# AI Structuring Work Practices and Fuelling Employee Outcomes- Manufacturing Industry

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## ABSTRACT

This research explores the influence of disruptive technologies on evolving work practices and their impact on employee experience and outcomes within the manufacturing industry. An extensive literature review was conducted to analyze existing academic research on the impact of AI on manufacturing work practices. A quantitative survey was conducted on 55 employees to assess their perspectives on the evolution of work practices driven by AI adoption. The survey analysed the key trends, patterns, and themes related to the intersection of AI, work practices, and employee experience. The findings reveal that AI-enabled automation enhances man-machine collaboration on the shop floor while allowing employees to focus on higher-level, intellectually stimulating tasks, thereby increasing job satisfaction. Moreover, proactive workforce upskilling and fostering a culture of continuous learning emerge as critical factors for maintaining employee motivation and engagement amidst the AI-driven transformation. The research findings provide valuable recommendations to assist managers in seamlessly integrating AI to transform work practices, these recommendations will aim to enhance employee experience, foster collaborative human-machine dynamics, and cultivate an engaged workforce aligned with Industry 4.0

**Keywords:** Automation; Future of work; Human-Centric AI ;Job Redesign; Robotics; Smart Manufacturing; Upskilling and Reskilling; Workforce Engagement

## INTRODUCTION

The manufacturing sector is undergoing a digital transformation, propelled by the widespread integration of cutting-edge technologies, with artificial intelligence (AI) and machine learning (ML) emerging as a pivotal driver of this evolution. Artificial intelligence is revolutionizing the professional landscape, altering not merely the manufacturing process but also the conceptualization, creation, distribution, and reception of goods and services. Automation is progressively undertaking tasks previously carried out by human workers, there is some new work for people, but that work is often precarious and always requires technology-mediated literacy skills and practices (Corbel et al., 2021). The convergence of AI, big data, and advanced robotics has ushered in the era of Industry 4.0, a technological revolution that has fundamentally reshaped traditional manufacturing processes into interconnected, data-driven, and highly automated systems (Grover et al., 2020). This transition has given rise to the concept of smart manufacturing, where advanced intelligent systems enable real-time responses to changing product demand and optimize the entire value chain (Peres et al., 2020). In this regard, The World Economic Forum predicts that automation will increase the total task hours completed from 29% to 58% across 12 industries by 2025. (WEF, 2018). This revolution relies on technological convergence, which in turn depends on relationships. These relationships involve not only technologies but also people, and the interaction between people and technologies. (Farrell et al., 2020).

The rapid advancement of automated systems, interconnected devices, robotics, artificial intelligence, and other cutting-edge digital innovations, collectively termed Industry 4.0 or the Fourth Industrial Revolution, is driving a profound transformation in the operational dynamics of industrial enterprises. Consequently, these technological advancements are reshaping the nature of human labour and the strategies employed for workforce management (MK et al.,2023). One of the pivotal components within Industry 4.0 is smart

manufacturing (SM), where smart factory systems facilitate the transformation of conventional factories into intelligent systems (Machado et al., 2018). In the domain of smart manufacturing products, transportation options, and tools are interconnected through the utilization of sensors and RFID chips to enhance overall production efficiency (Ramzi et al., 2019a). The integration of IoT sensors enables the real-time collection and analysis of data, thereby enabling proactive maintenance, efficient quality control, and optimized production schedules. (Chaudhuri et al.,2022b)

The emergence of smart factories, advanced robotics, and 3D printing have led to increased efficiency, reduced waste, and greater flexibility in production processes (Bajpai et al.,2018). According to a recent study by McKinsey & Company, the adoption of AI-powered technologies can enhance productivity in the manufacturing sector by up to 40% (McKinsey, 2022).This burgeoning integration of AI into manufacturing operations holds profound implications for the nature of work practices and the experiences of the workforce within this dynamic industry .The current wave of Smart Manufacturing and Industry 4.0 by Mobile, Cloud, Big Data Analytics, Machine-to-Machine (M2M), Man to Machine Interactions (M2MI),Predictive maintenance, Cyber-Physical Systems ,3D Printing, Robotics ,IoT and much more, requiring organizations with special expertise (ramzi et al.,2019). As a result, the need for human workforce in the new industrial revolution is inevitably being reallocated (Loi, 2015; Xu, David, & Kim, 2018).

A recent report by the Brookings institution highlighted that the adoption of AI in manufacturing can lead to a shift in the skill requirements of the workforce, with a growing demand for data analysis, machine learning, and human-AI interaction competencies (Brookings, 2022). Furthermore, a study by the International Federation of Robotics found that the integration of collaborative robots (cobots) in manufacturing can increase worker productivity by up to 85% (IFR, 2021). Collaborative robots work alongside human operators, elevating safety, and productivity. AI empowers manufacturers to meet dynamic consumer demands by enabling mass customization through the analysis of preferences and market trends, enhancing customer satisfaction and competitiveness. However, the successful implementation of these disruptive technologies also requires unique focus, particularly in terms of workforce upskilling, reskilling, and the need to align technological advancements with employee well-being and engagement (Deloitte, 2021; Gartner, 2021).

AI offers fundamental advantages such as speeded quality, accuracy, transparency, unbiasedness, and commonality, making it a ready-to-use technology, removing routine tasks and enhancing overall engagement towards job (Chaudhuri et al.,2022).A study by (Jha et al.,2022a) suggests that employees proficient in Industry 4.0 technologies may experience an increase in autonomy, resulting in the assignment of more engaging ,meaningful and less stressful tasks, ultimately leading to greater job satisfaction. (Eriksson et al., 2020) suggests that the integration of AI in manufacturing not only enhances creative thinking but also supports critical capabilities such as context awareness, reasoning abilities, communication skills, and self-organization resulting in more engaged employees in workplace. A study by (bajpai et al.,2018a) shows that fostering a motivating work environment involves assigning challenging tasks that align with employees values and interests, while cultivating a culture that encourages innovation and creativity. Employees feel motivated when their creative strengths are highlighted, while AI handles repetitive tasks, making work more meaningful and engaging. (Pooja & Krishnan, 2023)

This comprehensive research study aims to investigate how the multifaceted applications of AI, ML and automation are shaping evolving work practices and influencing employee engagement, job satisfaction, and motivation within the transforming manufacturing industry landscape.

## LITERATURE REVIEW

The adoption of AI-powered technologies is transforming work practices across many industries, including the manufacturing sector. Over 70% of companies in this sector plan to invest in AI by 2025 to enhance competitiveness (PwC, 2020). As these disruptive technologies become increasingly prevalent, it is crucial to evaluate their impact on employee outcomes such as job roles, skills requirements, and overall work experiences. This review explores how AI is molding work practices and impacting employee engagement and its outcomes in the manufacturing sector.

Industry 4.0 and smart factories change how work is organized with humans, robots, and high-tech tools (Jerman et al., 2019a). The integration of Artificial Intelligence (AI) and emerging technologies, such as collaborative robots (cobots), in the manufacturing sector has the potential to significantly transform work practices and employee experiences (Matheson et al.,2019). According to the World Economic Forum, by 2025, robots and automation technologies will replace most of the jobs that have traditionally been done by humans. This will result in a reduction of the workforce in routine jobs, as robots can perform tasks with more accuracy and speed, making them a more efficient replacement for human labour. The International Federation of Robotics predicts that robots will create new job opportunities, particularly in high-skilled and professional roles. For instance, in the production sector, robot-assisted production will replace manual labor, through interaction with their environment using sensors, but it will also create a new job called the robot coordinators (Lorenz et al., 2015).

AI-powered automation can lead to changes in work processes, workflows, collaboration patterns, cross-functional work, and cross-company partner networks. (Bauer et al., 2021; Rubmann et al., 2015). AI-powered automated systems are increasingly capable of taking over repetitive, dangerous, and mundane tasks, thus freeing up employees to focus on more complex, value-added work (Brynjolfsson et al., 2014a). The application of automation systems such as industrial robots offers high levels of flexibility, by intelligently combining human skills with the qualities of robotic systems, such as flexibility, speed, and precision, beneficial synergistic effects can be achieved. This synergy can lead to significant improvements, particularly in terms of increased productivity and the humanization of workplace production processes (Ramzi et al., 2019b). Automating routine tasks can reduce costs, enhance the quality of goods and services, boost productivity, and enhance safety in hazardous conditions. Manufacturing robotics systems will assist human workers in performing a variety of tasks through intelligent interaction, rather than replacing them (Ramzi et al., 2019c). Employees may need to learn to work alongside automated systems, coordinate their efforts, and leverage the capabilities of these intelligent technologies to enhance overall productivity and efficiency (Davenport & Kirby, 2016; Sachsenmeier, 2016a). This shift in task allocation can enhance employee experiences by reducing the burden of monotonous work and allowing them to engage in more intellectually stimulating and meaningful activities (Autor, 2015; Sirkin, Zinser, & Rose, 2015). Employees can redirect their efforts towards problem-solving, innovation, and strategic decision-making, leading to increased job satisfaction, a greater sense of purpose, and improved overall well-being (Frey & Osborne, 2017; Sachsenmeier, 2016b).

The adoption of AI/ML technologies in manufacturing is leading to shifts in job roles and skill requirements (Autor et al., 2023). As Industry 4.0 enhances productivity, it is creating new employment opportunities in manufacturing to meet rising demand. To address this, reskilling and upskilling lower and middle-skilled workers will be necessary (Jha et al.,2022b). Human skills remain vital as manufacturing will not rely solely on machines to run businesses. A highly skilled workforce is still needed to operate and control the advanced systems. The transition to Industry 4.0 necessitates significant changes in how future employees are educated and trained to develop the requisite competencies (Sony & Naik, 2019). Digital skills, continuous professional development, technical expertise, IT security knowledge, coding abilities, and media competencies will be particularly important for personnel in smart factories (Jha et al.,2022c). Knowledge sharing can be beneficial in this context, allowing employees to learn from each other, utilize the latest technologies, enhance performance, foster creativity and innovation, develop problem-solving abilities, and demonstrate positive attitudes toward organizational changes (Park et al.,2015). Immersive technologies like virtual and augmented reality can significantly impact manufacturing management, they enable training simulations, customer interactions, and product design in safe, controlled virtual environments, imposing sensor-driven internal control on production lines to replace monotonous work. These solutions can improve product/service quality, customer satisfaction, and employee skill development (Bajpai et al.,2019b)

Smart factory presents a decentralized production system featuring real-time communication between equipment, processes, people, and resources (Jerman et al., 2019b). Businesses can obtain deeper and more comprehensive insights into their supply chains, boost the agility of their digital supply network, save costs, and make smarter planning decisions by having more visibility into both static and real-time data that influences employee motivation. (Helo & Hao, 2021) AI and ML significantly reduce decision-making time, errors, and cost (Krishnan et al.,2022). Predictive analytics and other cutting-edge technology have improved

decision-making processes. For instance, Cyber-physical systems (CPS) engage in real-time interactions with individuals and with one another over the Internet, both within and between companies. (Munyai et al.,2017). IoT technologies have enabled real-time data access and insights for managers, improving decision-making (Chaudhuri et al.,2022a) IoT technologies have also facilitated remote work and collaboration for teams working from different locations.

AI-driven computer vision and machine learning technologies have the potential to transform quality control and inspection processes in the manufacturing industry (Sundaram & Zeid, 2023). Six Sigma and lean manufacturing transformed the shop floor by transforming production workers into problem solvers who strive for ongoing improvement (Ganeshan et al,2023). Another job, essential for future manufacturing, is the maintenance of the high-tech smart system (Jerman et al., 2019c), AI algorithms can analyze vast amounts of data from sensors and machinery to predict potential equipment failures before they occur (Zonta et al.,2020). (Brynjolfsson and McAfee 2014b) argue that the adoption of AI-powered predictive maintenance can free up employees from reactive, time-consuming repair work and allow them to focus on more engaging, value-added activities. In the context of project management AI tools benefit project management by reducing costs, increasing revenue, improving quality, predicting and preventing cost overruns, reducing human errors, identifying risks early, and optimizing project performance, cost, and quality (Krishnan et al.,1997).

A study by (Molino et al.,2020a) reveals that a favourable attitude towards AI/ML tools may promote work engagement. Technology adoption increases employee motivation, making workers more vivacious, eager to put effort into their task, and tenacious in the face of challenges. For organizations to succeed in the Industry 4.0 revolution, organizational leaders must play a crucial role in bridging the gap between these transformative methodologies and the workforce, leaders need to ensure employees' adaptiveness towards new paradigms of work and career paths emerging from industrial digitalization (Deloitte Insight, 2018). By focusing on driving transformations, leaders motivate employees towards upskilling instead of handling routine transactions, leadership can deliver superior business results (Krishnan et al.,2022). By inspiring and motivating employees through these more people-centric approaches, managers can foster greater engagement, efficiency, and successful organizational change (Bajpai et al.,2019c).

According to a study by (Akshaya et al.,2023a), artificial intelligence can automate repetitive and monotonous tasks, thereby allowing employees to concentrate on higher-level and more fulfilling work. This can result in increased motivation and job satisfaction among employees. It is crucial for businesses to proactively invest in upskilling their workforce to acquire new skills and remain relevant in the age of AI. This can involve providing training programs in areas such as data analysis, software development, and digital marketing. Furthermore, companies can foster a culture of continuous learning and professional development, encouraging employees to continuously develop their skills and stay abreast of new technologies. This approach can help employees feel more confident and secure in their jobs, leading to increased motivation and job satisfaction (Akshaya et al., 2023b). Overall, while AI has the potential to significantly impact employee motivation and upskilling, businesses need to approach its integration into the workplace thoughtfully and proactively, taking steps to minimize potential negative impacts and support employee development.

The success of a business hinges on the efficiency and productivity of its workforce, which is directly linked to job satisfaction (Kwiotkowska & Gębczyńska, 2022a). A Study by (Bajpai et al.,2019d) shows that meaningful work and higher employee engagement levels can lead to increased job satisfaction and productivity. As the adage goes, "A happy employee is a productive employee." satisfied and content workers tend to be more engaged, productive, and less likely to leave the organization, moreover when employees feel motivated by the rewards and facilities provided, they are more inclined to go the extra mile in contributing to organizational goals (Kwiotkowska & Gębczyńska, 2022b).

According to a 2018 World Economic Forum prediction, technological advancement will lead to a considerabl e decrease in working hours and a significant rise in leisure time, which would raise job satisfaction. AI/ML can help increase job satisfaction by improving work design, which involves combining organizational, social, and work elements to determine individual and organizational interests. Work characteristics encompass a range of elements, including work planning autonomy, team collaboration, decision-making

autonomy, work method autonomy, task variety, task meaning, task identity, and job feedback. Enhancing these factors through AI/ML can greatly impact job satisfaction (Kwiotkowska & Gębczyńska, 2022c).

While automation is taking over lower-level jobs, new roles requiring higher-order thinking and elevating engagement towards work are emerging (Tan & Rajah, 2019). (Vidhya et al.,2023) study argues that artificial intelligence can be utilized as a tool to boost employee output and work engagement. AI-powered tools can analyze employee data on job satisfaction, workload, and stress levels to provide personalized engagement strategies tailored to individual needs and preferences, this can effectively improve employee satisfaction, well-being, and engagement levels (Krishnan et al.,2023). Leveraging AI for employee engagement can positively impact organizational outcomes such as optimized processes, productivity, quality, and company image. Additionally, findings suggest that a positive disposition towards AI tools may leverage work engagement by fostering a motivational process that makes workers more energetic and invested in their roles (Molino et al.,2020b). Ultimately, the well-being of workers and organizational success in the manufacturing domain are interlinked, highlighting the importance of utilizing AI to drive employee engagement, job satisfaction, and motivation.

**Key Research Questions**

**RQ1**:How does the integration of Artificial Intelligence (AI) and Machine Learning (ML) affect the effectiveness of man-machine collaboration on the shop floor in the manufacturing industry?
**RQ2**:What is the impact of AI and ML technologies on workforce motivation and overall job satisfaction in the manufacturing sector?
**RQ3**:To what extent do AI and ML technologies in the manufacturing industry influence employee engagement and commitment towards the organization?

**Research Objective**

1. To investigate how the integration of AI, ML influences the effectiveness of man-machine collaboration on the shop floor.
2. To analyse the impact of AI, ML technologies on workforce motivation and job satisfaction in the manufacturing units
3. To examine to what extent AI/ML technologies influence employees level of engagement and commitment towards the organization.

**Conceptual Framework**

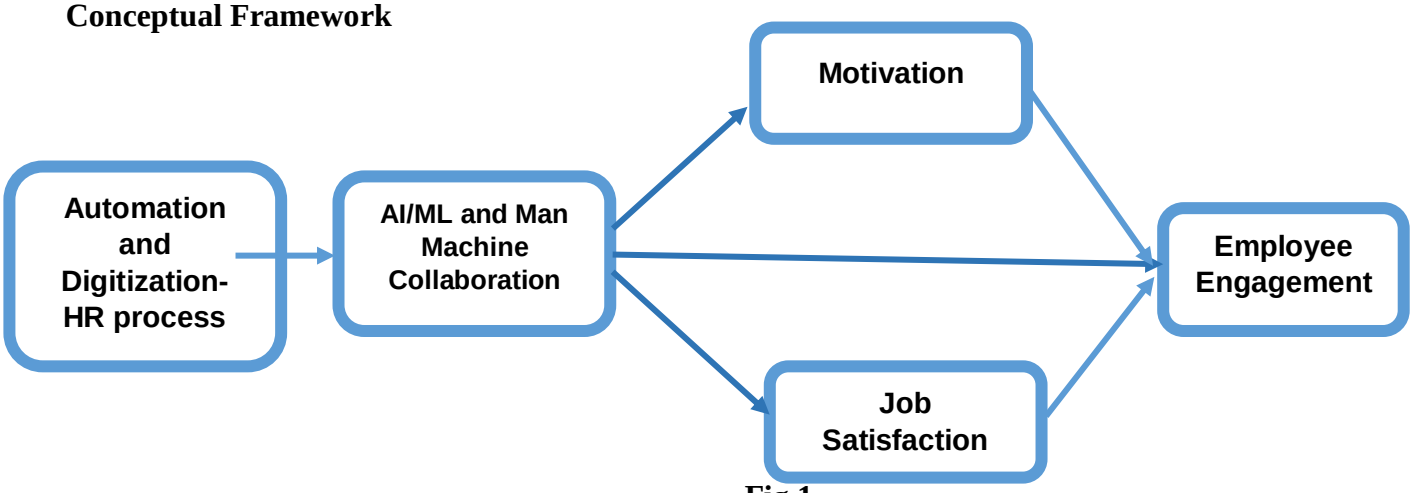


**Fig 1**

**Fig 1** represents that the integration of artificial intelligence (AI) and machine learning (ML) technologies into manufacturing processes is driving a fundamental shift towards automation and digitization, as repetitive and monotonous tasks become automated, human workers are freed from such mundane responsibilities and can instead focus on higher-order thinking and more complex, value-added roles. This transition enables a restructuring of job roles, where employees are engaged in more mentally stimulating and challenging work. Such an evolution in the nature of work can lead to increased job motivation and satisfaction among the

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workforce. When individuals find their jobs more motivating and satisfying, it cultivates a sense of engagement and investment in their work and the organization.

## METHODOLOGY

To investigate the impact of AI and ML technologies on the manufacturing workforce, a comprehensive literature review was undertaken to analyse the existing academic research on AI's role in manufacturing and industry 4.0 technologies. A simple random sample of 55 participants was drawn from manufacturing companies in India that have integrated AI/ML and automation technologies. Each participant received a structured questionnaire designed to measure their perceptions of AI's impact on job satisfaction, man-machine collaboration, motivation, and employee engagement. The questionnaire used a 5-point Likert scale, allowing respondents to indicate their level of agreement or disagreement with various statements. After data collection, statistical analysis was conducted using SPSS to test the hypotheses and to draw meaningful conclusions about the influence of AI/ML technologies on employee engagement in manufacturing industry.

**Hypothesis**

**H1:** Automation and digitalization positively impacts AI/ ML , enhancing man machine collaboration in the shop floor

**H2:** The integration of AI/ML technologies has a significant impact on motivation and job satisfaction in manufacturing industry

**H3:** The integration of AI/ML technologies has a significant impact on employee engagement in manufacturing units

## ANALYSIS AND RESULTS

| **PROFILE OF RESPONDENTS** | | |
|---|---|---|
| **Variable** | **Frequency** | **%** |
| | | |
| **Gender** | | |
| Female | 2 | 3.57 |
| Male | 54 | 96.43 |
| | | |
| **Age** | | |
| 18-25 | 1 | 1.76 |
| 20-25 | 38 | 67.86% |
| 26-30 | 7 | 12.50% |
| 31-35 | 8 | 14.29% |
| Above 40 | 2 | 3.57% |
| | | |
| **Academic Background** | | |
| Bachelor’s in Technology | 1 | 1.79% |
| Bachelor's in Technology | 3 | 7.14 |

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| | | |
|---|---|---|
| Diploma | 4 | 7.14 |
| Masters in Technology | 1 | 1.79 |
| MBA | 22 | 39.29 |
| Other degree | 1 | 1.79 |
| PG | 13 | 23.21 |
| UG | 11 | 19.64 |
| | | |
| **Designation** | | |
| Machine operator | 3 | 5.36 |
| Middle manager | 13 | 23.21 |
| Others | 22 | 39.29 |
| Senior Manager | 2 | 3.57 |
| Supervisor | 10 | 17.86 |
| Technician | 6 | 10.71 |
| | | |
| | | |
| **Industry** | | |
| 3D Printing/Additive Manufacturing | 3 | 5.36 |
| Automotive Manufacturing | 23 | 41.07 |
| Electronics Manufacturing | 2 | 3.57 |
| Farm equipment manufacturing | 12 | 21.43 |
| Metal Fabrication and Machinery Manufacturing | 7 | 12.5 |
| Others | 2 | 3.75 |
| Robotics and Automation Manufacturing | 7 | 12.5 |
| | | |
| **Seniority in organization(years of experience)** | | |
| 0-5 | 35 | 62.5 |
| 10-20 | 4 | 7.14 |
| 5-10 | 16 | 28.57 |
| Above 30 | 1 | 1.97 |

**Reliability Statistics**

**Table 1**
**CRONBACH'S ALPHA TEST**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | No of Items |
|---|---|---|
| 0.808 | 0.807 | 16 |

**Table 1** provides reliability statistics to assess the internal consistency of a variable. The calculated value of 0.808 indicates a high degree of reliability, suggesting a strong and substantial correlation among the 16 items evaluated.

**Regression Analysis**

**Table 2**
**Model Summary**

| | R | R Square | Adjusted R Square | Std Error of Estimates |
|---|---|---|---|---|
| **Hypothesis -1** | 0.367 | 0.134 | 0.118 | 1.260 |
| **Hypothesis -2** | 0.435 | 0.189 | 0.174 | 1.068 |
| **Hypothesis -3** | 0.418 | 0.175 | 0.16 | 1.173 |

Refer **Table 2** for model summary, which includes the standard error of the estimate. The R-squared values are 0.134 for H1, 0.189 for H2, and 0.175 for H3, indicating the overall strength of the association. However, these values do not specify the impact of individual variables on the dependent variable. This analysis is useful for understanding which predictors are associated with the dependent variable. The adjusted R-squared offers additional insight into the accuracy of the relationship between variables.

**Table 3**
**ANOVA**

| | Model | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| **Hypothesis 1** | Regression | 13.327 | 1 | 13.327 | 8.388 | 0.004 |
| | Residual | 85.798 | 54 | 1.589 | | |
| | Total | 99.125 | 55 | | | |
| **Hypothesis 2** | **Model** | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** |
| | Regression | 14.376 | 1 | 14.376 | 12.613 | 0.001 |
| | Residual | 61.552 | 54 | 1.14 | | |
| | Total | 75.929 | 55 | | | |
| **Hypothesis 3** | **Model** | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** |
| | Regression | 15.74 | 1 | 15.74 | 11.446 | 0.001 |
| | Residual | 74.26 | 54 | 1.375 | | |
| | Total | 90 | 55 | | | |

Refer **Table 3** for the evaluation of relationship between variables. A total variance analysis was conducted with 50 . The goal was to assess the influence of AI/ML and man-machine collaboration towards employee engagement. The p-values from the three hypothesis tests were all below 0.05, indicating that the results are statistically significant. The residual value across the three hypotheses was 54, with regression values of 13.327, 14.376, and 15.74, and residual values of 85.798, 61.552, and 74.26. H1 is significant which proves that automation and digitalization positively impacts AI/ ML , enhancing man machine collaboration in the shop floor.H2 is also significant which demonstrates that the integration of AI/ML technologies in manufacturing industry has a significant impact on motivation and overall job satisfaction and H3 is significant which shows implies that the integration of AI/ML technologies in manufacturing industry has a significant impact on employee engagement. Thus, the analysis proves a significant relationship between the

variables. (I.e.) AI/ML and man-machine collaboration in manufacturing industry has a positive impact towards employee engagement.

## FINDINGS

The integration of artificial intelligence (AI) and machine learning (ML) in manufacturing processes is catalyzing a transformative shift towards automation and digitization. This technological revolution is reshaping job roles, enabling the automation of repetitive, mundane tasks and allowing human workers to transition to more mentally stimulating and cognitively demanding responsibilities. By fostering a culture of innovation, continuous learning, and problem-solving creativity, AI/ML implementation enhances employee motivation. Simultaneously, it reduces physical strain, improves workplace safety, and cultivates a sense of achievement by embracing cutting-edge technologies, thereby boosting job satisfaction. Crucially, the synergistic effects of elevated motivation and job satisfaction contribute to heightened employee engagement. This engagement is further amplified through the involvement of human workers in AI/ML development, data-driven decision-making, upskilling opportunities, and collaborative partnerships between humans and AI systems focused on shared goals. Ultimately, the findings indicate that the strategic integration of AI/ML in manufacturing operations has the potential to create a more motivated, satisfied, and engaged workforce, driving continuous improvement and sustained competitiveness.

### Limitations

This study is focused on a relatively small sample of manufacturing companies using AI/ML in their day to day activities on a specific geographic region, limiting the generalizability of the findings. Future studies could broaden the scope to enhance the transferability of findings across diverse regions.

### Implication For Managers

The Fourth Industrial Revolution (4IR) and the incorporation of technologies like artificial intelligence (AI), machine learning (ML), and robotics have significant implications for Human Resource Management (HRM) in manufacturing sector. Managers must address changes in skills requirements and training needs, as these technologies rapidly alter the competencies demanded across various roles (Stahl et al., 2017). HRM strategies should focus on continuous learning and upskilling programs to ensure that workforce remains up-to-date with emerging technologies. Moreover, recruitment and talent management practices need to evolve, seeking specialized talents adept at adapting to a dynamic technological landscape, potentially requiring revisions to job descriptions and leveraging new recruitment channels (Scholarios et al., 2018). Crucially, the emergence of AI/ML can significantly impact employee motivation and job satisfaction, necessitating efforts from HRM to provide meaningful work that aligns with employees' values and interests. To effectively navigate these implications, manufacturing companies must adopt a strategic approach to talent management, with HRM collaborating cross-functionally to understand technology's impact on the organization's overall strategy and develop a comprehensive workforce plan aligning with the changing needs of the 4IR (Stahl et al., 2017; Scholarios et al., 2018).

### Scope For Future Research

While the current study highlights how AI/ML integration improves worker engagement, motivation, and job satisfaction in the manufacturing industry, more investigation is required to fully comprehend and handle the long-term effects. Studies with a longitudinal design may yield important information about the long-term consequences of this technology change on the labour force. Furthermore, comparisons between cultures and industries may help clarify differences in worker experiences and organizational

preparedness for the use of AI and ML in various settings. Furthermore, talent development initiatives would be informed by research into the particular roles, competencies, and training needed for human-AI collaboration in manufacturing environments. Investigating ethical issues, worries about job displacement, and change management strategies are equally crucial to ensuring a fair and seamless shift to AI/ML-driven manufacturing processes.

## CONCLUSION

The convergence of statistical evidence and in-depth analysis illuminates AI's transformative potential in reshaping work practices and driving positive employee outcomes within the manufacturing industry. The automation of repetitive tasks liberates human workers, enabling them to channel their efforts towards higher-order responsibilities, cultivating a heightened sense of job satisfaction. In this AI-driven era, upskilling the workforce emerges as an imperative, fostering a culture of continuous learning that empowers employees to stay relevant and develop their skills continually. Job satisfaction, intricately linked to efficiency and productivity, finds its roots in meaningful work and elevated engagement levels, catalyzing a virtuous cycle of improved job satisfaction and heightened productivity. Machine learning's prowess lies in its ability to facilitate employee skill and knowledge growth, harnessing data-driven insights to refine systems and optimize learning pathways. Leveraging technology's potential streamlines the production of high-quality goods, while the integration of Six Sigma principles amplifies productivity and enhances product quality (Poorani & Krishnan, 2021). AI's transformative influence extends to the realm of work design, enhancing autonomy and feedback mechanisms, thereby elevating job satisfaction. AI-powered tools can analyze employee data, enabling personalized engagement strategies that resonate with individuals, ultimately yielding positive organizational outcomes. Cultivating a positive attitude towards AI tools can nurture work engagement, a catalyst for worker well-being and organizational success.

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