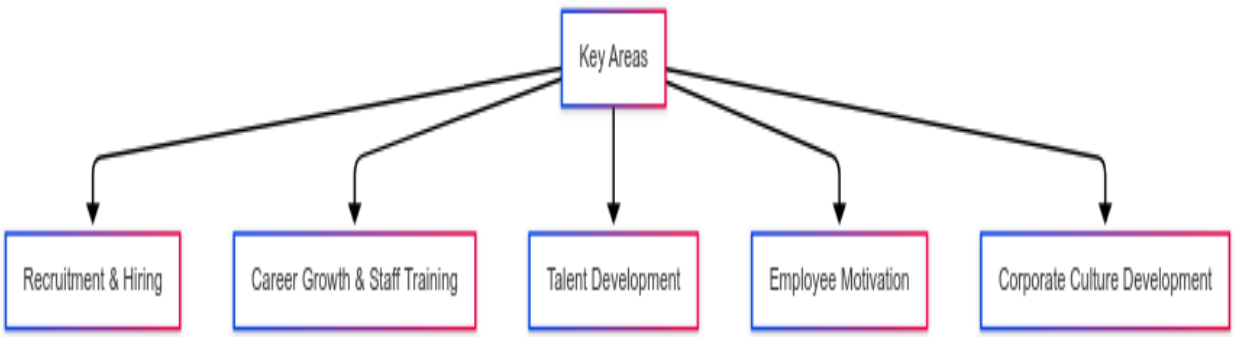

Figure 2:
Key Areas of Machine Learning and Immersive Technologies in Management

Machine Learning Applications, Figure 2 - these provided solutions with regards to the Organisational learning, knowledge retention and the skills needed to apply these concepts in real life. This information however does not include any shifts in the employee engagement and organisational culture development with the implementation of the

immersive technologies and the machine learning. Using a combination of data sources, an organisation is able to improve their recruitment and hiring processes. Machine Learning models are effectively functioning in these spheres as the models are trained on previously recruited employees with regards to their qualifications, behavioral outcomes, and previous experiences. This helps in tailoring better jobs positions for each candidate, thus increasing retention rates. The use of predictive analytics increases the accuracy of recruitment and reduces various forms of biases.[26] The use of Immersive Technology or Artificial Reality in staff training is very different from traditional ones. Virtual Reality provides hands on environment allowing for training to be more interactive and engaging. Training staff increases the value of the firm, especially skilled workers as it enhances productivity. AI allows for further improvement of this program by customization of learnt elements into a structured form taking into account previously learned knowledge and the level of need for further training.[27]

Talent Development: Within the organization, machine learning is helpful in finding possible talent. By evaluating employee records, such as their previous achievements and their potential, firms are able to accurately assess advancement, design useful career planning, as well as integrating leadership development programs [28].

Employee Motivation: An ML model can determine employee performance and satisfaction rates based on survey and feedback data, as well as behavioral monitoring. These models can also pinpoint motivational obstacles and recommend personalized solutions to increase effectiveness [29].

Corporate Culture Development: The positivity of corporate culture can also be attained and maintained through the use of ML and immersive technologies by measuring interactivity among emploees and the adherence to company principles and values. These systematic approaches through sentiment analysis and employee feedback can enable a diverse and healthy business organization [29]. These key areas highlight the remarkable changes brought forth by machine learning and immersive technologies designed for the management system, including recruitment, training, employee motivation, and nurturing the company culture. Every new technology comes with changes, and with these changes, new methods and solutions are crafted that advance the efficiency of managing employees and the organizational structure as a whole.

Global Market Growth Dynamics

According to international analytical agency Gartner, the global RPA market reached $1.8 billion in 2021 and is expected to reach $2.4 billion in 2022 as shown in Figure.3. Under the influence of deep machine learning, the business process automation technology is evolving into more complex intelligent robotic process automation and will expand the list of applied tasks. According to Gartner as shown in Figure.4, 60% of organizations with revenues over $1 billion already use business process automation, and the agency predicts that by 2030, 80% of project tasks will be automated [Gartner, 2021].

Table 2:
Dynamics of Growth of the Global Software Market 2019–2021

Year	Market Volume (Trillions USD)
2019	3.74
2020	3.87
2021	4

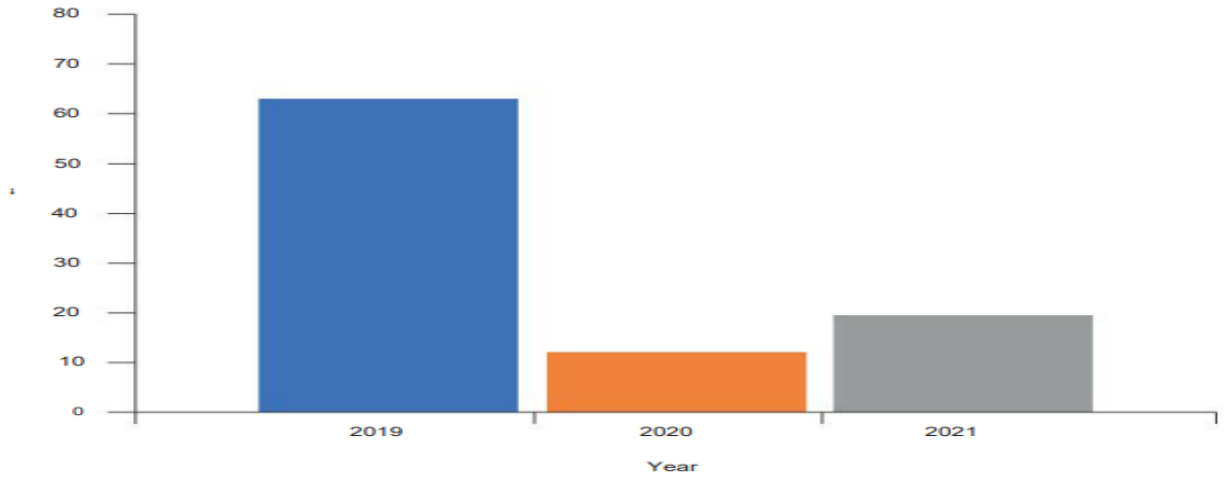

Figure 3:
Growth Dynamics of the Global RPA Market in 2019-2021 (in %)

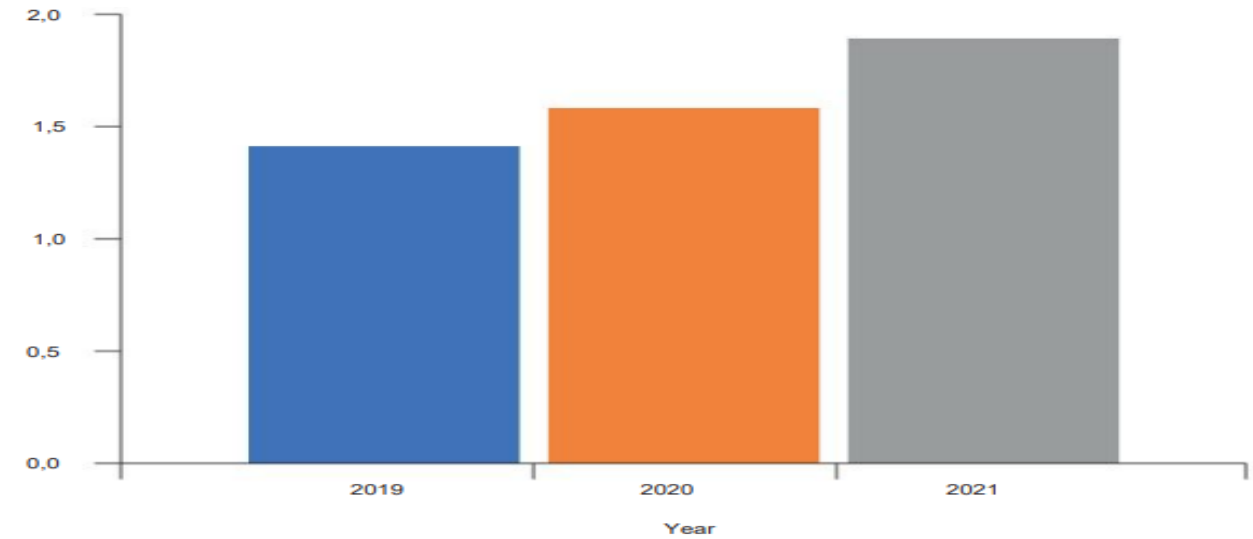

Figure 4:
Dynamics of Changes in the Income of Companies from the Sale of RPA Software, Billions USD

The Table.2 shows the growth in the global software market from 2019 to 2021, with a steady increase in market volume each year.

Threats and Risks of Using Machine Learning and Immersion Technologies

The second direction of technological development currently implemented in modern management is the development of devices to track employee activity. Various methods and special detectors are used for monitoring. These sensors may be embedded in lighting fixtures that can detect movement, monitor energy usage, automatically adjust lighting brightness, and track behavioral patterns of employees. Companies are beginning to apply wearable devices such as bracelets, badges, and sensors that can detect fatigue and even depression in employees. Major American companies, like Bank of America, IBM, BP, Barclays, and Target, started offering their employees wearable trackers from Fitbit, a company that held more than 50% of the market in this segment. In 2019, Google acquired Fitbit for $2.1 billion, taking a step closer to tracking not only users'

search queries but also biological monitoring of people, including health indicators, emotional states, and moods. Amazon, known for its strict "military" corporate culture, recently patented a wristband that tracks employees' locations at work and recognizes hand movements. A British journalist, in 2016, delved into the issues of low-wage labor and worked in one of Amazon's warehouses. In 2018, he published a book detailing the working conditions at the company [Bloodworth, 2018]. He explained that employees had to wear a portable device to track their work efficiency, including their movement speed and order-picking rate. According to the journalist, managers would analyze employees' activities and warn them if they were in the bottom 10% for productivity. The journalist concluded that, in order to meet required targets, employees had to move almost at a run within the warehouse, though running was prohibited and would result in punishment.

The journalist even found a bottle of urine, left by an employee who wanted to save time on bathroom breaks. After the book was published, more than 30 people contacted "Business Insider" to confirm the strict surveillance at Amazon. Some companies have taken employee monitoring to a new level. The U.S. company Three Square Market offered employees a voluntary, free microchip implant between their thumb and index finger. Surprisingly, 72 out of 90 employees at the company's headquarters agreed to the chip implantation. The chips can be used by employees to access office doors and authenticate their presence at work. Chinese companies have also started using sensors embedded in employees' helmets. These sensors track brain activity, determine fatigue levels, stress, anger, and other emotions. One Chinese energy company used this technology to monitor the frequency and duration of work breaks. The technology was also applied in high-speed trains to monitor the fatigue and concentration levels of train drivers, thus improving safety. The company Humanize focuses on workforce analytics and has developed an intelligent badge worn by employees. This badge tracks working hours, off-site time, and even conversations within the company.

The device can analyze the tone of employees' voices, assess their work activity, and even conduct alcohol tests. The food delivery company Deliveroo uses performance tracking for couriers working in the company. This practice led to top-performing couriers receiving priority orders. The use of such devices is continuously expanding and has become a necessity for obtaining high-paying jobs worldwide. Employees are often required to agree to monitor their productivity through technical devices or software. Machine Learning systems and AI technologies face a challenge when seeking to use image processing technologies to estimate human behavior in organizational context, as shown in this Figure 5. Here, it is necessary to address the psychology of people, amend to nonlinearity, have primary predictive accuracy, and manage with emotional responses to changes in jobs. The focus of the Figure.5 is to describe the systemic problems of using AI to interpret unconstrained human action toward people in a management situation. The concern is mostly about issues that stem from employing such complex systems as machine learning for describing activities within an organizational setting. The first challenge Psychology of individuals claims that the participant is supposed to be rational or at least to some extent reasonable. In particular employees can be very unpredictable in their behavior for many reasons. Capturing the responses and relations of individuals to a different organizational aspects such as leadership, work setting, and levels of

motivation is multifarious which is hard, if not impossible, for AI models to model. The second challenge Nonlinear systems, as has been pointed out, makes it impossible to understand the behavior of humans around us by applying deductive reasoning to human actions. Individuals may behave under the influence of multiple factors.

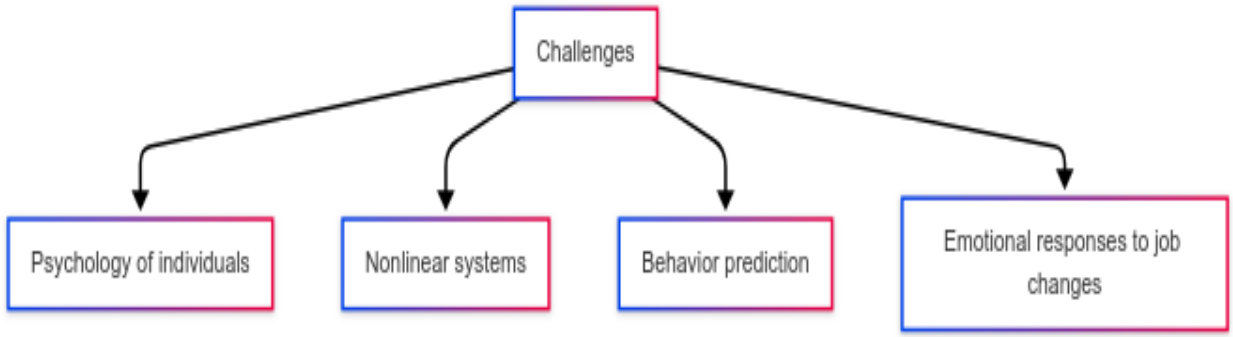

Figure 5:
Challenges in Predicting Human Behavior in Management

These factors can also be contrary and work against each other. Constructing traditional algorithms does not do justice because of such complications. Behavior prediction is a critical concern. While the past data can be useful to train machine learning algorithms, accurately predicting human actions with precision is rather complex owing to varying responses to the same situation due to several factors such as context, personality, and emotional state. Lastly, emotional the "Emotional Responses to Job Changes" challenge is indicative to how hard it is to foresee employees' emotional reactions to changes such as promotions, demotions, layoffs, and transfers. Such changes largely impact the employees' nerves, satisfaction levels, levels of engagement, or overall organizational morale which is why there is such negative emotion toward it and where it becomes a critical area for organizational models, but an area that is particularly hard to measure. To conclude, machine learning and AI, in particular, may offer sound reasoning for supervision and workforce management, but as articulated in this Figure.5, most attempts to predict human behavior continue to be the most challenging and complex issue.

Personnel analytics is increasingly relying on more advanced software suites, including those based on artificial intelligence elements. For instance, British company StatusToday offers a software solution that extends the monitoring from work documentation to tracking working hours. The program analyzes an employee's previous activity, creates a behavior profile, and compares it to their current actions. This allows the identification of deviations from standard behavior, which could be linked to potential business misconduct. For example, if an employee starts copying large volumes of files to external storage, it may signal a potential security threat to the company. Hiscox insurance company used this software to track the activity of a former employee's account, after they had already left the company. A similar solution is being developed by the Russian company VocaTech, which is creating audio badges. Among the companies using their development is the real estate company "Mangazeya Development." The success of the company's projects depends, in part, on the quality of customer service. For various positions within the company, different evaluation criteria are used, as, for instance, an administrator's role places more importance on politeness and creating a favorable environment for customers, whereas a manager's role focuses on sales steps, identifying

needs, demonstrating value, and clarifying the deal's terms. These practices have raised concerns and led to legal disputes. For example, the European Court of Human Rights ruled that employers have the right to review their employees' work-related emails and can lawfully fire employees for social media activity during work hours. However, court decisions vary by country. In Germany, the Federal Labor Court ruled that using "keyboard spy" software (keyloggers) to monitor employees is illegal. The conclusions from the previous discussion are straightforward: companies will continue striving to improve efficiency and will use all available tools to achieve this. Modern software allows for the monitoring of employee activities. The simplest category of such software includes lists of programs used and websites visited, while more advanced versions track email recipients, social media posts, and monitor keyboard activity. This software is designed to provide managers with a visualization of employee activity.However, developers do not stop at creating software with limited ethical functionality. Many developers now offer software that allows for full surveillance of employees' activities, including viewing what is open on their desktops, listening to what happens in the office, activating cameras, and recording everything typed on the keyboard.

Software such as Kickidler allows managers to view a grid of employee screens and monitor their actions. Similar tools include Hubstaff, Interguard, Work Examiner, StaffCop, Enterprise, and Clever Control. A key difference is whether employers inform employees about the installation of such software. Some programs notify employees about which activities are being tracked, while others, like WorkSmart, notify employees of their activities' results in graphical formats. The information gathered by employers can also be used as grounds for firing employees in situations such as economic downturns or reduced profitability. Some software products also track employees' geolocation via work phones and applications. For example, the Russian company MegaFon offers employers a "Personnel Control" service for a subscription fee, which allows tracking the location of employees, coordinating their travel routes, and controlling task completion. However, some employers try to force employees to use tracking applications even outside of working hours. A controversy arose in Britain over the dismissal of an Intermex employee who refused to use a mobile phone tracking app. The employee considered this an invasion of privacy and demanded $500,000 in damages through the court.

It is clear that deep machine learning tools can improve employee productivity but also create a total dependence of subordinates on management. For this reason, unions must be involved in creating guidelines for the ethical and responsible use of such tools. These issues are actively discussed in Western literature [Brynjolfsson and McAfee, 2014; Furman, 2016]. Systems based on artificial intelligence elements, such as Enaible, help management assess each employee's performance by assigning a score from 0 to 100. The system can analyze how one employee's work impacts others. Such information can be used when promoting employees or during downsizing. However, the current weakness of these systems is that they are better suited for analyzing repetitive tasks and not more complex ones that require creativity. Yahoo, which shifted its employees to remote work, claimed that employee productivity decreased. However, more time is needed for a thorough and accurate analysis. Many companies, during the pandemic, decided not just to temporarily switch employees to remote work, but to make it a permanent arrangement. Immersive technologies refer to virtual or augmented reality, creating an effect of presence. Over the past five years, virtual reality technologies have

gained popularity in employee training, particularly in the field of safety and labor protection. They allow employees to practice skills in a simulated real-world environment without any risk to life or health. The list of areas where companies are using virtual reality (VR) continues to grow, with HR departments now able to significantly reduce the time spent on training and adapting new employees while freeing up time for other tasks. The biggest savings occur for companies that previously used traditional training and had to pay for transportation and travel expenses for employees.

Virtual reality allows them to avoid these costs without compromising the quality of training, sometimes even surpassing traditional methods. Immersive technologies have become a powerful and promising tool in the educational process due to their unique technological characteristics [Chernyshova et al., 2017]. A new phase of development is happening in the education sector [Bakin, 2020; Kornilov, Popov, 2018], where the dropping prices of virtual reality headsets and the creation of quality educational content allow more educational institutions and students to adopt these technologies for educational purposes. New projects using virtual reality are being launched every year in various disciplines, with pilot programs being launched by many Russian schools and universities. Augmented reality is actively being used by the industrial sector to reduce errors [Sirakaya, 2018]. Major companies like Boeing, Ford, Fiat, and Volkswagen have adopted augmented reality glasses, which have significantly reduced defects and increased efficiency.

DISCUSSION

ML focused systems-such as algorithms- are widely adopted in recruitment and hiring because they automate the hiring processes. These systems formulate predictions about who would fit in specific job roles based on large datasets that include resumes, job interviews, and even employee behavior. Using these systems, organizations not only automate parts of the recruitment process, but reduce biases and enhance the effectiveness of hiring. However, as Garg et al. [30] reported, "discrimination enabled through historical data" is a major challenge in machine learning applications. In addition, while immersive VR training solutions have merged, showing self reported improvements in job readiness, the technology's cost and accessibility to smaller organizations pose serious limitations [31]. Focus categories like employee development and training are steadily adopting immersive technologies such as virtual realiy and augmented reality. These tools afford learners interactive experiential learning environments that simulate real life situations where they can rehearse different situations without fear of making mistakes. Being trained through VR is particularly beneficial in sectors that require practical experience such as the healthcare and manufacturing sectors.

As Kappen et al. [32] point out, these solutions are immersive, are able to create and recreate real settings, and enhance the retention of learned skills compared to other modes of training. Moreover, machine learning modeling can be used to develop training models that target specific areas of interest and gaps in productivity of different employees. Talent management and development is also mastered through ML because these algorithms are capable of determining the future potential of an employee through performance and historical data. Identify employees with high prospects of assuming leadership positions and provide them with career development opportunities using ML models. Although, ensuring that these predictions are unbiased with regards to gender, ethnicity, and other sociological factors is still an obstacle [30]. Employers are increasingly

utilizing ML models to break down performance data and predict elements correlated with motivation and satisfaction of employees. In the research conducted by Loyarte-Lopez and Garcia-Olaizola, ML predictive analytics can assess the level of engagement or burnout and allow management to take steps to minimize low productivity. Yet, these technologies are very helpful, but, still, privacy threats arise because perpertual observation may produce a sense of being watched too much. Similarly, also, the development of corporate culture is more and more being aided by the analysis of data. ML algorithms scan employee feedback, sentiments, and other metrics to detect workplace culture concerns to make changes to improve employee engagement. Yet, while ML can help create a conducive work place as noted by Pessach et al, surveillance and privacy issues are still fundamental problems to take into consideration. ML and immersive technologies offer many possibilities for management improvements, however, organizations have to consider the ethical, accessibility, and privacy challenges. These technologies should be carefully adopted, so that they will not do more harm than good.

CONCLUSION

There is the risk of inflicting excessive stress on employees and biasing them, which can result in the infringement of privacy, unethical conduct, degradation of moral standards, and the misuse of information for the detriment of employees. Hence, it is critical to strike a balance when it comes to formulating policies related to the implementation of these technologies. These decisions ought to incorporate professional organizations, nongovernmental organizations, human rights ombudsmen, civic councils and chambers, industrial chambers, distinguished attorneys, government, employers, and other relevant stakeholders. The implementation of these technologies will raise new positive impacts in terms of automated work processes, computation and service rendering increments, but alongside these there will be adverse impact on such social indices like employment. Society will gradually realign the mural preferences for employment. The incorporation of machine learning and immersive technologies within contemporary management practices has enabled shifts towards efficient, evidence-based decision making within multifaceted functions of a business. These technologies are deployed to manage and improve recruitment, employee training, talent development, motivation, as well as the corporate culture of the organization in order to improve overall performance.

The capacity of a machine learning model to predict an employee's behavior, such as turnover intention, job satisfaction and performance potential, provides marked benefits to those organizations that wish to enhance engagement and retention. Moreover, immersive technologies include virtual reality which transforms training and development programs by creating realistic and risk-free environments, lowering costs while increasing employee readiness. The use of advanced technologies, such as ML, presents significant hurdles which need to be resolved. Despite the promise ML holds in fundamentally changing hiring processes and decision-making, it is limited as it may often prove problematic in respect to managing and adjusting biases. Apart from that, monitoring employees and collecting information on them poses great privacy risks which can only be mitigated through increased organizational efficacy. These legal issues should not keep organizations from adopting these technologies, but policies should therefore be put in place to mitigate these concerns when implementing ML and immersive technologies. The future of management with the goal of planning and maximizing

organizational resources will greatly depend on the contemporaneous development and adoption of modern computer programs. In order to achieve that, it is vital that the business increases corporate transparency, fairness, and inclusion. When combined with immersive technologies, careful planning along with strict ethical guidelines will remedy socially irresponsible practices to enable exceptional, innovative, and efficient dealings with employees.

DECLARATIONS

Acknowledgement: We appreciate the generous support from all the supervisors and their different affiliations.

Funding: No funding body in the public, private, or nonprofit sectors provided a particular grant for this research.

Availability of data and material: In the approach, the data sources for the variables are stated.

Authors' contributions: Each author participated equally to the creation of this work.

Conflicts of Interests: The authors declare no conflict of interest.

Consent to Participate: Yes

Consent for publication and Ethical approval: Because this study does not include human or animal data, ethical approval is not required for publication. All authors have given their consent.

REFERENCES

Bakin M.V. (2020), "Immersive technologies in the development of social empathy and education," *Mezhdunarodnyinauchno-issledovatel'skiizhurnal*, no. 10-2 (100), pp. 16–19. (In Russian). https://doi.org/10.23670/IRJ.2020.100.10.037

Bloodworth J. (2018), *Hired: Six months undercover in low-wage Britain*, Atlantic Books, UK, 280 p.

Bockholt N. (2017), "VR, AR, MR and what does immersion actually mean?", *Cross-media, Global, Media & Entertainment, Technology, Industry Perspectives*, pp. 78.

Brynjolfsson E. and McAfee A. (2014), *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*, W. W. Norton & Company, USA, 320 p.

Kornilov Yu.V., and Popov A.A. (2018), "VR-technologies in education: experience, review of instruments, and application prospects," *Innovatsii v obrazovanii*, no. 8, pp. 117–129. (In Russian).

Chernysheva M.V., Lvov L.V., and Chernov V.A. (2017), "The use of technology of virtual teaching for improving the quality of education," *Sovremennayavysshayashkola: innovatsionnyi aspect*, vol. 9, no. 2 (36), pp. 54–63. (In Russian). https://doi.org/10.7442/2071-9620-2017-9-2-54-63

Deng, L., and Yu, D. (2014), "Deep learning: methods and applications," *Foundations and Trends in Signal Processing*, vol. 7, no. 3-4, pp. 197–387.

Furman J. (2016), "Is this time different? The opportunities and challenges of artificial intelligence," *AI Now: The Social and Economic Implications of Artificial Intelligence Technologies*, *Complex & Intelligent Systems*, vol. 1, no. 1, pp. 57–68. https://doi.org/10.1007/s40747-016-0005-9

Gartner says worldwide robotic process automation software revenue to reach nearly $2 billion in 2021, *Gartner*. Available at: https://www.gartner.com/en/newsroom/press-releases/2020-09-21-gartner-says-worldwide-robotic-process-automation-software-revenue-to-reach-nearly-2-billion-in-2021 (accessed 17.01.2022).

Gordon R. J. (2016), *The Rise and Fall of American Growth: The U.S. Standard of Living Since the Civil War*, Princeton University Press, Princeton, USA, 784 p. https://doi.org/10.1515/9781400888955

Ivanova A.V. (2018), "VR & AR technologies: opportunities and application obstacles," *Strategic decisions and risk management*, no. 3 (106), pp. 88–107. https://doi.org/10.17747/2078-8886-2018-3-88-107

Muleronko R.A., and Shikov A.N. (2016), "Problems of using virtual reality technologies in education," *Elektronnyinauchnyizhurnal*, no. 12-1 (15), pp. 169–176. (In Russian).

Sirakaya M., Sirakaya D.A. (2018), "Trends in educational AR studies: a systematic review," *Malaysian Online Journal of Educational Technology*, vol. 6, no. 2, pp. 60–74. https://doi.org/10.17220/mojet.2018.02.005

Md Tanvir Rahman Tarafder, Md Masudur Rahman, Nisher Ahmed, Tahmeed-Ur Rahman, Zakir Hossain, Asif Ahamed, "Integrating Transformative AI for Next-Level Predictive Analytics in Healthcare," 2024 IEEE Conference on Engineering Informatics (ICEI-2024), Melbourne, Australia, 2024.

Asif Ahamed, Md Tanvir Rahman Tarafder, S M Tamim Hossain Rimon, Ekramul Hasan, Md Al Amin, "Optimizing Load Forecasting in Smart Grids with AI-Driven Solutions," 2024 IEEE International Conference on Data & Software Engineering (ICoDSE-2024), Gorontalo, Indonesia, 2024.

A. Nuthalapati, "Building Scalable Data Lakes For Internet Of Things (IoT) Data Management," Educational Administration: Theory and Practice, vol. 29, no. 1, pp. 412–424, Jan. 2023, doi: 10.53555/kuey.v29i1.7323.

SM T. H. Rimon, Mohammad A. Sufian, Zenith M. Guria, Niaz Morshed, Ahmed I. Mosaddeque, Asif Ahamed, "Impact of AI-Powered Business Intelligence on Smart City Policy-Making and Data-Driven Governance," International Conference on Green Energy, Computing and Intelligent Technology (GEn-CITy 2024), Johor, Malaysia, 2024.

Abdullah Al Noman, Md Tanvir Rahman Tarafder, S M Tamim Hossain Rimon, Asif Ahamed, Shahriar Ahmed, Abdullah Al Sakib, "Discoverable Hidden Patterns in Water Quality through AI, LLMs, and Transparent Remote Sensing," The 17th International Conference on Security of Information and Networks (SIN-2024), Sydney, Australia, 2024, pp. 259-264.

Ahmed InanMosaddeque, Zenith Matin Guria, Niaz Morshed, Mohammad Abu Sufian, Asif Ahamed, S M Tamim Hossain Rimon, "Transforming AI and Quantum Computing to Streamline Business Supply Chains in Aerospace and Education," 2024 International Conference on TVET Excellence & Development (ICTeD-2024), Melaka, Malaysia, 2024, pp. 231-236, doi: 10.1109/ICTeD62334.2024.10844659.

Asif Ahamed, Nisher Ahmed, Jamshaid Iqbal Janjua, Zakir Hossain, Ekramul Hasan, Tahir Abbas, "Advances and Evaluation of Intelligent Techniques in Short-Term Load Forecasting," 2024 International Conference on Computer and Applications (ICCA-2024), Cairo, Egypt, 2024.

T. Abbas, J. I. and M. Irfan, "Proposed Agricultural Internet of Things (AIoT) Based Intelligent System of Disease Forecaster for Agri-Domain," 2023 International Conference on Computer and Applications (ICCA), Cairo, Egypt, 2023, pp. 1-6, doi: 10.1109/ICCA59364.2023.10401794.

J. I., A. Sabir, T. Abbas, S. Q. Abbas and M. Saleem, "Predictive Analytics and Machine Learning for Electricity Consumption Resilience in Wholesale Power Markets," 2024 2nd International Conference on Cyber Resilience (ICCR), Dubai, United Arab Emirates, 2024, pp. 1-7, doi: 10.1109/ICCR61006.2024.10533004.

Nadeem, N., Hayat, M.F., Qureshi, M.A., et al., "Hybrid Blockchain-based Academic Credential Verification System (B-ACVS)," Multimed Tools Appl 82, 43991–44019, 2023. doi: 10.1007/s11042-023-14944-7.

A. Rehman, F. Noor, J. I. Janjua, A. Ihsan, A. Q. Saeed, and T. Abbas, "Classification of Lung Diseases Using Machine Learning Technique," 2024 International Conference on Decision Aid Sciences and Applications (DASA), Manama, Bahrain, 2024, pp. 1-7, doi: 10.1109/DASA63652.2024.10836302.

Asif Ahamed, Hasib Fardin, Ekramul Hasan, S M Tamim Hossain Rimon, Md Musa Haque, & Abdullah Al Sakib. (2022). Public Service Institutions Leading The Way With Innovative Clean Energy Solutions . Journal of Population Therapeutics and Clinical Pharmacology, 29(04), 4477-4495.

E. Yunusa, T. Atoyebi, J. O. Owoyemi, "Redefining the Future of Work: an Immersive Gamified Workplace," *IJRS*, 2025.

D. Sahija, "Critical review of machine learning integration with augmented reality for discrete manufacturing," *ResearchGate*, 2021.
R. Nyathani, "Integration of Industry 4.0 and Human Resources: Evolving Human Capital Management and Employee Experience through Digital Innovations," *ResearchGate*, 2022.
M. Vochozka, J. Horak, "Virtual Human Resource Management, Workplace Tracking and Algorithmic Monitoring Systems, and Cognitive and Affective Metrics in the Immersive Metaverse," *CEEOL*, 2022.
S. Garg, S. Sinha, A.K. Kar, M. Mani, "A review of machine learning applications in human resource management," *International Journal of Production and Operations Management*, vol. 40, no. 2, pp. 211-230, 2022.
M. Kappen, M. Naber, "Objective and bias-free measures of candidate motivation during job applications," *Scientific Reports*, vol. 11, no. 1, pp. 2405-2416, 2021.
M. Kappen, M. Naber, "Objective and bias-free measures of candidate motivation during job applications," *Scientific Reports*, vol. 11, no. 1, pp. 2405-2416, 2021.
E. Loyarte-López, I. García-Olaizola, "Machine learning based method for deciding internal value of talent," *Applied Artificial Intelligence*, vol. 36, no. 1, pp. 102-115, 2022.