Transition to a Greener Era with Industry 5.0 and Sustainability

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Abstract

Industry 5.0, also known as the Fifth Industrial Revolution, is a brand-new stage of industrialization that is now in developing phase. In this stage, enhanced workplace operations are performed with the use of artificial intelligence and new industrial technology. This is paired with a greater emphasis on sustainability and pliancy; it also includes the strategy that places greater attention on people. In initial phase of the Industrial Revolution 5.0, manpower was gradually replaced by automated processes that were powered by steam and hydropower. In the second stage, mass manufacturing was made possible by the introduction of electricity. In the third stage, programmable computers and a strong digital ecosystem arose. The potential of big data, cloud computing, robotics, the Internet of Things (IoT), and artificial intelligence was harnessed in smart factories as a component of the previous industrial revolution (Industry 4.0). Important questions those were left unanswered during these consecutive advancements are addressed by Industry 5.0, Are we undervaluing human resources at this point in the automation process? We did not decide to completely automate the industry since we found that individuals still play an important part in the revolution. Is it possible to reconcile productivity and the environment with technology? Resilience, sustainability, and human-centeredness serve as the cornerstones around which Industry 5.0 is constructed. It is able to accomplish its objectives thanks to these pillars. The plan of action for industry 5.0 driven environmental responsibility that this research has accomplished ought to deliver an expanded comprehension of how the newest version of industry 5.0 can help to environmentally friendly growth. It describes how each components development should be carried out in an instrument that maximizes their combined influence and involvement with future sustainability values. The data that has been collected through questionnaires and a range of secondary sources indicates that industry 5.0 with human-machine collaboration has a bright future and findings shows that productivity rises and can lead to a greener future through the use of technologies.

Keywords: Industry 5.0, sustainability, greener future, human machine collaboration, technologies, artificial intelligence

Introduction:

A vision of the industrial landscape of the future that emphasises safeguarding society and the environment has lately surfaced as the "Industry 5.0" idea. People collaborating with robotics and intelligent machines are referred to as "Industry 5.0." Industry 5.0 must advance since industry 4.0 priorities environmental sustainability and employee wellness less than the technological advancement of production and manufacturing systems and efficiency. Humanity and civilizations are valued by the Industry 5.0 revolution. By utilising cutting-edge technology such as the Internet of Things (IoT), big data and robots can help people operate more efficiently and quickly. Setting off on an environmentally sensitive and innovation translation journey alongside Industry 5.0 as well as sustainability means taking a revolutionary approach to translation. The need for sustainability grows as we enter the next industrial revolution, which is marked by innovative technologies and systems that are connected. Within this framework, translation comprises not only converting languages but also the use of procedures and tools that give priority to environmentally sustainable practices and reduce their negative effects on the environment. It necessitates a comprehensive approach to sustainability, including energy-efficient workflow implementation and the procurement of environmentally conscious materials for translation equipment. The translation sector can help to create a more environmentally friendly future and act as an inducement for a larger shift in society towards sustainability by adopting these values. Industry 4.0 pillars of efficiency and automation are given a more human touch through this. It aims to combine the inventiveness and problem-solving abilities of human employees with the powers of mechanisation and artificial intelligence, ultimately producing a more productive and adaptable production environment.

This paradigm shift emphasises the value of human decision-making and intervention in the industrial context while addressing the drawbacks of complete automation. By fusing the strengths of both robots and humans, Industry 5.0, which is still in its early stages, has the potential to revolutionise several industries. In 1987, the United Nations Commission defined sustainability as addressing the requirements of the present without compromising the capacity of people in the future to address their issues. Encouraging people to live in harmony with the environment, society, and economy is known as sustainability. An industry that is ecological would be able to expand in all three directions while preserving the environment and addressing significant environmental problems. Sustainability is essential in Industry 5.0, the next stage of industrial development characterised by growing digitization and automation. Within this paradigm, sustainable practices reduce resource consumption, trash, and emission levels, leading to more effective utilisation of resources like materials and energy. Industry 5.0's commitment to sustainability reduces waste, carbon dioxide emissions, and environmental impacts. Utilising green technologies and eco-friendly practices helps reduce environmental impact. By encouraging the creation of circular economy models, sustainability encourages innovation. These models emphasise waste reduction, material reuse, and product life extension—all of which are consistent with the industry 5.0 paradigm. Improved business financial outcomes are a result of lower energy use, waste disposal expenses, and resource usage. Sustainability and Industry 5.0 have a mutual beneficial relationship. Industry 5.0 incorporates sustainable practices, like the application of sustainable energy sources, waste reduction, and giving ethical supply chain priority, into production operations. Conversely, nevertheless, the growth of industry 5.0 is guided by sustainability principles, which encourages the

use of technologies that minimise environmental impact and enhance resource efficiency. When combined, they seek to maximise positive benefits on society and the environment and promote economic growth. Industry 5.0 sustainability activities can reduce the risks brought on by social unrest, resource shortages, and climate change. Businesses that foresee these difficulties will be better able to adjust to upcoming uncertainties. It supports broader objectives of social and environmental responsibility, which are more crucial to businesses' performance in the twenty-first century. Industry 5.0 and an improved future are connected by their mutual commitment to environmentally friendly and sustainable manufacturing. Future environmental concerns can be lessened by using industry 5.0 practises and technologies to create better environment friendly industrial environment.

Literature Review

Sharma, R., & Gupta, H. (2024) has concluded in their research papers that significant insights across various fields, affecting the path of sustainable industrial progress towards Industry 5.0 and aligning with the world's environmental goals and this will contribute in the growth of sustainability in production process.

Van Erp, T., Carvalho, N. G. P., Gerolamo, M. C., Gonçalves, R., Rytter, N. G. M., & Gladysz, B. (2024) has identified that the most advanced knowledge in the discipline of strategies design and implementation research by offering a framework for decision-making that supports the production of sustainable, resilient, and human-centred value, which aids in sustainable management.

Ivanov, D. (2023) has observed that Industry 5.0 enables the forthcoming phase of manufacturing and logistics through economical, responsive, human-centric, flexible, and environmentally friendly supply chain networks that span activities and supply chain administration, manufacturing engineering, computer science, and automation and robotics, necessitating multidisciplinary research collaborations.

Ben Youssef, A. et al (2023) has examined in their paper and focusing on 2020 as a relevant year in the development of research about industry 5.0. This reflects growing societal and environmental concern with the increased emphasis on resilience brought on by the COVID-19 pandemic. According to the evolution of concepts within the co-occurrence network, eco-innovation, communication, SMEs, surroundings, and mechanisms are more recent subjects with reference to Industry 5.0, whereas sustainable growth, human-centricity, intelligent production, and 6G are well-established concepts.

Morteza Ghobakhloo et. al (2023) concluded in their research that the need of boosting industrial productivity and the advancement of science and technology have been the primary factors behind Industry 4.0. According to our observations, Industry 4.0 has been generally effective in that it has produced the desired productivity-based results. Although Industry 4.0 unintentionally promotes certain micro-societal values, such resource efficiency or workplace safety, it does not systematically value social and environmental sustainability. The literature acknowledges that Industry 4.0 has negatively impacted a number of social and human-centric values, mostly as a result of social actors' inability to actively control and regulate the rate of technology absorption. These negative consequences can include weakening worker autonomy and dignity, increasing regional and company-level economic inequality, exacerbating the skills gap issue, and leading to a large loss of jobs. The disruptive developments in society caused by Industry 4.0 have an important

effect on the world at large, particularly in Europe and the majority of Western economies. This indicates that social actors are strongly supporting the Industry 5.0 model.

Pedro Coelho et. al (2023) concluded that the term was initially used in a study carried out in 2016 that links I5.0 to the rise of disruptive technologies like as synthetic biology and bionics. Despite introducing a concept that could be considered a true industrial revolution, this paper is the least cited in the collection. The majority of other works link the term Industry 5.0 to a fifth industrial revolution that will accomplish what the Industry 4.0 failed to do. A collection of ideas that are comparable to one another is proposed: a revolution aimed at fostering a more equitable and sustainable world where people and machines/robots coexist and work together. Similar to Industry 4.0, the emergence and ubiquity of this expression in the literature can be explained by the launch of governmental programs, the Society 5.0, by the Japanese government, and following the discussions around the future of industry in the EU.

Yin, S., Liu, L., & Mahmood, T. (2023) has identified that the merging of the internet, green, and creativity economies is driving novel developments in sustainable growth. Digitalization, green technology, creative thinking, circular economy principles, ethical banking, and mutually beneficial relationships are all driving the shift to an ecologically friendly and inclusive future. Adopting these trends will provide sustained sustainable development and accelerate economic growth and social well-being.

Adel, A. (2022) has identified in his paper that the primary goal of the Industry 5.0 idea is to optimise machine productivity and human productivity both. The definition of industry 5.0 is provided in the paper from both the viewpoint of the academic

and industrial community.

Ghobakhloo, M. Et al (2022) has concluded in their paper abut industry 4.0 and deal with the socio-environmental issues raised by the current digital industrial transition. It has been also explained that Industry 5.0 will support sustainable growth. But it's not obvious how Industry 5.0 will actually promote the values of sustainable development.

Grabowska, S. et al (2022) has determined that the structure that defines what Industry 5.0 idea is and pinpointed the flaws in the previous Industry (industry 4.0) theory, particularly it is related with the functions of human in smart factories. Human-centric, sustainable, and pliancy developments is the three main basis of Industry 5.0. Production employees perceived increasing digitization and automation as a severe danger because Industry 4.0 was firstly focused on using technologies to remove humans from the manufacturing process and solely leave them in charge of supervision and control.

Kasinathan, P., Pugazhendhi, R., Elavarasan, R. M., Ramachandramurthy, V. K., Ramanathan, V., Subramanian, S.,…$ Alsharif, M. H. (2022) has analyse the various evolution of industries starting from Industry 1.0 to Industry 5.0. And also shows the relation of industry 5.0 and society 5.0 in their paper.

Majerník, M. et al (2022) concluded in their paper that Industry 5.0 promotes innovation and the quickening of industrial technology development, making completely automated production processes attractive for job opportunities for young people looking for meaningful and sustainable lives. Additionally, it contributes to the enhancement of more environmental-friendly technological workplaces by enhancing interactions between humans, machines, and robots through digitization, AI, and robotics. In the context of fourth- and fifth-generation smart

businesses, the latest code of values will also need to more clearly identify and dimension employee well-being.

Patnaik, A. et, al (2022) has observed that Interaction among humans and machines is a developing topic in Industry 5.0. People may be confident that the collaboration of both humans and machines will be an important move forward for humanity and have an important effect on how people do business in sustainable manner.

Johri, P., et. al (2021) has concluded that Industry 4.0 give the way for the generation of the concept of Industry 5.0 and the 5th industrial revolution will occur when technology and human intellect unite to create intelligent machines, networks, and automation. The trust between the two elements leads to improved performance, consistent quality, fewer waste, and more flexible output. This would increase client traffic and enhance service quality at your workplace.

Nahavandi, S. (2019) has identified that the next industrial revolution is going to start when its three primary components—intelligent machines, automated processes, and cognitive automation—completely integrate with the physical environment in collaboration with human intelligence. It is going to put more individuals back to the workforce while improving process efficiency, faultless production, little waste, and customisable manufacturing.

Research Gap

After a review of the literature, we discovered that many authors had looked into the development of industry 5.0. This is because, while industry 4.0 emphasises efficient production methods, sustainable production is crucial for the environment today. Industry 5.0 advances both environmentally friendly practices and efficient

methods of production. Additionally, it is discovered that not enough research has been done explicitly to explore the idea behind industry 5.0, and earlier writers have not discovered how it can be helpful for greener industrial future, very A small number of writers have researched the connection between environmental sustainability and industry 5.0. No research has been done based on reform and innovation in relation to Industry 5.0, which gives the need for writing this paper.

Objectives

To investigate how sustainability objectives can be integrated with Industry 5.0 principles.

To assesses the possible advantages of sustainable industrial future.

Hypothesis:

H_{01}: Industry 5.0 principles have no potential to be a major force in the move towards a sustainable future.

H_{a1}: Industry 5.0 principles have the potential to be a major force in the move towards a sustainable future.

H_{02}: Sustainability and Industry 5.0 cannot pave the way for a greener future.

H_{a2}: Sustainability and Industry 5.0 can pave the way for a greener future.

Research Methodology

Research Design

Descriptive research was employed in the study to create a clear and useful pattern about Industry 5.0 and sustainability. The present investigation employed suitable statistical instruments, such as

graphs, diagrams, and one sample test, to enhance the presentation and analysis of the results. Those who are aware about the concept of fifth industrial revolution (Industry 5.0) are entailed in the study's universe as the survey's targeted demographic. The majority of study participants are either students or research experts from different institutions or colleges. Convenient sampling is the technique employed for sampling. There were 150 responders in the study's sample out of which 100 responders were aware about the term Industry 5.0. With the use of primary data and real science-based learning, the present study is empirical in nature.

Data Collection

This study incorporated both the data i.e. primary and secondary data. 150 participants completed a Google Form to provide primary data, out of which 100 respondents from different sectors are aware about the concept of Industry 5.0, and annual reports from numerous websites, public authorities, journals, and publications were used to compile secondary data for study. Since primary data can be gathered more quickly and easily and has higher dependability than secondary data, it is employed in this study. However we use additional sources of data to compare this statistics.

Statistical tools & Techniques

Data collected via questionnaires are analysed with the help of statistical tools like graphs, diagrams, tables, correlation and paired t-test. After analysis, Interpretation is made of the result obtained in the context of null hypothesis.

Universe & Sample Size

The universe of the study as targeted population is the users of artificial intelligence and those respondents which are well known about industry 5.0. For the better and true result, most of the

respondents are either academician or involved in their own business or having industry are consider for the study.

Data Analysis and Interpretation

On the basis of information gathered through the questionnaire, it is concluded that the majority of individuals are aware about Industry 5.0 and how sustainability is related to it. Despite having a bright future, many responders are ignorant of it. About 67% of those surveyed were aware about industry 5.0. It can be said that Industry 5.0 changed the pace of business and is making continuously challenging for the industry with sustainability.

On the basis of data available in the table 1.1, it is found that 88% respondents think that artificial intelligence and automation helps in optimising the resources whereas only 3 % of the total respondents are disagree with it. Around two-third of the total respondents believe that industry 5.0 support the development of eco-friendly and sustainable products in industries. More than 70% respondents believe that utilising the industry 5.0 technologies results in a more adaptive and productive environment and more than 80% of the total respondents thinks that increased production is possible with sustainability. It is also analysed that more than 50 % respondents believe that there will be fewer sustainable practices in the future after industrial revolution 5.0. In the matter of resource efficiency and waste reduction more than 70% respondents believe that it will increase efficiency of the resources and it'll be helpful in the reduction of greenhouse gas emission. When we talk about future challenges and journey of industry 5.0 it is found that 98% respondents believe that there are a lot of challenges associated with the transition to a greener future driven by principles of industry 5.0.

Table 1.1

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Do you think automation and artificial intelligence help in optimising the resources?	16	72	09	01	02	100
Do you think Industry 5.0 support the development of eco-friendly and sustainable products in industries?	11	56	28	09	01	100
Do you believe that utilising the Industry 5.0 technologies results in a more adaptive and productive environment?	15	56	23	05	01	100
Do you think it is possible to balance increased production with sustainability?	16	65	16	02	01	100
Do you believe there will be fewer sustainable practices in the future after the Industrial Revolution 5.0?	08	43	28	19	02	100
Do you think Industry 5.0 can address the arduous of resource efficiency and waste reduction in industrial processes?	10	63	23	03	01	100
Do you think Industry 5.0 promote the reduction of greenhouse gas emission?	11	50	32	06	01	100
Do you believe complete automation is a drawback for Industries?	11	46	29	11	03	100
Do you think there are many arduous associated with the transition to a greener future driven by Industry 5.0 principles?	10	72	16	00	02	100
Do you think that Industry 5.0 contributes to the journey to a green future?	10	63	18	08	01	100

Table 1.2

One-Sample Statistics				
	N	**Mean**	**Std. Deviation**	**Std. Error Mean**
If so, do you believe that humans survive with robots and intelligent machines?	100	3.48	.915	.092
Do you think automation and artificial intelligence help in optimising the resources?	100	3.99	.689	.069
Do you think Industry 5.0 support the development of eco-friendly and sustainable products in industries?	100	3.62	.838	.084
Do you believe that utilising the Industry 5.0 technologies results in a more adaptive and productive environment?	100	2.00	.932	.093
Do you believe there will be fewer sustainable practices in the future after Industrial Revolution 5.0?	100	3.36	.948	.095
Do you think renewable energy plays a relevant role in Industry 5.0's transition to a greener future?	100	1.49	.847	.085
Do you think Industry 5.0 promote the reduction of greenhouse gas emission?	100	3.64	.798	.080
Do you think there are many arduous associated with the transition to a greener future driven by Industry 5.0 principles?	100	3.88	.656	.066

Table 1.3

One-Sample Test						
	Test Value = 0					
	T	**Do**	**Sig. (2-tailed)**	**Mean Difference**	**95% Confidence Interval of the Difference**	
					Lower	**Upper**
Do you believe that humans survive with robots and intelligent machines?	38.016	99	.000	3.480	3.30	3.66
Do you think automation and artificial intelligence help in optimising the resources?	57.915	99	.000	3.990	3.85	4.13
Do you think Industry 5.0 support the development of eco-friendly and sustainable products in industries?	43.186	99	.000	3.620	3.45	3.79
Do you believe that utilising the Industry 5.0 technologies results in a more adaptive and productive environment?	21.458	99	.000	2.000	1.82	2.18

On the ground of above analysis, it is found that around two-third of the population think that industry 5.0 is playing vital role in their business with the sustainability. It is analysed that human can survive with robotics and intelligent machines. By the analysis of table 1.3 we found that the t-value is higher than critical value so the first null hypothesis is rejected and it shows that in present time industry 5.0 has a good potential to be a bigger force in the move towards sustainability. In second null hypothesis we can see in table 1.3 that the calculated value is higher than critical value. So, the second null hypothesis is also rejected and alternative hypothesis is accepted because sustainability and Industry 5.0 can pave the way for a greener future. Although industry 5.0 is not so popular till now and people are thinking it will not be economical and India is not technologically ready for Industry 5.0 but with the passes of time it has a good future in India.

Findings

We found Industry 5.0 is beneficial for the future, yet a lot of individuals are still unaware about Industry 5.0. By industry 5.0 men can be more efficient as compared to now and environmental issues like emission of carbon can be solved. We can reduce the high use of energy and we are also capable of managing garbage in an effective manner. Work with AI and robotics will give high competition and men can be more critical thinker in many ways. Artificial intelligence has the potential to tackle a lot of unanswered issues throughout an outstanding manner in the years to come but there is also a possibility of many hurdles will also be there with the passes of time and usage of technologies in bad ways. Although machine can never replace to the man fully but it might be so challenging for human to compete with them in the era of industry 5.0 due to the fact that there are several factors which can be done by machine with a very good speed and with high efficiency.

Conclusion

It is summarised that sustainability can be integrated with the principles of industry 5.0. Industry 5.0 is working with human machine collaboration which is the need of time because automation made many things easy and optimised the resources. Industry 5.0 support the evolution of eco-friendly and sustainable products in industry. It is found that fewer sustainable practices will be performed in the future because industry 5.0 transited to a renewable energy and continuously trying to reduce greenhouse gas emission. Although industry 5.0 has many arduous associated with it but it definitely has a good future because of its advantages. But there is also a privacy issue and it always has a question mark of data privacy. The main difference between I4.0 and I5.0 is industry 4.0 emphasizes on automation and data-driven processes while Industry 5.0 focuses on human-machine collaboration, customization and decentralized control.

Recommendations

By implementing sustainable manufacturing processes, eco-friendly practices can be possible. Renewable energy should be used maximum like solar or wind power to reduce carbon footprint. Use of energy efficient robotics can be helpful for improving efficiency and we should use smart supply chain management to reduce emissions by transportation sector. We should also encourage employees regarding sustainability and train them whenever required. Sustainability can be accomplished by any industry in a variety of ways, but lowering waste production is just one of the basic necessities for sustainability. And waste management. It is a relevant part of the industry that the use of renewable energy must be encouraged. It should also be focused by the industries with the development that the industry should reduce the emission of carbon dioxide. As

industry 5.0 is in introductory phase now, so it should also be focused on the developing problems and what challenges are there in present and what possibility in the near future.

Scope for future

With the passes of time, technological adoption changes and can give a good impact on sustainability and it may provide an area of research. It may also be possible that proper policy should be made and available policies, rules and regulations should be revised with widening use of artificial intelligence and robotics. A data security must be an issue in future and proper rules and regulations should be made according to need of situation. Any rules and regulations must not be same and constant as the technology changes rapidly so it always needs dynamic environment for rule and regulations. Other than this, there might be potential for more study in areas like security and defence.

Limitation

As the industry 5.0 is not so popular for all, so it may be possible that the result is derived till now may mismatch in future and relevancy of the data is also a question mark because it is of till limited period of time. The data is collected basically by state level and result is derived for a single state basis by using convenient sampling methods which is easily available .So, it has limited scope and not covered all the research area and may be the findings are not apply on other groups. This study is only limited with industrial revolution 5.0 and sustainability.

References

Sharma, R., & Gupta, H. (2024). Harmonizing sustainability in industry 5.0 era: Transformative strategies for cleaner production and sustainable competitive advantage. *Journal of Cleaner Production*, 141118.

Van Erp, T., Carvalho, N. G. P., Gerolamo, M. C., Gonçalves, R., Rytter, N. G. M., & Gladysz, B. (2024). Industry 5.0: A new strategy framework for sustainability management and beyond. *Journal of Cleaner Production*, 142271.

Ben Youssef, A., & Mejri, I. (2023). Linking Digital Technologies to Sustainability through Industry 5.0: A bibliometric Analysis. Sustainability, 15(9), 7465.

Coelho, P., Bessa, C., Landeck, J., & Silva, C. (2023). Industry 5.0: the arising of a concept. Procedia Computer Science, 217, 1137-1144.

Ghobakhloo, M., Iranmanesh, M., Tseng, M. L., Grybauskas, A., Stefanini, A., & Amran, A. (2023). Behind the definition of Industry 5.0: a systematic review of technologies, principles, components, and values. *Journal of Industrial and Production Engineering*, 40(6), 432-447.

Ghobakhloo, M., Iranmanesh, M., Mubarak, M. F., Mubarik, M., Rejeb, A., & Nilashi, M. (2022). Identifying industry 5.0 contributions to sustainable development: A strategy roadmap for delivering sustainability values. Sustainable Production and Consumption, 33, 716-737.

Patnaik, A., Dawar, S., & Kudal, P. (2022, December). Industry 5.0: Sustainability Challenges in Fusion of Human and AI. In Proceedings of the 4th International Conference on Information Management & Machine Intelligence (pp. 1-7).

Adel, A. (2022). Future of industry 5.0 in society: Human-centric solutions, challenges and prospective research areas. *Journal of Cloud Computing*, 11(1), 1-15.

Grabowska, S., Saniuk, S., & Gajdzik, B. (2022). Industry 5.0: improving humanization and sustainability of Industry 4.0. Scientometrics, 127(6), 3117-3144.

Kasinathan, P., Pugazhendhi, R., Elavarasan, R. M., Ramachandaramurthy, V. K., Ramanathan, V., Subramanian, S., ... & Alsharif, M. H. (2022). Realization of sustainable development goals with disruptive technologies by integrating industry 5.0, society 5.0, smart cities and villages. Sustainability, 14(22), 15258.

Majerník, M., Daneshjo, N., Malega, P., Drábik, P., & Barilová, B. (2022). Sustainable development of the intelligent industry from Industry 4.0 to Industry 5.0. Advances in Science and Technology. *Research Journal*, 16(2).

Ivanov, D. (2023). The Industry 5.0 framework: viability-

based integration of the resilience, sustainability, and human-centricity perspectives. *International Journal of Production Research*, 61(5), 1683-1695.

Yin, S., Liu, L., & Mahmood, T. (2023). New Trends in Sustainable Development for Industry 5.0: Digital Green Innovation Economy. Green and Low-Carbon Economy.

Johri, P., Singh, J. N., Sharma, A., & Rastogi, D. (2021, December). Sustainability of coexistence of humans and machines: an evolution of industry 5.0 from industry 4.0. In 2021 10th International Conference on System Modeling & Advancement in Research Trends (SMART) (pp. 410-414). IEEE.

Nahavandi, S. (2019). Industry 5.0—A human-centric solution. Sustainability, 11(16), 4371

https://www.researchgate.net/publication/362490784_Ident ifying_Industry_50_contributions_to_sustainable_development_A_strategy_roadmap_for_delivering_sustainability_values

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https://www.mastercontrol.com/gxp-lifeline/3-things-you-need-to-know-about-industry-5.0/#:~:text=The%20term%20Industry%205.0%20refers,pillars%20of%20automation%20and%20efficiency
·   .
https://www.un.org/en/academic-impact/sustainability
·
https://www.mdpi.com/1996-1073/15/17/6276
·
https://www.twi-global.com/technical-knowledge/faqs/industry-5-0
·
https://aliresources.hexagon.com/articles-blogs/industry-5-0-a-comprehensive-introduction
·   .