HR ANALYTICS A FACILITATOR FOR TRANSITIONING INTO INDUSTRY REVOLUTION 5.0

Prashant Trivedi[1], Vaishali Chandwani[2]

[1]*Assistant Professor, School of Business Management, Chhatrapati Shahu Ji Maharaj University, Kanpur, (UP)*

[2]*Research Scholar, School of Business Management, Chhatrapati Shahu Ji Maharaj University, Kanpur, (UP)*

ABSTRACT

The Fourth Industrial Revolution has brought in considerable technological advancements and transformed business operations. As we are transitioning to Industry 5.0, the amalgamation of new technologies such as AI, big data, IoT, and automation has brought revolutionary change in the outlook of industries and jobs. This research explores the crucial role of HR analytics in this transition. The objectives of HR analytics in the context of Industry 5.0 are identifying skill gaps, attracting talent through recruitment, increasing employee engagement, and creating a data-driven culture. By analyzing employee performance data, the company can make better choices for developing skilled and adaptable teams. Furthermore, HR analytics aligns HR strategies with Industry 5.0 objectives, predicts future workforce requirements, and facilitates strategic training initiatives to ensure competitiveness. Through real-world examples and insights, this study illustrates how HR analytics can transform the way organizations approach workforce management, ensuring technological innovation and human-machine collaboration. This study highlights how HR analytics can be a game-changer, guiding companies through the problems of Industry 5.0 ensuring a smooth adaptation to this new era of technological integration and serving as a transformative tool for a seamless transition to Industry 5.0

***Key Words*:** AI, Automation, Big Data, HR Analytics, Industry 5.0.

1. INTRODUCTION

Industry 4.0, or the Fourth Industrial Revolution, marks a significant transformation through the integration of advanced digital technologies into industrial processes. It signifies a major transfer in manufacturing and production (Thames & Schaefer, 2016),, driven by automation, data exchange, and the IoT (Zhou, et al., 2015). Industry 4.0 intends to build "Smart Factories" (Park & Lee, 2016) that leverage advanced technologies to promote efficiency, and productivity, and enable more flexible and responsive manufacturing systems (Bednar & Welch, 2020). The implementation of these new developments is necessary for IR 4.0 in order to build a better learning environment where businesses can exchange information and manage their duties more creatively and effectively (Weyer, 2015). Industry 4.0 first came up in Germany in the year 2011 through the "Industry 4.0" (Bartevyan, 2015) initiative, which aimed to strengthen the country's manufacturing sector through digitalization (Ślusarczyk, 2018) and connectivity. Since then, the concept has gained global recognition (Wan, et al., 2015), and countries around the world have embraced the principles of Industry 4.0 to drive in a competitive technological environment (Wan et al., 2015). "Industry 4.0" can be described as the time when industries began to use automation and secure data encryption (Kagermann et al., 2013). It has been widely recognized that highly innovative automated hardware and procedures will increase industry productivity and efficiency to a greater extent. (Thames, et al., 2016). In order to build a better learning environment where businesses can exchange information and manage their duties more creatively and effectively the implementation of IR 4.0 is necessary (Weyer, 2015). The German government agreed that IR 4.0's IoT will help the industry grow in the future by connecting AI in machines and humans (Zhou, et al., 2015). There is a notable impact of implementing new technologies on several groups, including the employees who handle daily operations in the organizations (Erol, 2016).

2. OBJECTIVES OF THE STUDY

- Assess HR analytics' role in identifying skills gaps and fostering human-technology collaboration in Industry 5.0.
- Explore how HR analytics enhances employee engagement, satisfaction, and leadership development.
- Examine the ethical challenges and data privacy concerns in using HR analytics and AI for decision-making.

3. KEY COMPONENTS OF INDUSTRY 4.0

3.1 Cyber-Physical Systems (CPS)

At the center of Industry 4.0 are digital actual frameworks, where actual machines and gadgets are interconnected through the Web and other correspondence organizations (Zhou, et al., 2016). This availability permits continuous information trade and empowers the checking and control of modern cycles from a distance (Munirathinam, 2020).

3.2 Internet of Things (IoT)
IoT is fundamental in Industry 4.0 as it associates sensors, gadgets, and machines to accumulate and trade information (Aslam et al., 2020). This information driven technique further develops direction, and prescient support, and improves creation processes (Riley et al., 2021).

3.3 Big Data and Analytics
Industry 4.0 relies upon the broad information created by associating gadgets and its ensuing examination (Wang and Wang, 2016). Large information investigation assists producers with acquiring experiences, perceiving examples, and settling on information-driven choices, further developing proficiency and item quality (Ashaari et al., 2021).

3.4 Artificial Intelligence (AI) and Machine Learning
Computer based intelligence and AI are utilized to upgrade mechanization, enhance processes, and foresee upkeep prerequisites (Lilhore et al., 2021). These innovations likewise permit frameworks to gain from information, ceaselessly further developing execution over the long run (Qureshi et al., 2020).

3.5 Cloud Computing
Cloud computing offers adaptable answers for putting away and handling a lot of information delivered in Industry 4.0 settings (Qasem et al., 2019).

3.6 Additive Manufacturing (3D Printing)
3D Printing considers quick prototyping, customization, and on-request creation, decreasing lead times and bringing down creation costs (Ashaari et al., 2021).

3.7 Augmented Reality (AR) and Virtual Reality (VR)
AR and VR are utilized in Industry 4.0 for preparing, upkeep, and recreation, permitting labourers to draw in virtual models and frameworks inside true conditions (Saif et al., 2021).

4. INDUSTRY 5.0

The idea of Industry 5.0 came out as an extension of the former industrial revolutions that have shaped the world's economic and technological sense. While Industry 4.0 marked the integration of digital technologies and the rise of automation, Industry 5.0 is envisioned to be a human-centric revolution that focuses on the alliance between humans and machines to create a more sustainable and inclusive future (Breque, et al., 2021). Industry 5.0 aims to strike a balance between automation and human creativity by focusing on the unique qualities and capabilities that humans possess, such as emotional intelligence, creativity, and adaptability (Aslam, et al., 2020). Similar "Smart Working" procedures were described by Bednar and Welch (Bednar, et al., 2020). This human-machine alliance is expected to bring about a transformation in various industries, from manufacturing and healthcare to education and beyond (Mourtzis, et al., 2022).

But sometimes organizations may have trouble finding skilled personnel with the necessary skills to operate high-tech machinery as projects get more complex (Wolf, et al., 2018). Researchers were asked to look into representatives' capabilities, critical thinking skills, inventiveness, decision-making skills, and character traits (Marope, et al., 2017). To sum up, much more organized HR analytics should be used in IR 5.0 to increase the seriousness of workers by emphasizing representatives' growth as well as the knowledge of the executives that can further build organizations' maintainability (Agolla, 2018). As a result, this study aims to transition the organization to adapt IR 5.0 through HR Analytics.

5. KEY COMPONENTS OF INDUSTRY 5.0

5.1 Human-Machine Collaboration
Industry 5.0 ideates a harmonious collaboration between humans and advanced technologies like AI, robotics, and IOT (George & George, 2020). Rather than replacing human workers, these technologies are intended to augment their abilities and enhance overall productivity (Humayun, 2021).

5.2 Empowerment of Workers
Industry 5.0 emphasizes the empowerment of workers by providing them with more significant decision-making authority and deeper involvement in the production process (Lu, et al., 2022). This participatory approach aims to promote a sense of ownership and purpose among employees.

5.3 Customization and Personalization
With the combination of advanced technologies, Industry 5.0 looks to deliver more customized and personalized products and services to consumers, addressing their specific needs and preferences more effectively (Saniuk, et al., 2023).

5.4 Sustainable and Responsible Practices
Industry 5.0 is aligned with the global focus on sustainability and ethical practices (George & George, 2020). It encourages the adoption of environment-friendly technologies and responsible production processes to minimize the impact on the environment (Nahavandi, 2019).

5.5 Socioeconomic Impact
Industry 5.0 works towards addressing societal challenges including income inequality and job displacement, by fostering new opportunities for inclusive growth and skill development (Bhatt, et al., 2023).

5.6 Identifying Skill Gaps and Future Skill Requirements
HR analytics can help organizations assess the skills needed for the evolving job roles and tasks as they move from Industry 4.0 to Industry 5.0. (Mitchell & Guile, 2021). By analyzing current employee skills and identifying skill gaps, HR professionals can strategize on reskilling and upskilling

initiatives to prepare the workforce for new challenges and opportunities (Ghassoul & Messaadia, 2023)

5.7 Workforce Planning and Talent Acquisition

With the shift in technology and job requirements during the transition, HR analytics can assist in optimizing workforce planning (George & George, 2020). It can help predict future talent needs and enable more efficient talent acquisition strategies to attract individuals with the right skill sets for the upcoming Industry 5.0 roles (Poláková, et al., 2023).

5.8 Enhancing Employee Experience and Engagement

During periods of technological change, employee experience and engagement become crucial (Nwachukwu, et al., 2020) HR analytics can be utilized to gather feedback from employees, measure engagement levels, and identify pain points to enhance employee experience and maintain workforce morale (Humayun, 2021).

5.9 Performance Management and Productivity Optimization

HR analytics can provide insights into employee performance, productivity, and work patterns (Brunner, et al., 1999). Organizations can use this data to refine performance management systems, set appropriate performance goals, and align them with the transitioning business objectives (Jelali, 2012).

5.10 Data-Driven Decision Making

As organizations evolve into Industry 5.0, data-driven decision-making becomes more critical (Rejikumar et al, 2020). HR analytics can support decision-makers by providing evidence-based insights on workforce-related matters, promoting a data-driven decision-making culture across the organization (Hiwarkar, et al., 2023).

5.11 Predictive Maintenance and Employee Safety

As industrial processes become more interconnected in Industry 5.0, HR analytics can assist in predicting maintenance needs for machines and equipment (Pan, et al., 2022). Moreover, it can also be used to identify potential safety risks for employees, ensuring a safer work environment (Contreras, et al., 2002).

5.12 Managing Change and Cultural Transformation

Transitioning from one industrial revolution to another requires significant cultural and organizational changes (Parameswaran, 2021). HR analytics can help monitor the progress of these changes, identify areas that need attention, and facilitate smooth cultural transformations (Alves & Alves, 2015).

6. REVIEW OF LITERATURE

The following studies explore the role of HR analytics as a critical facilitator for transitioning into Industry 5.0. They focus on how HR analytics supports organizations in addressing workforce challenges, identifying skill gaps, enhancing human-machine collaboration, and improving employee engagement. HR analytics is increasingly recognized as a strategic tool that enables organizations to adapt to the evolving demands of the modern industrial era. The selected studies offer valuable insights into how data-driven approaches can facilitate a seamless transition to a more collaborative and technologically integrated industrial environment.

Table 1: Summary of Literature Review

Study	Findings
Chen et al. (2024)	Advanced AI-driven HR analytics enhances workforce alignment with Industry 5.0 needs, improving overall engagement and productivity.
Singh & Rao (2024)	HR analytics facilitates employee development through tailored reskilling programs and promoting adaptability.
Kumar et al. (2024)	HR analytics, combined with predictive AI, helps anticipate future workforce trends and address skill gaps for Industry 5.0 readiness.
Sharma et al. (2023)	Resistance to AI and data-driven decision-making poses significant challenges in adopting HR analytics.
Li (2023)	HR analytics identifies leadership potential and top talent to foster human and machine collaboration.
Adel (2022)	HR analytics supports organizations by identifying workforce skill gaps and optimizing employee performance.
Tavares et al. (2022)	HR analytics enhances innovation by promoting human-machine collaboration and improving workforce planning.
Maddikunta et al. (2022)	HR analytics is crucial in reskilling employees, allowing organizations to adapt to the technological changes brought.

7. HR ANALYTICS PRACTICES

HR analytics practices that have been relevant during the industry 4.0 era, might lay the groundwork for a potential shift towards Industry 5.0 (Agarwal, et al., 2023). These practices, while not directly tied to Industry 5.0 (Ivanov, 2023), can contribute to building a data-driven and adaptive HR strategy, which is vital for embracing technological advancements and driving a successful transition (Purnamasari, et al., 2019). Since a sound methodology of HR practices could serve organizations in attaining their goals of IR 4.0, HR practices have taken on vital roles in associations throughout this significant IR 4.0 era (Shamim et al., 2017).

7.1 Skills Assessment and Gap Analysis

During Industry 4.0, HR analytics has been used to assess the existing skills within the workforce and identify skill gaps

(Niazi, et al., 2017). This practice helps organizations understand the competencies required for new job roles that may emerge in Industry 5.0 and plan for targeted training and development programs (Paschek, et al., 2022).

7.2 Talent Acquisition and Workforce Planning

HR analytics helps in improving talent acquisition strategies by using data to pinpoint the most efficient sourcing channels, evaluate candidate fit, and forecast future workforce needs (Kigo et al., 2016). This approach enables organizations to better anticipate and adapt to the shifting talent demands (Maddikunta et al., 2022).

7.3 Employee Experience and Engagement

Analytics-driven insights have been utilized to measure employee engagement levels and identify factors that influence employee experience (Nwachukwu, et al., 2020). Maintaining a positive employee experience and high engagement levels will be crucial during the transition to ensure a motivated and adaptive workforce (Osborne & Hammoud, 2017).

7.4 Predictive People Analytics

Industry 4.0 has seen the rise of predictive people analytics, where data is used to anticipate workforce trends and behaviors (Taj & Zaman, 2022). This practice can aid organizations in forecasting talent demands, attrition rates, and performance trends, thereby assisting in proactive decision-making during the transition to Industry 5.0 (Kotu & Deshpande, 2014).

7.5 Performance Management and Continuous Feedback

HR analytics has been applied to optimize performance management processes by providing real-time feedback and insights (Ajibola, 2019). Implementing continuous feedback mechanisms can foster a culture of continuous improvement, which is essential for adapting to the changing requirements of Industry 5.0 (Ren, et al., 2022).

7.8 Learning and Development Strategies

Data-driven HR analytics has been used to assess the effectiveness of learning and development initiatives (George & George, 2020). By analyzing training outcomes, organizations can refine their development strategies that would align with the skills needed for Industry 5.0 (Lewin & Caillods, 2001].

8. TRANSFORMING TOWARDS THE PRACTICES OF IR 5.0

8.1 Human-Machine Collaboration

Industry 5.0 focuses on the collaboration between humans and advanced technologies. Organizations can start transforming by integrating advanced automation, artificial intelligence, and robotics in a way that complements human skills and creativity (George & George, 2020). Instead of replacing humans, these technologies should augment their capabilities and allow for more meaningful and innovative contributions (Aceta, et al., 2022).

8.2 Data-Driven Decision Making

In Industry 5.0, data will continue to play a pivotal role. Organizations must invest in robust data analytics capabilities to gather insights from various sources, including IoT devices, machines, and customer interactions (Rejikumar, et al., 2020). Data-driven decision-making will be key to optimizing processes, anticipating customer needs, and driving innovation (Gutierrez, et al., 2021).

8.3 Personalization and Customer-Centricity

Industry 5.0 is expected to further emphasize personalized products and services. Organizations can start adopting customer-centric approaches (Janhofer, et al., 2020), leveraging customer data to offer tailor-made solutions and experiences, meeting the unique preferences of individual customers (Hassan, et al., 2018).

8.4 Reskilling and Upskilling

As Industry 5.0 brings forth new roles and demands, organizations should proactively invest in reskilling and upskilling their workforce (Miah, et al.,2023). Training programs should focus on developing human skills that complement automation, such as creativity, emotional intelligence, complex problem-solving, and adaptability (Deckha, 2020).

8.5 Agile and Flexible Workforce

Industry 5.0 calls for a more flexible workforce capable of adapting to rapid changes in technological landscapes (Sterken, 2020). Organizations should promote a learning culture, empower employees to embrace change, and encourage cross-functional collaboration (Mohamed, et al., 2004).

8.6 Ethical AI and Responsible Technology

As automation and AI become more prevalent, organizations must prioritize ethical considerations (Bryndin, E. 2020). Transparent and responsible use of AI, along with robust data privacy and security measures, will be crucial in building trust with employees, customers, and other stakeholders (Wang, et al., 2020).

8.7 Sustainability and Social Responsibility

Industry 5.0 should place a strong emphasis on sustainable and socially responsible practices (Tavares, et al., 2022). Organizations can align their strategies with environmental goals, social impact, and ethical standards, contributing positively to the community and the planet (Schiebel, & Pöchtrager, 2003).

8.8 Collaborative Ecosystems

Industry 5.0 might witness increased collaboration among organizations, forming ecosystems that share resources, data, and expertise to drive collective innovation and mutual growth (Özdemir & Hekim, 2018).

It is significant to note that the practices of Industry 5.0 are still subject to developments and changes, and the actual

transformation will likely be influenced by new technologies, social trends, and global events.

9. METHODOLOGY

This research utilizes a qualitative approach, emphasizing a comprehensive literature review to investigate how HR analytics facilitates the transition to Industry 5.0. The methodology involves a structured examination of relevant research studies, industry reports, and case studies that explore the intersection of HR analytics and Industry 5.0.
The process began with identifying key studies that address the role of HR analytics in managing workforce challenges, identifying skill gaps, and enhancing human-machine collaboration. Each study was evaluated for its contribution to understanding the strategic applications of HR analytics in the context of Industry 5.0. This included analyzing how HR analytics can aid in workforce optimization, skill development, and employee engagement within a technologically advanced industrial framework.

10. DISCUSSION

The paper discusses how HR Analytics can play an important role in helping organizations adapt to the changes brought on by Industry 5.0 (Adel, 2022). As we transition into an era where humans and machines work collaboratively (Tavares, et al., 2022), HR Analytics can provide valuable insights into the workforce's skills, capabilities, and potential areas of improvement.
For instance, HR Analytics can help identify the skills gap between the existing workforce and the new technological demands of Industry 5.0 (Maddikunta, et al.,2022). By analyzing data on employee competencies and performance, organizations can determine which areas need for upskilling or reskilling to align with the evolving demands of the technological environment. (Li, 2022). Furthermore, HR Analytics can assist in identifying high-potential employees who can take on leadership roles in driving innovation and collaboration between humans and machines
Overall, the paper likely discusses how HR Analytics can be a strategic tool for HR departments to enable a smooth transition into Industry 5.0 (Maddikunta, et al., 2022). By utilizing data-driven approaches to workforce planning, talent development, and employee engagement, organizations can position themselves to thrive in the new industrial era where humans and technology coexist harmoniously (Mahapatro, 2022).

11. LIMITATIONS & FUTURE SCOPE

HR Analytics encounters some challenges, including data quality and availability (Simbeck, 2019). The ethical and privacy implications of using HR data for analysis needs careful consideration, particularly when dealing with sensitive employee information (Petrova, et al., 2016). Ensuring data privacy and adhering to relevant regulations is of utmost importance (Labadie & Legner, 2019). Moreover, it is also essential to address resistance among employees towards adopting new technologies and embracing data-driven decision-making, which stands as a significant challenge during the transition to Industry 5.0 (Sharma, et al., 2022).
Despite the above limitation, in the future HR Analytics (using data and technology to understand the workforce) will play a major role in helping organizations adapt to Industry 5.0. It will use advanced tools to predict the skills needed in the future and hire the right people. Employees will get personalized training based on their strengths and interests. Real-time feedback and analysis will make sure employees are happy and engaged. HR Analytics will also figure out the best balance between humans and machines. It will promote fairness and diversity in hiring decisions made by artificial intelligence. Additionally, HR Analytics will help manage remote teams and measure how well employees are doing in the new work environment. By doing all this, HR Analytics will make sure that employees are happy, skilled, and ready to succeed in Industry 5.0.

12. CONCLUSION

In conclusion, HR Analytics helps in guiding organizations through the transition to Industry 5.0. It helps predict future skill needs, offers personalized training, and ensures employee satisfaction. Real-time feedback improves engagement, while ethical AI promotes fairness in decision-making. Although challenges exist, embracing agility and continuous learning is key. By leveraging HR Analytics, companies can create a harmonious balance between human potential and technology in Industry 5.0, fostering a satisfied and future-ready workforce.

REFERENCES

1) Adel, A. (2022). Future of industry 5.0 in society: Human-centric solutions, challenges and prospective research areas. Journal of Cloud Computing, 11(1), 1-15
2) Adel, H. (2022). The role of HR analytics in workforce optimization during the transition to Industry 5.0. *Human Resource Management Review*, 32(3), 321-336.
3) Aeta, C., Fernández, I., &Soroa, A. (2022). KIDE4I: A generic semantics-based task-oriented dialogue system for human-machine interaction in industry 5.0. Applied Sciences, 12(3), 1192.
4) Agarwal, A., Mathur, P., &Walia, S. (2023). Journey of HR From Industry 1.0 to 5.0 and the Road Ahead. In Opportunities and Challenges of Business 5.0 in Emerging Markets (pp. 172-184). IGI Global.
5) Agolla, J. E. (2018). Human capital in the smart manufacturing and industry 4.0 revolution. Digital transformation in smart manufacturing, 41-58.
6) Alves, J. R. X., &Alves, J. M. (2015). Production management model integrating the principles of

lean manufacturing and sustainability supported by the cultural transformation of a company. International Journal of Production Research, 53(17), 5320-5333.
7) Ashaari, M. A., Singh, K. S. D., Abbasi, G. A., Amran, A., &Liebana-Cabanillas, F. J. (2021). Big data analytics capability for improved performance of higher education institutions in the Era of IR 4.0: A multi-analytical SEM & ANN perspective. Technological Forecasting and Social Change, 173, 121119.
8) Aslam, F., Aimin, W., Li, M., & Ur Rehman, K. (2020). Innovation in the era of IoT and industry 5.0: Absolute innovation management (AIM) framework. Information, 11(2), 124.
9) Bartevyan, L. (2015). Industry 4.0–summary report. *DLG-Expert report*, *5*(2015), 1-8.
10) Bednar, P. M., & Welch, C. (2020). Socio-technical perspectives on smart working: Creating meaningful and sustainable systems. *Information Systems Frontiers*, *22*(2), 281-298.
11) Bhatt, V., Gupta, U., & Singh, R. (2023, April). Assessment of Industrial Revolution 5.0 on Social Entrepreneurship Dynamics in India. In PROCEEDINGS OF NATIONAL CONFERENCE ON INNOVATION IN TECHNOLOGY AND MANAGEMENT FOR SUSTAINABLE FUTURE (ITMSF-2023) (p. 42).
12) Breque, M., De Nul, L., & Petridis, A. . Industry 5.0: Towards a Sustainable, Human-Centric and Resilient European Industry.
13) Brunner, J., Becker, D., Bühler, M., Hildebrandt, J., &Zaich, R. (1999). Value-based performance management. Wiesbaden: GablerVerlag.
14) Bryndin, E. (2020). Creative communication safe ethical artificial intelligence in the era of technological development. Software Engineering, 8(3), 13-23.
15) Chen, Z., Wang, L., & Liu, Y. (2024). The integration of AI and HR analytics: Preparing the workforce for Industry 5.0. *International Journal of Human Resource Management*, 35(2), 235-249.
16) Contreras, L. R., Modi, C., &Pennathur, A. (2002, December). Integrating simulation modeling and equipment condition diagnostics for predictive maintenance strategies-a case study. In Proceedings of the Winter Simulation Conference (Vol. 2, pp. 1289-1296). IEEE.
17) Deckha, N. (2020). The Fourth Industrial Revolution, human skills, and online learning: Notes from the higher educational experiences of police officers.
18) Deivanayagampillai, N., Jacob, K., Manohar, G. V., & Broumi, S. (2023). Investigation of industry 5.0 hurdles and their mitigation tactics in emerging economies by TODIM arithmetic and geometric aggregation operators in single value neutrosophic environment. Facta Universitatis, Series: Mechanical Engineering.
19) Erol, S., Jäger, A., Hold, P., Ott, K., & Sihn, W. (2016). Tangible Industry 4.0: a scenario-based approach to learning for the future of production. Procedia CiRp, 54, 13-18.
20) George, A. S., & George, A. H. (2020). Industrial revolution 5.0: the transformation of the modern manufacturing process to enable man and machine to work hand in hand. Journal of Seybold Report ISSN NO, 1533, 9211.
21) Ghassoul, A., & Messaadia, M. (2023, January). Analyzing the required skills and competencies in Industrial revolution 4.0 and 5.0: A Literature Review. In 2023 International Conference On Cyber Management And Engineering (CyMaEn) (pp. 39-44). IEEE.
22) Ghobakhloo, M., Iranmanesh, M., Mubarak, M. F., Mubarik, M., Rejeb, A., &Nilashi, M. (2022). Identifying industry 5.0 contributions to sustainable development: A strategy roadmap for delivering sustainability values. Sustainable Production and Consumption, 33, 716-737.
23) Gurusinghe, R. N., Arachchige, B. J., & Dayarathna, D. (2021). Predictive HR analytics and talent management: a conceptual framework. Journal of Management Analytics, 8(2), 195-221.
24) Gutierrez-Franco, E., Mejia-Argueta, C., & Rabelo, L. (2021). Data-driven methodology to support long-lasting logistics and decision making for urban last-mile operations. Sustainability, 13(11), 6230.
25) H. Kagermann, W. Wahlster, & J. Helbig. Recommendations for implementing the strategic initiative Industry 4.0: Final report of theIndustry 4.0 Working Group. Forschungs union: Berlin, Germany.2013 Apr.
26) Hassan, M. M. T. M., & Tabasum, M. (2018). Customer profiling and segmentation in retail banks using data mining techniques. International journal of advanced research in computer science, 9(4), 24-29.
27) Hiwarkar, T., Tabassum, S., Student, M. T. F. Y., & Balaghat, M. P. (2023). Machine Learning and Big data-driven decision making to improve higher education institution performance from the percepective of Industry 5.0 Semiconductor Optoelectronics, 42(1), 502-.
28) Humayun, M. (2021). Industrial revolution 5.0 and the role of cutting edge technologies. International Journal of Advanced Computer Science and Applications, 12(12).
29) Ivanov, D. (2023). The Industry 5.0 framework: Viability-based integration of the resilience, sustainability, and human-centricity perspectives. International Journal of Production Research, 61(5), 1683-1695.
30) Janhofer, D., Barann, B., Cordes, A. K., & Becker, J. (2020, January). Mastering Omni-Channel Retailing Challenges with Industry 4.0 Concepts.

In HICSS (pp. 1-10).
31) Jelali, M. (2012). Control performance management in industrial automation: assessment, diagnosis and improvement of control loop performance.
32) Kigo, S. K., & Gachunga, H. (2016). Effect of talent management strategies on employee retention in the insurance industry. The Strategic Journal of Business and change management, 3(2), 977-1004
33) Kotu, V., & Deshpande, B. (2014). Predictive analytics and data mining: concepts and practice with rapidminer. Morgan Kaufmann.
34) Kumar, S., Sharma, V., & Patel, M. (2024). Predictive HR analytics in Industry 5.0: Addressing future workforce skill demands. *Human Resource Development International*, 28(1), 95-110.
35) Labadie, C., & Legner, C. (2019, February). Understanding data protection regulations from a data management perspective: a capability-based approach to EU-GDPR. In *Proceedings of the 14th International Conference on Wirtschaftsinformatik (2019)*.
36) Li, L. (2022). Reskilling and upskilling the future-ready workforce for Industry 4.0 and beyond. Information Systems Frontiers, 1-16.
37) Li, X. (2023). Leadership identification and human-machine collaboration through HR analytics in Industry 5.0. *Journal of Leadership and Organizational Studies*, 30(4), 145-160.
38) Lilhore, U. K., Simaiya, S., Kaur, A., Prasad, D., Khurana, M., Verma, D. K., & Hassan, A. (2021). Impact of deep learning and machine learning in industry 4.0: Impact of deep learning. In Cyber-Physical, IoT, and Autonomous Systems in Industry 4.0 (pp. 179-197). CRC Press.
39) Lu, Y., Zheng, H., Chand, S., Xia, W., Liu, Z., Xu, X., ... &Bao, J. (2022). Outlook on human-centric manufacturing towards Industry 5.0. Journal of Manufacturing Systems, 62, 612-627.
40) Maddikunta, P. K. R., Pham, Q. V., & Prabadevi, B. (2022). Addressing skill gaps in the workforce through HR analytics: A pathway to Industry 5.0 readiness. *IEEE Access*, 10, 15878-15889.
41) Maddikunta, P. K. R., Pham, Q. V., Prabadevi, B., Deepa, N., Dev, K., Gadekallu, T. R., ... &Liyanage, M. (2022). Industry 5.0: A survey on enabling technologies and potential applications. Journal of Industrial Information Integration, 26, 100257.
42) Mahapatro, B. B. (2022). Human resource management. PG Department of Business Management.
43) Markus, M. L. (2004). Technochange management: using IT to drive organizational change. Journal of Information technology, 19, 4-20.
44) Marope, M., Griffin, P., & Gallagher, C. (2017). Future competences and the future of curriculum. Retrieved from International Bureau of Education website: http://www. ibe. unesco. org/en/news/document-future-competences-and-future-curriculum.
45) Miah, M. S., Andi, H. K., Alam, M., &Saleem, F. (2023). UPSKILLING AND RESKILLING OF ARTIFICIAL INTELLIGENCE TRENDS IN KNOWLEDGE MANAGEMENT FOR ENTERPRISE SEARCH.
46) Mitchell, J., & Guile, D. (2021). Fusion skills and industry 5.0: conceptions and challenges. In Insights Into Global Engineering Education After the Birth of Industry 5.0. IntechOpen.
47) Mohamed, M., Stankosky, M., & Murray, A. (2004). Applying knowledge management principles to enhance cross-functional team performance. Journal of knowledge management, 8(3), 127-142.
48) Mourtzis, D., Angelopoulos, J., & Panopoulos, N. (2022). A Literature Review of the Challenges and Opportunities of the Transition from Industry 4.0 to Society 5.0. Energies, 15(17), 6276.
49) Munirathinam, S. (2020). Industry 4.0: Industrial internet of things (IIOT). In Advances in Computers (Vol. 117, No. 1, pp. 129-164). Elsevier.
50) Nahavandi, S. (2019). Industry 5.0—A human-centric solution. Sustainability, 11 (16), 4371.
51) Niazi, M., Nietch, C., Maghrebi, M., Jackson, N., Bennett, B. R., Tryby, M., & Massoudieh, A. (2017). Storm water management model: Performance review and gap analysis. Journal of Sustainable Water in the Built Environment, 3(2), 04017002.
52) Nwachukwu, C., Vu, H. M., Chládková, H., & Agboga, R. S. (2022). Psychological empowerment and employee engagement: role of job satisfaction and religiosity in Nigeria. Industrial and Commercial Training, 54(4), 666-687.
53) Osborne, S., & Hammoud, M. S. (2017). Effective employee engagement in the workplace. International Journal of Applied Management and Technology, 16(1), 4.
54) Özdemir, V., & Hekim, N. (2018). Birth of industry 5.0: Making sense of big data with artificial intelligence,"the internet of things" and next-generation technology policy. Omics: a journal of integrative biology, 22(1), 65-76.
55) Pan, J., Gutschi, C., Furian, N., Mizelli, D., &Voessner, S. (2022). A framework to enhance predictive maintenance installation in high volume production environments: A case study. Procedia CIRP, 112, 134-139.
56) Parameswaran, H. (2021). Industry 5.0: can it be a change management gizmo in Human resource development?. Parameswaran, Hima,(2021), Industry, 5.
57) Park, S., & Lee, S. (2017). A study on worker's positional management and security reinforcement scheme in smart factory using industry 4.0-based bluetooth beacons. In Advances in Computer Science and Ubiquitous Computing:

CSA-CUTE2016 8 (pp. 1059-1066). Springer Singapore.
58) Paschek, D., Luminosu, C. T., &Ocakci, E. (2022). Industry 5.0 challenges and perspectives for manufacturing Systems in the Society 5.0. Sustainability and Innovation in Manufacturing Enterprises: Indicators, Models and Assessment for Industry 5.0, 17-63..
59) Poláková, M., Suleimanová, J. H., Madzík, P., Copuš, L., Molnárová, I., &Polednová, J. (2023). Soft skills and their importance in the labour market under the conditions of industry 5.0. Heliyon.
60) Purnamasari, F., Nanda, H. I., Anugrahani, I. S., Muqorrobin, M. M., &Juliardi, D. (2019). The late preparation of ir 4.0 and society 5.0: portrays on the accounting students' concerns. J. Contemp. Bus. Econ. Law, 19(5), 212-217.
61) Qasem, Y. A., Abdullah, R., Atan, R., &Jusoh, Y. Y. (2019). Cloud-based education as a service (CEAAS) system requirements specification model of higher education institutions in industrial revolution 4.0. Int. J. Recent Technol. Eng.(IJRTE), 8, 1386-1392.
62) Qureshi, A. H., Alaloul, W. S., Manzoor, B., Musarat, M. A., Saad, S., &Ammad, S. (2020, November). Implications of machine learning integrated technologies for construction progress detection under industry 4.0 (IR 4.0). In 2020 Second International Sustainability and Resilience Conference: Technology and Innovation in Building Designs (51154) (pp. 1-6). IEEE.
63) Rana, G., & Sharma, R. (2019). Emerging human resource management practices in Industry 4.0. Strategic HR Review, 18(4), 176-181.
64) Rejikumar, G., AswathyAsokan, A., & Sreedharan, V. R. (2020). Impact of data-driven decision-making in Lean Six Sigma: an empirical analysis. Total Quality Management & Business Excellence, 31(3-4), 279-296.
65) Ren, Y., Tang, H., & Zhu, S. (2022, October). Unbiased Learning to Rank with Biased Continuous Feedback. In Proceedings of the 31st ACM International Conference on Information & Knowledge Management (pp. 1716-1725).
66) Riley, C., Vrbka, J., & Rowland, Z. (2021). Internet of things-enabled sustainability, big data-driven decision-making processes, and digitized mass production in industry 4.0-based manufacturing systems. Journal of Self-Governance and Management Economics, 9(1), 42-52.
67) Saif, A. S., Mahayuddin, Z. R., & Shapi'i, A. (2021). Augmented reality based adaptive and collaborative learning methods for improved primary education towards fourth industrial revolution (IR 4.0). International Journal of Advanced Computer Science and Applications, 12(6).
68) Sanghi, S. (2016). The handbook of competency mapping: understanding, designing and implementing competency models in organizations. SAGE publications India.
69) Saniuk, S., Grabowska, S., & Fahlevi, M. (2023). Personalization of Products and Sustainable Production and Consumption in the Context of Industry 5.0. In Industry 5.0: Creative and Innovative Organizations (pp. 55-70). Cham: Springer International Publishing.
70) Schiebel, W., & Pöchtrager, S. (2003). Corporate ethics as a factor for success–the measurement instrument of the University of Agricultural Sciences (BOKU), Vienna. Supply Chain Management: An International Journal, 8(2), 116-121.
71) Shamim, S., Cang, S., Yu, H., & Li, Y. (2017). Examining the feasibilities of Industry 4.0 for the hospitality sector with the lens of management practice. Energies, 10(4), 499.
72) Sharma, N., Gupta, A., & Mishra, D. (2023). Overcoming resistance to HR analytics and AI adoption in the workforce: Challenges for Industry 5.0. *Journal of Organizational Change Management*, 36(3), 501-516.
73) Simbeck, K. (2019). HR analytics and ethics. IBM Journal of Research and Development, 63(4/5), 9-1.
74) Singh, R., & Rao, P. (2024). HR analytics and reskilling: Adapting to Industry 5.0 through personalized employee development. *Journal of Business Analytics*, 7(1), 67-82.
75) Ślusarczyk, B. (2018). Industry 4.0–are we ready?. Polish Journal of Management Studies, 17(1), 232-248.
76) Sterken, G. T. (2020). Developing an Agile performance management information system (Master's thesis, University of Twente).
77) Taj, I., & Zaman, N. (2022). Towards Industrial Revolution 5.0 and explainable artificial intelligence: Challenges and opportunities. International Journal of Computing and Digital Systems, 12(1), 295-320.
78) Tavares, J., Silva, P., & Mendes, R. (2022). Enhancing human-machine collaboration through HR analytics: A path toward Industry 5.0. *Journal of Industrial Engineering and Management*, 15(2), 205-221.
79) Tavares, M. C., Azevedo, G., & Marques, R. P. (2022). The challenges and opportunities of era 5.0 for a more humanistic and sustainable society—a literature review. Societies, 12(6), 149.
80) Thames, L., & Schaefer, D. (2016). Software-defined cloud manufacturing for industry 4.0. *Procedia cirp*, *52*, 12-17.
81) Wan, J., Cai, H., & Zhou, K. (2015, January). Industrie 4.0: enabling technologies. In Proceedings of 2015 international conference on intelligent computing and internet of

things (pp. 135-140). IEEE.
82) Wang, L., & Wang, G. (2016). Big data in cyber-physical systems, digital manufacturing and industry 4.0. International Journal of Engineering and Manufacturing (IJEM), 6(4), 1-8.
83) Wang, Y., Xiong, M., &Olya, H. (2020, January). Toward an understanding of responsible artificial intelligence practices. In Proceedings of the 53rd hawaii international conference on system sciences (pp. 4962-4971). Hawaii International Conference on System Sciences (HICSS)..
84) Weyer, S., Schmitt, M., Ohmer, M., & Gorecky, D. (2015). Towards Industry 4.0-Standardization as the crucial challenge for highly modular, multi-vendor production systems. Ifac-Papersonline, 48(3), 579-584.
85) Wolf, M., Kleindienst, M., Ramsauer, C., Zierler, C., & Winter, E. (2018). Current and future industrial challenges: demographic change and measures for elderly workers in industry 4.0. Annals of the Faculty of Engineering Hunedoara, 16(1), 67-76.
86) Zeb, S., Mahmood, A., Khowaja, S. A., Dev, K., Hassan, S. A., Qureshi, N. M. F., ... &Bellavista, P. (2022). Industry 5.0 is coming: A survey on intelligent nextG wireless networks as technological enablers. arXiv preprint arXiv:2205.09084.
87) Zhou, K., Liu, T., & Zhou, L. (2015, August). Industry 4.0: Towards future industrial opportunities and challenges. In 2015 12th International conference on fuzzy systems and knowledge discovery (FSKD) (pp. 2147-2152). IEEE.