

Examining the Impact of ESG Metrics on Sustainable Practices and Operational Efficiency in the Indian Automotive Manufacturing Sector Through the Integration of Disruptive Technologies

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Abstract— This paper conducts a thorough examination of ESG metrics to assess the sustainability performance of car manufacturers, focusing on environmental impact, social responsibility, and corporate governance within automotive production. It explores various facets, including carbon emissions, resource utilization, labor practices, human rights, product safety, supply chain management, board diversity, executive compensation, and regulatory adherence. By delving into these ESG risks in detail, the report offers valuable insights for automakers, regulators, shareholders, and other stakeholders. Moreover, the paper presents a comprehensive overview of IoT applications in the automotive industry, highlighting their significant advantages. It begins with a brief introduction to IoT and its relevance in automobile manufacturing, exploring various applications of AI such as predictive maintenance, quality control, supply chain optimization, and robotics. The study illustrates how AI utilizes real-time data from sensors and other sources to help manufacturers anticipate and prevent equipment failures, optimize production schedules, and enhance product quality. Furthermore, the research examines the crucial role of cybersecurity in automotive manufacturing and its importance in ensuring the safety, reliability, and integrity of modern vehicles. It specifically addresses emerging vulnerabilities in connected and autonomous vehicles, discussing potential threats to information security, vehicle integrity, and passenger safety. Overall, the paper aims to offer a comprehensive analysis of ESG metrics, IoT applications, and cybersecurity risks in the automotive industry, with the objective of promoting sustainability, efficiency, and safety within the sector.

Index Terms— Manufacturing, ESG, AI, IOT, Cybersecurity.

I. INTRODUCTION

The automotive industry is undergoing significant changes, and automotive suppliers need to adapt their business practices to succeed in the new normal. Our research suggests that successful companies prioritize increasing the value provided by each employee, possess strong financial management capabilities, and cultivate solid relationships with suppliers and consumers. Additionally, implementing best practices such as attracting and retaining top talent, building a strong leadership team, and separating ownership from management can contribute to success in a dynamic market. While the future of the automobile industry may present challenges, it also offers exciting opportunities for innovation, collaboration, and growth.

Furthermore, the sustainability performance of car manufacturers is gaining importance, considering the significant impact of the automotive industry on the environment, society, and economy. To evaluate the sustainability of Indian car manufacturing, this paper extensively examines various environmental, social, and governance (ESG) metrics. It explores ESG risks associated with automotive production, such as carbon emissions, resource depletion, labor practices, human rights, and

regulatory compliance, providing valuable insights for stakeholders.

The paper also explores the benefits of implementing Internet of Things (IoT) technology in the automotive industry. IoT can optimize supply chains, enhance product quality, and prevent equipment breakdowns. Moreover, the paper discusses the applications of artificial intelligence (AI) in the industry, including predictive maintenance, quality control, and robotics.

Additionally, the paper emphasizes the importance of cybersecurity in the manufacturing of modern cars, particularly in addressing emerging vulnerabilities in connected and self-driving vehicles. Cybersecurity is crucial to ensure information security, vehicle integrity, and passenger safety.

In summary, this paper aims to comprehensively analyze ESG metrics, IoT applications, and cybersecurity risks in the Indian automotive industry, with the objective of promoting sustainability, efficiency, and safety within the sector.

II. ESG IN INDIAN CAR MANUFACTURING

ESG factors are gaining importance in the global automotive industry, including the Indian car manufacturing sector. Indian automakers should consider the following key

ESG parameters:

Environmental:

- a. Energy Efficiency: Indian automakers should focus on reducing energy consumption and improving the energy efficiency of their manufacturing processes.
- b. Renewable Energy: To lower their carbon footprint, Indian automakers should explore the use of renewable energy sources such as solar or wind power.
- c. Waste Management: Effective waste management practices should be adopted to minimize the environmental impact of manufacturing operations.

Social:

- a. Labor Standards: Indian automakers must comply with local labor laws, provide safe working conditions for employees, and ensure fair compensation.
- b. Diversity and Inclusion: Promoting diversity and inclusion within the workforce is essential, ensuring fair treatment and a variety of perspectives among employees.
- c. Community Engagement: Indian automakers should engage with the local community to ensure their operations contribute to social and economic development.

Governance:

- a. Ethical Practices: Indian automakers need to integrate ethical behavior into their operations, promoting honesty and transparency while avoiding corruption.
- b. Board Diversity: Ensuring diversity in the board of directors, including individuals from different backgrounds and viewpoints, is important for effective governance.
- c. Risk Management: Robust risk management systems should be in place to identify and mitigate potential risks to operations and stakeholders.

In conclusion, Indian automakers must prioritize ESG factors to establish transparent, sustainable, and ethical business practices. By incorporating ESG considerations into their business plans, Indian automakers can enhance long-term value for stakeholders, reduce environmental impact, and contribute to the social and economic well-being of the communities they operate in.

A. ESG vs CSR

ESG (Environmental, Social, and Governance) and CSR (Corporate Social Responsibility) are related concepts, but they have distinct differences. ESG is a framework used by investors to evaluate a company's performance in terms of sustainability and ethical impact across environmental, social, and governance aspects. It assesses how a company affects the environment, interacts with its stakeholders, and maintains effective management practices.

On the other hand, CSR refers to a company's voluntary efforts to mitigate the negative social and environmental impacts of its operations. It includes initiatives like charitable

giving, employee volunteering, environmental protection programs, and ethical sourcing. CSR is often seen as a way for businesses to demonstrate their commitment to sustainability and social responsibility, fostering trust with stakeholders.

While both ESG and CSR focus on the societal and environmental effects of corporate activities, CSR consists of voluntary actions a company can take to enhance its impact. ESG, on the other hand, is a comprehensive framework for evaluating overall performance. CSR is commonly used as a means for companies to build their brand and strengthen relationships, while ESG is increasingly important for investors seeking companies with a demonstrated commitment to sustainability and responsible business practices.[5]

B. Value of ESG in India

ESG holds tremendous significance in India due to the imperative for businesses to consider these factors. Several arguments support the importance of ESG in India:

1. Regulatory Compliance: The Indian government mandates that businesses include an ESG section in their annual reports, requiring them to focus on ESG practices to meet regulatory requirements.
2. Reputation: With increasing awareness among consumers and investors about ESG issues, businesses that prioritize these factors can enhance their reputation and attract more clients and investors.
3. Innovation: ESG factors can drive innovation in Indian firms, inspiring them to develop new, environmentally friendly methods of conducting operations. This can lead to the creation of products, services, and technologies that benefit society and the environment.
4. Sustainability: By incorporating ESG factors into their business plans, Indian enterprises can generate long-term value for stakeholders and contribute to the economic and environmental sustainability of the country.

In India, the significance of ESG lies in its ability to support sustainability, manage risks, enhance reputation, and foster innovation. Consequently, Indian businesses that prioritize ESG issues are likely to achieve long-term success and deliver increased value to their stakeholders.

III. SETTING UP MANUFACTURING HUB FOR INDIAN CAR MANUFACTURING**A. Car manufacturing process**

The manufacturing process of a car involves several stages, starting from design and development to the final delivery.

Car-making process:

1. Design and Development: The initial step involves the design team creating a car prototype, which is evaluated by engineers for viability and necessary adjustments.

2. **Parts Manufacturing:** After design and development, various automotive parts, such as engines, transmissions, chassis, and suspension systems, are fabricated. These components can be produced internally or sourced from suppliers.
3. **Assembly:** The parts are then assembled on an assembly line, where the car body, doors, and other components are welded together. Mechanical parts like the engine and transmission are installed during this stage.
4. **Painting:** Once assembled, the car undergoes preparation processes, including sanding, cleaning, and painting of its body. Painting is a time-consuming step, taking several hours to complete.
5. **Quality Control:** After painting, the car goes through a rigorous quality control examination. The quality assurance team checks for any flaws or issues, assessing engine performance and overall external appearance.
6. **Testing and Delivery:** Following the quality control tests, the car undergoes testing on a designated track to ensure compliance with safety regulations. Once it passes the tests, the vehicle is ready to be delivered to showrooms.

The car manufacturing process in India involves significant investments in machinery, infrastructure, and skilled workers. With its emphasis on cost-effective manufacturing practices, India has emerged as a prominent hub for vehicle assembly in recent years.[7]

B. Current use of technologies in car manufacturing

In recent years, the automotive industry has witnessed a growing integration of technology into car manufacturing processes, and this trend is projected to continue. Here are some examples of how technology is currently applied in automobile production:

1. **Computer-Aided Design (CAD) Software:** Digital versions of car designs can be easily modified and improved using CAD software before actual production begins. This technology enables designers to test various concepts swiftly, produce intricate designs, and enhance the overall design process.
2. **Robotics and Automation:** Robots and automated systems are increasingly performing tasks such as welding, painting, and assembly in car manufacturing. This integration enhances production accuracy, efficiency, and worker safety.
3. **3D Printing:** 3D printing is utilized in the creation of prototypes and even some components of the final car. This technology enables faster prototyping, testing, and the production of intricate and personalized designs.
4. **New Materials:** The use of new materials like carbon fiber and high-strength steel has become common in car production to achieve lighter, stronger, and more

fuel-efficient vehicles. Working with these materials requires advanced production processes such as specialized cutting and bonding methods.

5. **Electric and Autonomous Technology:** With the rise of electric and autonomous vehicles, specialized production procedures are needed. Autonomous cars require sophisticated sensors and processing systems, while electric vehicles involve battery manufacturing and integration.

The integration of technology in the automotive industry has significantly improved process efficiency, accuracy, and safety. Moreover, it has opened up possibilities for more complex and sophisticated car designs. As technology continues to advance, we can expect further advancements in the manufacturing processes of automobiles.

IV. POLICIES BY GOVERNMENT OF INDIA FOR SETTING MANUFACTURING HUB IN INDIA

The Indian government has implemented a number of policies to promote the establishment of manufacturing hubs in the country. These policies include:

Make in India: This initiative, launched in 2014, aims to make India a global manufacturing hub. It offers a number of incentives for businesses to invest in India, including tax breaks, streamlined regulatory processes, and help with infrastructure.

National Manufacturing Policy: This policy, launched in 2011, aims to increase the contribution of manufacturing to India's GDP to 25% by 2025. It calls for the establishment of National Investment and Manufacturing Zones (NIMZs) with world-class infrastructure.

Foreign Direct Investment (FDI) Policy: The government has liberalized the FDI policy in a number of sectors to attract foreign investment into the country. Most sectors allow FDI through the automatic route, while others only allow it through the approval route.

Development of Industrial Corridors: The government has identified several industrial corridors across the country, such as the Delhi-Mumbai Industrial Corridor (DMIC) and the Chennai-Bengaluru Industrial Corridor (CBIC). It offers businesses a number of incentives to set up shop in these corridors, including assistance with land acquisition, tax benefits, and infrastructure support.

Skill India: This initiative, launched in 2015, aims to train 400 million people in a variety of skills, including manufacturing. This will help to ensure that the workforce has the skills that are needed to meet the demands of the manufacturing sector.

These are just some of the policies that the Indian government has implemented to promote the establishment of manufacturing hubs in the country. These policies offer a number of incentives and support for businesses that are looking to invest in India.[3]

A. The Indian Government Policies to improve Car Manufacturing in India

The Indian government has implemented a number of policies to promote the growth of the automobile industry in the country. These policies include:

1. **Automotive Mission Plan (AMP) 2026:** This plan aims to make India a global hub for the production, research and development, and innovation of automobiles. It includes measures such as stimulating research and development spending, promoting sustainable mobility, and fostering the growth of the automotive sector.
2. **National Electric Mobility Mission Plan (NEMMP) 2020:** This plan aims to encourage the use of electric vehicles in India. It includes measures such as providing subsidies and incentives for electric vehicle manufacturers and buyers, setting up charging infrastructure, and promoting the use of renewable energy sources for charging.
3. **Make in India:** This initiative aims to attract domestic and international businesses to invest in India and manufacture their products there. It includes measures such as relaxing regulations, offering tax breaks, and creating special economic zones to attract investment.
4. **Production Linked Incentive (PLI) Scheme:** This scheme encourages both domestic and foreign businesses to invest in the production of high-value products, such as automobiles. It provides financial incentives to businesses that increase production, exports, and meet quality and sustainability standards.
5. **National Automotive Testing and R&D Infrastructure Project (NARTRiP):** This project aims to build a world-class automotive testing and research infrastructure in India. It includes establishing facilities for automobile and component testing and homologation, as well as encouraging research and development in the automotive sector.

These policies have helped to make India a more attractive destination for automobile investment. In recent years, the Indian automobile industry has experienced rapid growth, with major automakers investing heavily in the country. The continued implementation of these policies and support from the government is expected to help the Indian automobile manufacturing sector expand further and establish itself as a major player in the global automotive industry.

B. PLI scheme for Indian automobile industry

The Production Linked Incentive (PLI) scheme for the Indian automobile industry is a government program that aims to increase local production and encourage the industry's adoption of cutting-edge technologies. The PLI scheme provides financial incentives to automakers who develop specified vehicle types, such as electric and hydrogen fuel cell vehicles, and who achieve specific production and sales goals.

The PLI scheme is a component of the larger "Atma Nirbhar Bharat" or "Self-Reliant India" project of the Indian government, which seeks to encourage domestic production and reduce the nation's dependency on imports. The program is expected to significantly increase investment in the Indian auto industry and create jobs.

The PLI scheme offers incentives ranging from 1% to 5% of the value of the products that automakers produce and sell. The goal of the PLI scheme is to persuade automakers to invest in cutting-edge manufacturing technologies, such as automation, robots, and artificial intelligence, in order to increase their competitiveness, productivity, and efficiency.

The PLI scheme is a major step for the Indian auto sector, as it gives vehicle manufacturers the much-needed help they need to invest in cutting-edge technology and grow their businesses. The program has the potential to increase the competitiveness of the Indian automobile industry and help it keep up with regional and global advances in the sector by stimulating the use of modern manufacturing technologies.

Here are some of the benefits of the PLI scheme:

- 1) It will increase local production of automobiles in India.
- 2) It will encourage the adoption of cutting-edge technologies in the automobile industry.
- 3) It will create jobs in the automobile sector.
- 4) It will reduce India's dependency on imports of automobiles.

The PLI scheme is a positive step for the Indian automobile industry, and it is expected to have a significant impact on the sector in the coming years.

C. How PLI and ESG will improve Efficiency for Indian car manufacturing.

The Production Linked Incentive (PLI) scheme and Environmental, Social, and Governance (ESG) aspects can significantly increase the efficiency of Indian vehicle manufacturing in the following ways:

1. **Investing in cutting-edge technology:** The PLI scheme encourages automakers to invest in cutting-edge production technology, such as robotics, automation, and artificial intelligence. These technologies can help automakers to improve their production processes, save costs, boost productivity, and increase efficiency.
2. **Reducing the environmental impact:** ESG considerations focus on reducing the environmental impact of production processes, which can lead to improved efficiency. For example, automakers can minimize environmental damage, reduce waste, and improve energy efficiency by implementing sustainable production techniques. Over time, this can lower costs and boost efficiency.
3. **Increased competitiveness:** Indian automakers can boost their competitiveness in the international market by investing in cutting-edge technology and environmentally friendly practices. Increased

economies of scale lead to increased efficiency, as well as larger sales and profits.

4. Improved supply chain management: ESG considerations also focus on social responsibility and ethical behavior. Automakers can boost operational efficiency and cut costs related to non-compliance and unethical practices by ensuring ethical and sustainable practices throughout the supply chain.

The efficiency and competitiveness of Indian automakers can be increased by the use of cutting-edge technologies and environmentally friendly practices. While ESG considerations provide a framework for ensuring sustainable and ethical practices in the industry, the PLI scheme offers financial incentives for automakers to invest in these technologies. Indian automakers can position themselves for growth and prominence in the global automotive market by taking advantage of these resources.

Here are some additional benefits of the PLI scheme and ESG aspects for the Indian automobile industry:

1. Job creation: The PLI scheme is expected to create millions of jobs in the Indian automobile industry.
2. Technology transfer: The PLI scheme will help to transfer cutting-edge manufacturing technology to India.
3. Exports: The PLI scheme will help Indian automakers to increase their exports.
4. Innovation: The PLI scheme will encourage innovation in the Indian automobile industry. The PLI scheme and ESG aspects are two important initiatives that can help to transform the Indian automobile industry. By investing in these initiatives, Indian automakers can become more competitive and sustainable in the global market.

V. INDIAN CAR MANUFACTURING STRATEGIC PLAN TO IMPROVE EFFICIENCY BY USING EMERGING TRENDS.

The paper recommends using new technologies such as artificial intelligence (AI), the Internet of Things (IoT), and cybersecurity to improve overall efficiency in the vehicle manufacturing process. Figure 1 depicts this topic graphically

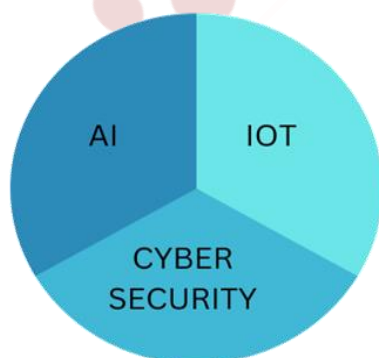


Figure 1. Emerging Trends in Car Manufacturing

A. Use of AI in Indian car manufacturing

Artificial intelligence (AI) is becoming more prevalent in automotive manufacturing in India and throughout the world to improve the efficiency and precision of assembly line procedures. Various uses of AI in the Indian automobile sector include:

Quality assurance: AI-powered computer vision systems analyze components in real time, identifying even minor faults like scratches or dents and alerting operators to the need for repairs.

Predictive maintenance: Artificial intelligence (AI) algorithms analyze data from sensors and machinery to forecast maintenance requirements, decreasing downtime and costs. This is especially useful in assembly line operations, where even tiny delays can have substantial financial consequences.

Robotics and automation: In India's car sector, AI-powered robots do repetitive operations like welding or painting with higher accuracy and efficiency than human labor. These robots can work indefinitely and are simply adjusted to meet changing manufacturing needs.

Supply chain management: AI algorithms evaluate data from vendors, logistics vendors, and manufacturing systems in order to maximize inventory levels and assure timely component delivery, lowering costs and reducing supply chain delays.

Demand forecasting: AI algorithms predict demand for various car models and combinations using data from marketing and sales systems. This allows producers to more effectively regulate production output and satisfy consumer demand.

In general, using AI into Indian automobile production improves assembly line speed, accuracy, efficiency, and cost-effectiveness. With additional technological breakthroughs, we can expect a greater application of AI in the automotive sector, both in India and elsewhere.

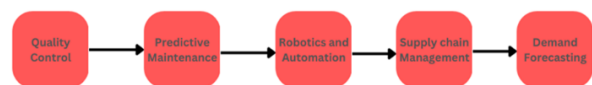


Figure 2. Use of AI

B. Use of IOT in Indian Car Manufacturing

The Internet of Things (IoT) is currently being utilized to improve productivity as well as efficiency in assembly line operations in India and around the world. The following are important IoT applications in the Indian auto industry:

Predictive upkeep: IoT sensors provide real-time machine and equipment health monitoring, offering early warnings of impending breakdowns. This lowers maintenance costs and reduces downtime.

Quality control: IoT sensors monitor the manufacturing process, allowing for the prompt detection of defects. Manufacturers can respond quickly to quality issues, lowering the likelihood of expensive recalls or claims for

warranty.

Asset tracking: IoT sensors can track the location and state of components, tools, and other assets in real time. This assists producers in managing inventory levels, reducing losses, and improving supply chain efficiency.

Energy management: IoT sensors offer real-time tracking of energy consumption, revealing prospects for cost savings and better utilization.

Remote surveillance of operational parameters and manufacturing line performance is made possible by IoT sensors. Even when not physically there, managers are capable of quickly recognizing and resolving problems.

In general, IoT integration has lowered costs and promoted sustainability while increasing effectiveness, efficiency, and quality in assembly line procedures within the Indian automobile sector. We may anticipate seeing more Internet of Things (IoT) applications in the international and Indian automotive industries as technology proceeds to advance.



Figure 3. Use of IOT

C. Use of Cyber security in Indian Car Manufacturing

The growing risk of attacks and the increasing interconnection of systems have made cybersecurity a key component of Indian vehicle production. Here are a few instances of how cybersecurity precautions are used in the Indian vehicle manufacturing industry:

Network security: To safeguard corporate networks and stop illegal access, Indian automakers use a variety of security approaches, including firewalls, intrusion detection systems, and access controls.

Data security: Indian automakers use encryption and other security measures to prevent unwanted access to and theft of private data, including customer information.

Employee education: To lower the danger of error by humans and insider threats, Indian automakers offer cybersecurity education to their staff. Regular security awareness education and practicing phishing scenarios are part of this.

Security from third parties: Indian automakers work with suppliers and partners to guarantee that their systems follow cybersecurity best practices and are sufficiently shielded from any vulnerabilities.

Incident response: To quickly identify and handle cybersecurity concerns, Indian manufacturers have built incident response protocols. These protocols involve actions to find the incident's primary cause, lessen its effects, and put systems back in working order.

In general, cybersecurity measures are being implemented in the Indian auto sector with the goal of preserving data and

system security, privacy, and dependability while reducing the danger of cyberattacks and ensuring continuous business operations. It is anticipated that more investments in cybersecurity would be made in the international and Indian automotive sectors as the threat landscape continues to change.



Figure 4. Use of Cyber Security

VI. HOW THESE EMERGING TRENDS ARE GOING TO BOOST EFFICIENCY AND PRODUCTIVITY

The Indian automobile industry has the ability to greatly increase efficiency and production through the use of new technologies like AI, IoT, and cybersecurity. Here's how these tendencies might help bring about these advancements:

1. AI in Car Manufacturing:

In the Indian car business, simplifying manufacturing procedures can be quite important. AI systems can spot patterns and trends by examining vast amounts of data that might otherwise go undiscovered. For instance, predictive maintenance using AI can help to reduce downtime and prevent equipment malfunctions, increasing production. Robots with AI capabilities can also speed up assembly line processes and enhance quality control procedures.

2. IoT in Car Manufacturing:

By giving current information on the production process, the Internet of Things (IoT) can help the Indian automotive industry increase productivity. IoT sensors can be installed all throughout the place of manufacture to collect data on machine output rates, energy usage, and performance. The production process can be improved with the use of this data, and waste can be decreased. IoT sensors may also keep an eye on environmental factors like temperature and humidity to ensure ideal production conditions.

3. Cybersecurity in Car Manufacturing:

As AI and IoT technologies proliferate in the sector, cybersecurity becomes a crucial issue. Strong cybersecurity measures are needed to protect manufacturing plants from cyber risks such as malware, hacking, and information breaches. The production process can be secured, disruptions can be avoided, and intellectual property can be protected by putting in place adequate cybersecurity precautions. Indian automakers can preserve firm data and uphold customer faith by giving cybersecurity first priority.

It may be determined from a survey of Indian automotive producers and vendors (including OEMs, Tier 1 and Tier 2 suppliers) that the sector will become more efficient and

productive overall when these disruptive technologies are adopted.

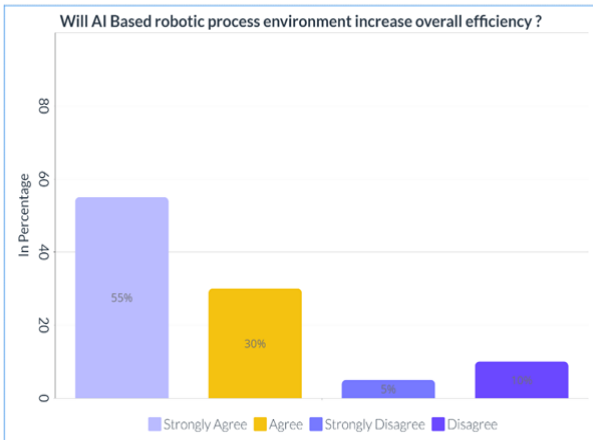


Fig 5. Graph on Efficiency

The graph in the previous figure shows how people perceive how an AI-based robotic process ecosystem will affect productivity. The x-axis shows various levels of agreement, from highly agree to strongly disagree, while the y-axis shows the percentage of responders. The graph gives participants' opinions a clear visual depiction, and it shows that the majority of participants either agree or strongly agree that the method has increased efficiency.

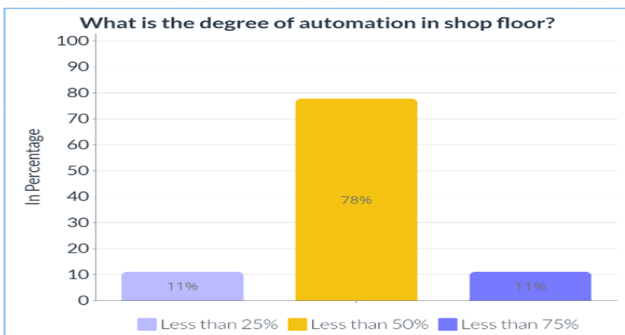


Fig 6. Graph on Degree of Automation

Based on participant replies, the graph above represents the degree of automation on the shop floor. The y-axis shows the proportion of responses, while the x-axis shows the various automation levels, which range from less than 25% to less than 75%. The graph shows that a sizable fraction of participants had operations with less than 50% automation, indicating a need for improvement. There is still opportunity for improvement because just a tiny portion of participants have automated over 75% of their processes.

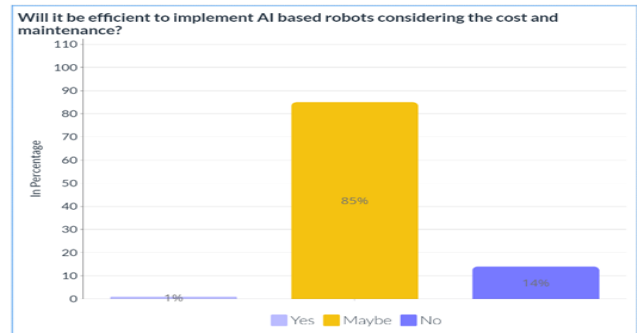


Fig 7. Graph on Cost & Maintenance

This graph displays the participants' opinions on the effectiveness of adopting AI robots while taking maintenance and cost into account. The x-axis shows the range of levels of agreement, from "yes" to "no," while the y-axis shows the percentage of responders. The graph indicates that the majority of participants express skepticism regarding the adoption of AI robots, probably owing to maintenance and expense concerns.

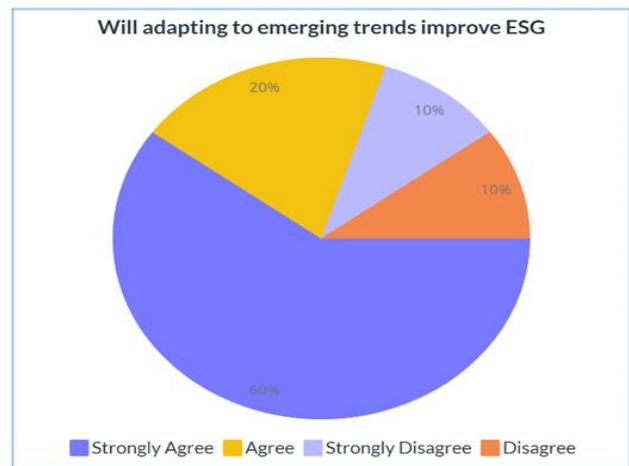


Fig 8. Graph on Improving of ESG

This pie chart gives us an overview of people's opinions on the question 'Will adapting to emerging trends improve ESG parameters?'. Majority of the people strongly agree to the fact that emerging trends will help in improving ESG parameters. Only around 20% of people disagree with this notion that adapting to emerging trends will not improve ESG parameters.

VII. CONCLUSION

The Internet of Things (IoT) and artificial intelligence (AI) integration in the automobile production process offer the Indian automotive sector a huge opportunity to increase productivity and efficiency. The use of AI algorithms makes it possible to analyze huge data volumes, making it easier to recognize patterns and anticipate equipment failures. Additionally, AI-enabled robots can speed up production processes, while IoT sensors offer real-time information on

machine performance, energy use, and output rates, allowing for process enhancements and waste reduction. The widespread implementation of AI and IoT technology does, however, also increase the danger of cybersecurity concerns like hacking and data breaches, which is something that must be acknowledged. Therefore, it becomes crucial to establish strong cybersecurity measures to safeguard production facilities and safeguard priceless corporate data. In conclusion, the Indian car sector can greatly improve its productivity and efficiency, optimize the production process, increase output, decrease waste, and assure the maximum security of crucial data by implementing IoT, cybersecurity, and AI technology.

REFERENCES

- [1] H. Chen, W. Eakins, J. Wang, G. Zhang, and T. Fuhlbrigge, "Robotic wheel loading process in automotive manufacturing automation," in 2009 IEEE/RSJ International Conference on Intelligent Robots and Systems, 2009, pp. 3814–3819.
- [2] B. Sun, S.-L. Jämsä-Jounela, Y. Todorov, L. E. Olivier, and I. K. Craig, "Perspective for equipment automation in process industries," IFAC-PapersOnLine, vol. 50, no. 2, pp. 65–70, 2017.
- [3] Neelofar Kamal, Impact of „Make in India“ on Automobile Sector International Journal of Business Administration and Management 2017
- [4] Amit K. Nerurkar, G. T. Thampi "Intelligent Process Automation for Detecting Unauthorized Entry by Actors in IoT Imbedded Enterprise Setting" IEMIS 2022 Springer Series Emerging Technologies in Data Mining and Information Security
- [5] Nikita Arya, "A Review of Growing Automobile Industry in India ", in 2019 International Journal of Research and Analytical Reviews VOLUME 6 ISSUE 1 IN JAN. – MARCH 2019
- [6] K P Naveen Reddy, Undavalli Harichandana, T Alekhya, Rajesh S M, "A Study of Robotic Process Automation Among Artificial Intelligence", International Journal of Scientific and Research Publications, Volume 9, Issue 2, February 2019
- [7] Geethanjali Jujjavarapu, Elonnai Hickok, Amber Sinha, "AI and the Manufacturing and Services Industry in India https://cisindia.org/internetgovernance/files/AIManufacturingandServices_Report_02.pdf
- [8] Weizheng Wang, "Applied Research of Industrial Robots in Automotive Intelligent Manufacturing Production Line", IWAACE 2020, Journal of Physics: Conference Series
- [9] Amit K. Nerurkar, G. T. Thampi "investigating complexities to be resolved for seamless Integration of intelligent robotic process automation in Partially automated shop floor environment of Indian Automotive manufacturing "2023 Journal of Data Acquisition and Processing
- [10] Amit K. Nerurkar, G. T. Thampi "Investigating the Preparedness of Car Manufacturing in Indian Automobile Industry to Integrate Intelligent Robotic Process Automation" The Ciência & Engenharia -Science & Engineering Journal ISSN: 0103-944X Volume 11 Issue 1, 2023pp: 2324-2334.