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# ROLE OF ARTIFICIAL INTELLIGENCE IN ENHANCING PRODUCTIVITY & HUMAN-MACHINE INTEGRATION-INDUSTRY 5.0 – AN EMPIRICAL ANALYSIS

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**ABSTRACT**

*Human Resources are considered the assets of any organization to reach the organizational goals, vision, and targets to improve the organization's overall performance. At the same time, organizations must start adopting innovative practices to sustain themselves in the competitive market. In the era of Industry 5.0, organizations are shifting from traditional practices towards implementing various innovative and advanced processes like artificial intelligence, automation, robotics, and machine intelligence. Industry 5.0 is the next level of the Industrial Revolution, highlighting the critical part of human and machine intelligence interaction. It is the advancement of Industry 4.0 that has heavily impacted various industries like manufacturing including the steel industry, the Power sector, Coal and clean, information technology, etc. through the application of automation processes, data transformation, Internet over things (IoT), Machine learning, and Artificial intelligence. In the process of the above-stated transformation, the researchers wish to focus on studying the "Role of Artificial Intelligence in enhancing productivity through an empirical analysis".*

**KEYWORDS:** *Human-Machine Interaction, Productivity, Artificial Intelligence, Data Analytics, Transformation of the Workforce.*

## INTRODUCTION

Industry 5.0 is a new revolution that is currently replacing Industry 4.0 whereas Industry 4.0 saw significant advancements in data analytics and extensive use of Artificial intelligence, Machine learning, the Internet over Things, and other technologies, Industry 5.0 is centered around mass communication or personalization of these already-existing technologies. Organizations across the country's corporate industry look to human resources as assets to boost overall performance. To accomplish this, organizations need to implement cutting-edge HR strategies that set them apart from the competition and make them the finest in the industry. The field of human resources management has experienced significant expansion, and transformation from conventional methods to cutting-edge, inventive HR approaches such as Robotics, HR automation, Machine learning, Artificial intelligence, and advanced analytics.

Overall, organizations across India have been making substantial steps towards implementing Industry 4.0. At the same time, the government is also supporting the same. Several programs as a part of this initiative Viksit Bharat have been launched such as:

- Ayushman Bharat Digital Mission
- CoWIN App
- Aarogya Setu
- e-Sanjeevani
- e-Hospital
- UMANG
- e-Marketplace (GeM)
- MyGov.in
- e-attendance

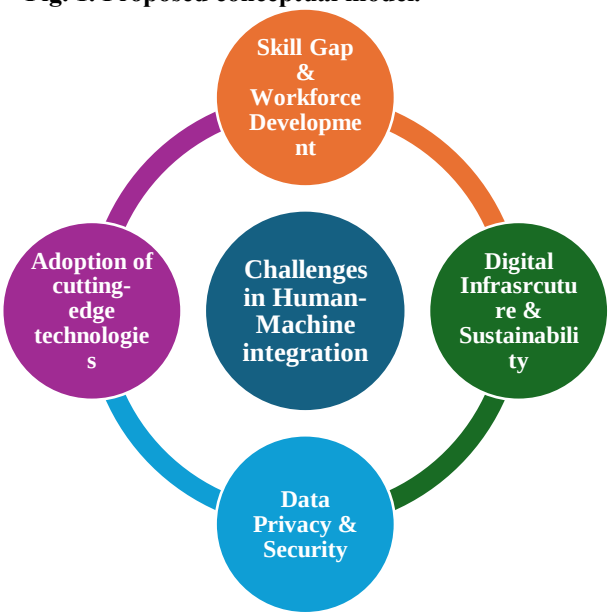
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However, Industry 5.0 requires a further broad and thorough approach to the integration of these technologies. The combination of human intelligence and machine intelligence is one of the key elements of Industry 5.0. It necessitates a dramatic mental shift in which people and machines coexist peacefully and cooperatively. This strategy necessitates a large investment in training programs, vocational skills, professional skills, and skill development that emphasize human-machine cooperation and collaboration.

Organizations have been making investments in programs for skill development and education to get their workforce ready for Industry 4.0. But Industry 5.0 demands a more all-encompassing strategy for overall skill development. Organizations must focus on investing in the development of skills like problem-solving and communication as well as hard skills like cognitive computing and human-machine collaboration. These abilities will be necessary to guarantee that workers can work together with machines in an efficient manner and take full advantage of Industry 5.0. Building a strong infrastructure is another essential element of Industry 5.0. A smooth flow of data and information is necessary for the integration of machine and human intelligence. Various aspects of the infrastructure and sustainable growth include building smart cities, transportation systems, and resilient infrastructure. Organizations across India have been heavily investing in building a strong infrastructure through sustainable programs like ChatGPT, GlassAI, DeepBrainAI, CaseperAI, JasperAi, and Salesforce Einstein. Still, there is a long way to go until a complete digital infrastructure that can facilitate the fusion of artificial and human intellect is developed which will foster innovation for the advancement of Viksit Bharat a developed nation a developed India. Other essential elements of Industry 5.0 is the data privacy and confidentiality, cyber security, Intellectual property rights, Corporate governance, and responsible and equitable deployment of advanced technology.

**Major Challenges in The Integration of Human Intelligence with Machine Intelligence in Industry 5.0 -**

**Fig. 1. Proposed conceptual model.**




**Adoption of Cutting-edge Technologies**

Industry 5.0 places a lot of focus on Cobots. The country must deal with the challenges that come with integrating cutting-edge technologies like artificial intelligence, machine learning, the Internet of Things, and robotics. In addition to managing a cultural shift to facilitate a smooth transition for the population, we also need to address concerns and insecurities around job losses by offering infrastructure and upskilling options. So, there is a significant effort that needs to be invested by organizations across the country in human-machine collaboration by enhancing the awareness and upskilling of human resources on advanced technologies and creating a growth mindset.

**Skill Gap & Workforce Development**

A major significant problem that has been growing in recent years and is not likely to go away anytime soon is the Skill gap. Individuals lacking particular technical skills in artificial intelligence (AI), data analytics, robotics, machine learning (ML), and internet over things (IoT), may find it difficult to obtain employment or may be assessed to lower-paying positions. The issue is that there are more skilled staff entering the workforce than there is a skill gap widening. Investing in training and development is the answer to the issue, but getting there will

require overcoming a few challenges. These challenges included a shortage of trained teachers, scheduling restraints, and financial limitations. Individuals should be provided with advanced training in the areas of teamwork, problem-solving, critical thinking, analytics, communication, leadership styles, and cognitive skills. Forecasts across various global forums indicate that by 2025, half of the skills that are in use today will be obsolete. Upskilling the current workforce to meet Industry 5.0 needs is a difficulty. It is imperative to achieve an appropriate equilibrium between technology and human resources.

**Digital Infrastructure & Sustainability**

One significant barrier to realizing Industry 5.0's full potential across the country is digital transformation. One major difficulty that still exists is the stark difference between digitally disadvantaged rural communities and technologically savvy urban localities. In many rural locations, lack of access to infrastructure and essential digital technologies not only hinders personal growth but also acts as a barrier to the smooth implementation of Industry 5.0 techniques. To overcome this challenge, a holistic approach is required, incorporating programs aimed at increasing digital literacy, increasing network connectivity, and guaranteeing the accessibility of digital services. Addressing the digital divide between urban and rural areas will open the door for a wider and more inclusive adoption of digital India and Industry 5.0, fostering creativity and economic development across all segments of the country.

**Data Privacy & Security**

The new work environment's dependency on interlinked and connected ecosystems and data interoperability in the sector would result in 5.0 thousand network equipment and devices which poses a serious risk to the security and privacy of the Organization's data. Thus, to protect confidential data, organizations need to have strong IT governance, Infosec guidelines, and cyber security policies and procedures in place as well as adhere to ever-changing IT protocols, Intellectual Property rights, and labor rights. At the same time, human resources have to be well-trained in the aspects of data security and lay down stringent rules and regulations to avoid any security incidents along with clearly defined security incident reporting and risk mitigation processes.

**REVIEW OF LITERATURE**

There are several studies conducted on how Artificial Intelligence (AI) and Automation can impact human-machine integration and collaboration. **Korzynski et. al, (2023)** conducted a study to examine how Generative Artificial Intelligence (AI) systems like ChatGPT could offer management ideas and concepts in new contexts. The examination of certain management theories on decision-making, knowledge management, customer service, human resources management, and administrative chores is presented in this research, along with potential changes following the implementation of Generative Artificial Intelligence (AI). **Singh et. al, (2023)** carried out an investigation on the use of artificial intelligence (AI) in human resources management (HRM) to improve organizational performance. Researchers conducted a systematic, multidisciplinary review of more than fifty recent papers. Using AI technologies in human resources management ushers in a new era of HR (version 5.0) and is innovative in today's world.

**Oreo and Sposato, (2022)** conducted a study by examining the viewpoint of recruitment experts to examine the benefits and concerns of using AI in recruiting and selection. A qualitative approach was used to perform an exploratory investigation. The findings showed that AI facilities routine tasks performed via automation. The risks associated with AI technology in recruiting and selection cause recruiters to be wary and mistrustful of it. AI adoption done right can enhance hiring practices. **Kambur and Akar (2022)** undertook a study to establish a valid and accurate scale as well as to uncover HR personnel's perceptions of AI and assess the changes AI has brought about in the HR department. It was concluded that the HR staff members and managers believed technology would relieve them of monotonous labor, lessen the stress associated with finding qualified individuals, and give them access to a larger pool of prospects.

**Arslan et. al, (2022)** investigated to concentrate on the difficulties HRM executives and departments in organizations experience because of the cooperative arrangements between AI (robots) and human employees at the team level. The connection between AI (especially Robots) and HRM in modern enterprises is examined in this research by integrating several streams of literature. The results showed that before putting human employees in teams with robots, organization support mechanisms including a conducive environment, training opportunities, and assuring a feasible technological competence level are vital. Finally, we discovered that one of the most difficult problems for HRM was performance assessment in teams where humans and AI (including robots) coexist.

**Scott W. O'Connor, (2020)** in the article titled Artificial Intelligence in Human Resource Management, the author clearly says that Artificial Intelligence will continue to positively shape the field of Human Resource Management in the coming years. HR professionals should also be more aware of the challenges that they might face. Thus, to prepare for the future of human resource management, professionals should take the necessary steps to know about the current trends in the field. **Albert Christopher, (2019)** in his article titled "Use of Artificial Intelligence in Human Resources Management", the author says that AI-based applications raise employee productivity. It can analyse, predict, diagnose, and become a more capable resource while focusing on employee needs and outcomes. However, there are challenges like privacy, talent gap, maintenance, integration capabilities, or limited proven applications.

## RESEARCH GAP

There have been inadequate findings globally on human-machine interactions and bringing collaboration of humans and machines to enhance productivity, quality and innovation, digitalization, artificial intelligence, circular economy**,** and societal impacts of industry 5.0. The past research does not focus on the challenges associated with the implementation of the integration of human intelligence and machine intelligence and its role in the advancement of Viksit Bharat.

## OBJECTIVES OF THE STUDY

- The objective of the study is to focus on the "Industry 5.0 - role of artificial intelligence in enhancing productivity through an empirical analysis with special reference to Wilco Source Technologies Private Limited.

## HYPOTHESIS

- H0 (Null): There is no significant impact of demographical factors on employee perceptions of the role of Artificial Intelligence in the enhancement of productivity.
- H1 (Alternative): There is a significant impact of demographical factors on employee perceptions of the role of Artificial Intelligence in the enhancement of productivity.

## METHODOLOGY

This research is built around a review of primary data collected with the help of a structured inquiry and secondary data found in the articles, periodicals, books, and journals, both printed and online through a web search, as well as the researcher's own experience, knowledge, and observations. It is conducted using both descriptive and analytical methodology to examine the enhancement of productivity by usage of advanced technologies like Artificial Intelligence and its role in the facilitation of collaboration for realizing Bharat's development aspirations and put forth certain suggestions based on that have been arrived at the study.

## SAMPLING METHOD

A simple random sampling method is deployed to select the sample respondents.

**Sample Population and Sample Respondents**

| Employee Level/Grade | Population | Sample Respondents | Per cent |
|---|---|---|---|
| Administrative/ mgt. | 70 | 34 | 3 |
| Architect | 110 | 52 | 5 |
| Manager | 240 | 114 | 10 |
| Technical Leads | 220 | 104 | 9 |
| Business Solutions Analyst | 96 | 46 | 4 |
| Senior Software Engineer | 516 | 246 | 21 |
| Software Engineer | 948 | 450 | 39 |
| Supporting Employees | 220 | 104 | 9 |
| **Total** | **2420** | **1150** | **100** |

## DATA ANALYSIS

As described in Table 1, the sample for the data was taken from employees who are working at Wilco Source Technologies Pvt Limited. A structured questionnaire on the challenges of the Skill gap and workforce development as well as the Digital infrastructure and sustainability/ Human-machine collaboration was circulated through E-mail to around 2420 employees at various grades. Out of which 575 of them responded completely. The response rate is 24%. While few have done half the work while few of them did not even bother to respond. These employees sent the complete responses from different levels of the position, including Administrative/ mgt.

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(70), Architect (110), Manager (240), Technical Leads (220), Business Solutions Analyst (96), Senior Software Engineer (516), Software Engineer (948), Supporting Employees (220).

**Experience of the Sample Respondents (Table - 1)**

| Experience level | Frequency | Percent |
|---|---|---|
| 0-2 years | 210 | 18% |
| 2-4 years | 270 | 23% |
| 4-6 years | 290 | 25% |
| 6-10 years | 220 | 19% |
| 10 years and above | 160 | 14% |
| Total | 1150 | 100% |

Table 1 describes the experience level of the employees who responded to the questionnaire. As described in Table 2, Out of the total sample of 1150 employees, 210 were juniors with 0-2 years of experience which is 18% of the total sample who accept that the advanced skills like Artificial Intelligence will enhance the productivity, 270 employees were entrant level with 2-4 years of experience and they feel that workforce development should be done with good investment in training the workforce in advanced technologies like Artificial Intelligence, which is 23% of the total sample, 290 the majority of the employees are at mid-level with 4-6 years of experience which is 25% of the total sample who accept that a robust digital infrastructure like Artificial Intelligence should be provided to the employees, 220 employees are at leading level with 6-10 years of experience which is 19% who are recommending to use build systems with advanced technologies like Artificial Intelligence and the remaining 160 employees are at a senior level which is 14% of the total sample who are strongly mentioning that we should enhance the digital infrastructure and train people on using advances technologies like Artificial Intelligence to enhance the productivity as well as enable the human-machine collaboration.

**Age of the Sample Respondents (Table - 2)**

| Age | Frequency | Per cent |
|---|---|---|
| Less than 30 | 460 | 40 |
| between 30 and 40 | 290 | 25 |
| between 40 and 45 | 230 | 20 |
| 45 and above | 170 | 15 |
| Total | 1150 | 100 |

Table 2 is about the age group of the sample. Analyzing the age groups, 460 employees are less than 30 years old and are eagerly waiting for training programs to be conducted by the management to address gaps in technologies like Artificial Intelligence, 290 are between 30 and 40, 115 are between 40 and 45 and 85 of them are above 45. The majority of the sample, 40.0% are between less than 30 and unanimously they agree to bring advanced technologies like Artificial Intelligence that will help enhance productivity.

**Educational Qualification of the Sample Respondents (Table - 3)**

| Age | Frequency | Per cent |
|---|---|---|
| Master's degree | 518 | 45 |
| Bachelor's degree | 288 | 25 |
| Diploma Holders | 345 | 20 |
| Total | 1150 | 100 |

Table 3 is about the age group of the sample. Analyzing the age groups, 518 employees who are master's degree holders and are ready to adopt Artificial Intelligence technologies in their work to enhance their performance. 288 are bachelor's degree holders and are likely to learn more advanced topics in Artificial Intelligence that will automate their regular tasks. The remaining 20.0% of them are Diploma holders and unanimously they agree to bring advanced technologies like Artificial Intelligence that will help enhance the performance.

**Reliability**

| Reliability Statistics | |
|---|---|
| Cronbach's Alpha | N of Items |
| .980 | 8 |

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**Age**

| ANOVA | | | | | | |
|---|---|---|---|---|---|---|
| | | Sum of Squares | df | Mean Square | F | Sig. |
| Quicker and Efficient Communication | Between Groups | 24.389 | 4 | 6.097 | 2.564 | .037 |
| | Within Groups | 2722.727 | 1145 | 2.378 | | |
| | Total | 2747.117 | 1149 | | | |
| Smart Scheduling | Between Groups | 28.114 | 4 | 7.028 | 3.079 | .016 |
| | Within Groups | 2613.604 | 1145 | 2.283 | | |
| | Total | 2641.718 | 1149 | | | |
| Writing and Editing | Between Groups | 20.740 | 4 | 5.185 | 2.316 | .055 |
| | Within Groups | 2563.517 | 1145 | 2.239 | | |
| | Total | 2584.257 | 1149 | | | |
| Writing coding/Programming | Between Groups | 20.957 | 4 | 5.239 | 2.520 | .040 |
| | Within Groups | 2380.260 | 1145 | 2.079 | | |
| | Total | 2401.217 | 1149 | | | |
| Project Reporting | Between Groups | 23.106 | 4 | 5.776 | 2.852 | .023 |
| | Within Groups | 2319.412 | 1145 | 2.026 | | |
| | Total | 2342.518 | 1149 | | | |
| Predictive Analysis | Between Groups | 21.429 | 4 | 5.357 | 2.641 | .032 |
| | Within Groups | 2322.397 | 1145 | 2.028 | | |
| | Total | 2343.826 | 1149 | | | |
| Effective Utilization of Resources | Between Groups | 26.705 | 4 | 6.676 | 3.313 | .010 |
| | Within Groups | 2307.153 | 1145 | 2.015 | | |
| | Total | 2333.857 | 1149 | | | |
| Identification and Removal of Bugs | Between Groups | 23.721 | 4 | 5.930 | 3.005 | .018 |
| | Within Groups | 2259.632 | 1145 | 1.973 | | |
| | Total | 2283.353 | 1149 | | | |

**Education**

| ANOVA | | | | | | |
|---|---|---|---|---|---|---|
| | | Sum of Squares | df | Mean Square | F | Sig. |
| Quicker and Efficient Communication | Between Groups | 30.125 | 4 | 7.531 | 3.174 | .013 |
| | Within Groups | 2716.991 | 1145 | 2.373 | | |
| | Total | 2747.117 | 1149 | | | |
| Smart Scheduling | Between Groups | 31.577 | 4 | 7.894 | 3.463 | .008 |
| | Within Groups | 2610.141 | 1145 | 2.280 | | |
| | Total | 2641.718 | 1149 | | | |
| Writing and Editing | Between Groups | 23.219 | 4 | 5.805 | 2.595 | .035 |
| | Within Groups | 2561.038 | 1145 | 2.237 | | |
| | Total | 2584.257 | 1149 | | | |
| Writing coding/Programming | Between Groups | 19.241 | 4 | 4.810 | 2.312 | .056 |
| | Within Groups | 2381.976 | 1145 | 2.080 | | |
| | Total | 2401.217 | 1149 | | | |
| Project Reporting | Between Groups | 22.163 | 4 | 5.541 | 2.734 | .028 |
| | Within Groups | 2320.355 | 1145 | 2.027 | | |
| | Total | 2342.518 | 1149 | | | |
| Predictive Analysis | Between Groups | 21.975 | 4 | 5.494 | 2.709 | .029 |
| | Within Groups | 2321.851 | 1145 | 2.028 | | |
| | Total | 2343.826 | 1149 | | | |
| Effective Utilization of Resources | Between Groups | 26.629 | 4 | 6.657 | 3.304 | .011 |
| | Within Groups | 2307.229 | 1145 | 2.015 | | |
| | Total | 2333.857 | 1149 | | | |
| Identification and Removal of Bugs | Between Groups | 22.910 | 4 | 5.728 | 2.901 | .021 |
| | Within Groups | 2260.443 | 1145 | 1.974 | | |
| | Total | 2283.353 | 1149 | | | |

**Experience**

| ANOVA | | | | | | |
|---|---|---|---|---|---|---|
| | | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** |
| Quicker and Efficient Communication | Between Groups | 30.549 | 4 | 7.637 | 3.219 | .012 |
| | Within Groups | 2716.568 | 1145 | 2.373 | | |
| | Total | 2747.117 | 1149 | | | |
| Smart Scheduling | Between Groups | 7.880 | 4 | 1.970 | .856 | .490 |
| | Within Groups | 2633.839 | 1145 | 2.300 | | |
| | Total | 2641.718 | 1149 | | | |
| Writing and Editing | Between Groups | 4.883 | 4 | 1.221 | .542 | .705 |
| | Within Groups | 2579.374 | 1145 | 2.253 | | |
| | Total | 2584.257 | 1149 | | | |
| Writing coding/Programming | Between Groups | 3.099 | 4 | .775 | .370 | .830 |
| | Within Groups | 2398.119 | 1145 | 2.094 | | |
| | Total | 2401.217 | 1149 | | | |
| Project Reporting | Between Groups | 3.022 | 4 | .755 | .370 | .830 |
| | Within Groups | 2339.497 | 1145 | 2.043 | | |
| | Total | 2342.518 | 1149 | | | |
| Predictive Analysis | Between Groups | 5.817 | 4 | 1.454 | .712 | .584 |
| | Within Groups | 2338.009 | 1145 | 2.042 | | |
| | Total | 2343.826 | 1149 | | | |
| Effective Utilization of Resources | Between Groups | 2.143 | 4 | .536 | .263 | .902 |
| | Within Groups | 2331.715 | 1145 | 2.036 | | |
| | Total | 2333.857 | 1149 | | | |
| Identification and Removal of Bugs | Between Groups | 4.579 | 4 | 1.145 | .575 | .681 |
| | Within Groups | 2278.774 | 1145 | 1.990 | | |
| | Total | 2283.353 | 1149 | | | |

## FINDINGS OF THE STUDY

- It has been observed that upskilling the employees through various training programs on advanced technologies like Artificial Intelligence will help to enhance the overall productivity of employees as well as the organization. Employees having high experience, and higher education believe that using Artificial Intelligence will be more effective in Quicker and Efficient Communication, Smart Scheduling, Writing and Editing, Writing coding/Programming, Project Reporting, Predictive Analysis, Effective Utilization of Resources, Identification and Removal of Bugs.
- It is also observed that using innovative technologies like Artificial Intelligence plays a crucial role in human-machine integration and collaboration. Experienced employees are more likely to adopt innovative technologies and their usage in their work.

## SUGGESTIONS

- To achieve high performance and to increase the productivity of the employees, it is essential that organizations need to introduce advanced technologies like Artificial Intelligence, data analytics, etc.
- The transformation of the workforce is very much required and make sure the organizations are conducting the training and upskilling programs to meet the technological advancements in Artificial Intelligence which will help the workforce grow in their careers and perform better.

## CONCLUSION

Human-machine interaction is crucial to the industrial revolution's goal of expediting and simplifying work. Industry 5.0 advances the concept of personalization. With increased efficiency Industry 5.0 is being utilized to create a virtual environment, cutting-edge computers, and information technologies, as well as to satisfy highly customized needs through the use of advanced technologies like Artificial Intelligence. It is anticipated that Industry 5.0 will generate higher-paying jobs with more latitude for creativity and design thinking. It contributes to increasing the overall productivity and increased client customization opportunities through the use of Artificial Intelligence.

The leadership team members as well as the CEOs, and CXOs have a critical role in determining how their organizations will develop in the future by managing the obstacles and seizing the opportunities presented by Industry 5.0. Businesses are best positioned to prosper in this new era of industrial change when they take a proactive approach to implementing advanced technologies like Artificial Intelligence to enhance overall productivity and maximize the potential of human-machine integration and collaboration. The leadership team members who successfully navigate the balancing act between technology innovation and human-centric values will be leading their enterprises into the world of previously unimaginable opportunities as Industry 5.0 takes shape and aims the Viksit Bharat a developed nation.

## SCOPE OF FURTHER RESEARCH AND LIMITATION OF THE STUDY

- As the study shows there are several challenges paired with the implementation and adoption of the best practice of Industry 5.0 as portrayed in Figure 1 below, there could be opportunities for improvement in these areas through the use of Artificial Intelligence that enhances productivity.
- Furthermore, using a quantitative approach, it could be investigated how these challenges associated with Industry 5.0 can be addressed thereby attaining the successful implementation of the practices compiled in Industry 5.0.
- It's essential to accept technology and have faith in it. The training of individuals utilizing new technologies like Artificial Intelligence occurs concurrently with the technology's adoption by humans.
- Present issues include Workforce Development, Provision of Digital Infrastructure and Sustainability, Data Privacy and Security, Cyber Security, and Adoption of Cutting-edge technologies like Artificial Intelligence.

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