A Hybrid Decision Model for Balancing the Technological Advancement, Human Intervention and Business Sustainability in Industry 5.0 Adoption

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Abstract. In Industry 5.0, humans and machines work together, using advanced technologies like Artificial Intelligence (AI), the Internet of Things (IoT), and automation to improve efficiency, productivity, and quality while also supporting sustainable practices and human values. There is a growing interest in learning about the challenges of Industry 5.0 and exploring these technologies to promote sustainability and responsible business practices. We need a hybrid decision model to strike a balance between technical progress, human values, and sustainable practices as we move toward Industry 5.0, which presents enormous challenges in the areas of technology, the environment, society and ethics, and business and economics. Through a literature analysis guided by the PRISMA technique and the Delphi method, the study highlighted challenges in the areas of technology, the environment, society and ethics, and business and economics, as well as solution measures to address them. The weightage of the challenges was determined using the Best Worst Method, and the ranking of the potential solutions was prioritized using the Elimination and Choice Expressing Reality method.

Keywords: Industry 5.0 · Artificial Intelligence · Technological Advancement · Human Values · Sustainable Practices · Challenges · Solution measure

1 Introduction

Ivanov [1] says that Industry 5.0 technologies have the ability to boost productivity, cut costs, and improve efficiency. But Feng et al. [2] the use of AI technologies also brings new problems linked to sustainability and human values. As the world tries to deal with climate change and other environmental problems, it is becoming more important to find

a balance between technological advancement and environmentally friendly methods [3]. At the same time, we need to make sure that growth does not negatively impact important human values like privacy, safety, and security.

Ahmed et al. [4] says that AI's unique technological advances have caused big changes in the business world. Even though these changes have made businesses more efficient, productive, and profitable, they have also made people worry about how they will affect human values and the world. It is important to find a balance between advancements in technology, human values, and sustainable practices so that the benefits of technological progress are shared by many people and do not hurt society or the world [5].

There are two objectives, through which we aim to contribute in this study. First objective is to identify the challenges and solution measures related to balancing technological advancement, human values, and sustainable practices while adopting Industry 5.0. To identify the challenges and solution measures for providing a balance between technological advancement, human values, and sustainable practices while adopting Industry 5.0, we will use the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach for systematic literature identification. We will conduct a comprehensive literature review by searching relevant databases and using search terms related to sustainability, human values, and technological advancements in Industry 5.0. We will also consult with experts to identify additional relevant sources. Through this process, we will identify the challenges and solution measures related to sustainability and human values in Industry 5.0.

Second objective is to analyzed the challenges and rank the solution measure to provide the implications for managers if Industry 5.0 is adopted. For attaining this objective, we will develop the framework through a hybrid Best Worst Method (BWM) - Elimination and Choice Expressing Reality (ELECTRE) approach. The initial inputs taken for BWM comparisons will be used to compute the weight of challenges, while further comparison of challenges and solution measures will be obtained for ELECTRE approach to compute the final ranking of the solution measures to overcome the challenges. This hybrid approach will help the authors provide implications and propositions for addressing the challenges to achieve a balance between technological advancement, human values, and sustainable practices in adoption process of Industry 5.0.

This study is structured as follows: Sect. 2 provides the literature review, Sect. 3 provides the Research gap, Sect. 4 provides the research design, Sect. 5 provides the conclusion.

2 Literature Review

The adoption of Industry 5.0 comes with its fair share of challenges, most of which have to do with finding a balance between advancements in technology, human values, and sustainable practices [6]. Industry 5.0 uses new technologies like artificial intelligence, robotics, and the Internet of Things to make output more efficient and better. But if these technologies are used quickly, they can have bad effects on human values and sustainable practices, like polluting the environment, using a lot of energy, and putting people out of work [7]. When adopting Industry 5.0, it is important to find and solve the challenges of balancing advancements in technology, human values, and sustainable practices.

One of the biggest challenges with implementing Industry 5.0 is that it might negatively impact human values. Sindhwani et al. [3] pointed out that the widespread use of advanced technologies in Industry 5.0 can lead to humans being replaced by robots, which can lead to a loss of jobs and a difference in income. The problem is made worse by the fact that there are not enough training and skill-building chances, which makes it hard for the workforce to keep up with the fast-paced changes in technology [1]. Therefore, it is important to make sure that implementing Industry 5.0 does not undermine human values and to come up with plans to help the workforce adjust to new technologies.

In addition to human values, adopting Industry 5.0 also makes it hard to do things in a way that is good for the environment. According to Sharma et al. [8], the integration of advanced technologies in Industry 5.0 may lead to increased energy consumption, carbon emissions, and waste generation, thereby exacerbating environmental problems. Furthermore, the production processes involved in Industry 5.0 may require the extraction of non-renewable resources, such as rare earth metals, leading to environmental degradation [4].

Several methods can be used to find a balance between advances in technology, human values, and practices that are good for the environment while using Industry 5.0. Maddikunta et al. [9] say that it is important to think about sustainability at every stage of implementing Industry 5.0, from planning to operation. This can be done by making a sustainability roadmap that lists the most important areas to focus on, such as energy efficiency, waste reduction, and assessing the effect on the environment, and sets up metrics to track progress toward sustainability goals. Also, everyone who has an interest in the process needs to be involved, including workers, customers, suppliers, and the wider community. Xu et al. [10] say that this can be done by coming up with a way to adopt Industry 5.0 that encourages collaboration and participation from all stakeholders. This method can help to find and address any worries about how Industry 5.0 will affect human values and the environment, as well as to promote practices that are ethical and good for society. In general, it is possible to find a balance between advancements in technology, human values, and sustainable practices when adopting Industry 5.0. This can be done by taking sustainability into account, involving stakeholders in the implementation process, and creating a culture of sustainable innovation.

3   Research Gap and Theoretical Lens

The study of the literature done on the adoption of Industry 5.0 shows that there are several gaps that need to be filled. First of all, there is not enough study on the challenges that organizations face when trying to balance technological progress, human values, and environmentally friendly practices as they move toward Industry 5.0. Even though there is a lot of writing about the benefits of Industry 5.0, not much of it talks about the trade-offs and problems that may come up. So, there is a need to learn more about the problems organizations may face as they move toward Industry 5.0.

Secondly, the role of human values in shaping the adoption and implementation of Industry 5.0 needs further examination. While some studies have examined the impact of Industry 5.0 on job displacement and skill development, little is known about how values such as ethics, social responsibility, and trust can guide the adoption and use of

Industry 5.0. Therefore, more research is needed to understand how human values can be integrated into the adoption process of Industry 5.0, which can help ensure that the technology aligns with human values and promotes positive outcomes for society.

The identified gaps emphasize the crucial requirement of a framework that can effectively balance technological progress, human values, and sustainable practices in the adoption of Industry 5.0. Moreover, these gaps also highlight the need to use the Multi-Criteria Decision-Making (MCDM) approach for assessing the challenges' severity and prioritizing solution measures. Therefore, the defined research objectives are validated by these findings.

The theoretical lens for this research will be grounded in the Multi-Criteria Decision-Making approach, which provides a framework for assessing and prioritizing the challenges and solutions related to balancing technological advancement, human values, and sustainable practices in the adoption of Industry 5.0. The MCDM approach enables decision-makers to evaluate multiple criteria simultaneously, including economic, social, environmental, and ethical factors, and make informed decisions based on a set of predetermined criteria. By using this approach, the research will be able to address the identified research gaps and provide a comprehensive understanding of the challenges and solution measures related to the adoption of Industry 5.0. Additionally, the MCDM approach can help policymakers and industry leaders make informed decisions about the future of Industry 5.0, based on a balanced consideration of technological advancement, human values, and sustainable practices.

4   Research Design

The study follows a positivism research paradigm as this study consists of two research designs. To develop a framework for balancing technological advancement, human values, and sustainable practices while adopting Industry 5.0, an exhaustive literature review was carried out to identify the key challenges and solution measures required to overcome them. These challenges and solution measure were then tabulated and presented before the decision panel for finalization. Based on the expert feedback, a framework was developed and tested using a combination of different methodologies [11]. A hybrid BWM-ELECTRE approach was used to rank the solution measures identified through the literature review. The BWM approach was utilized for computing the weight of the challenges, while the ELECTRE approach was used to identify high-priority solutions.

The study further discusses the relationship between the challenges and their solution measures by describing how these top-priority solutions will assist in balancing technological advancement, human values, and sustainable practices while adopting Industry 5.0. The implications of the study's findings for researchers and practitioners are also presented. The overall flow of present research work are as follows in Fig. 1.
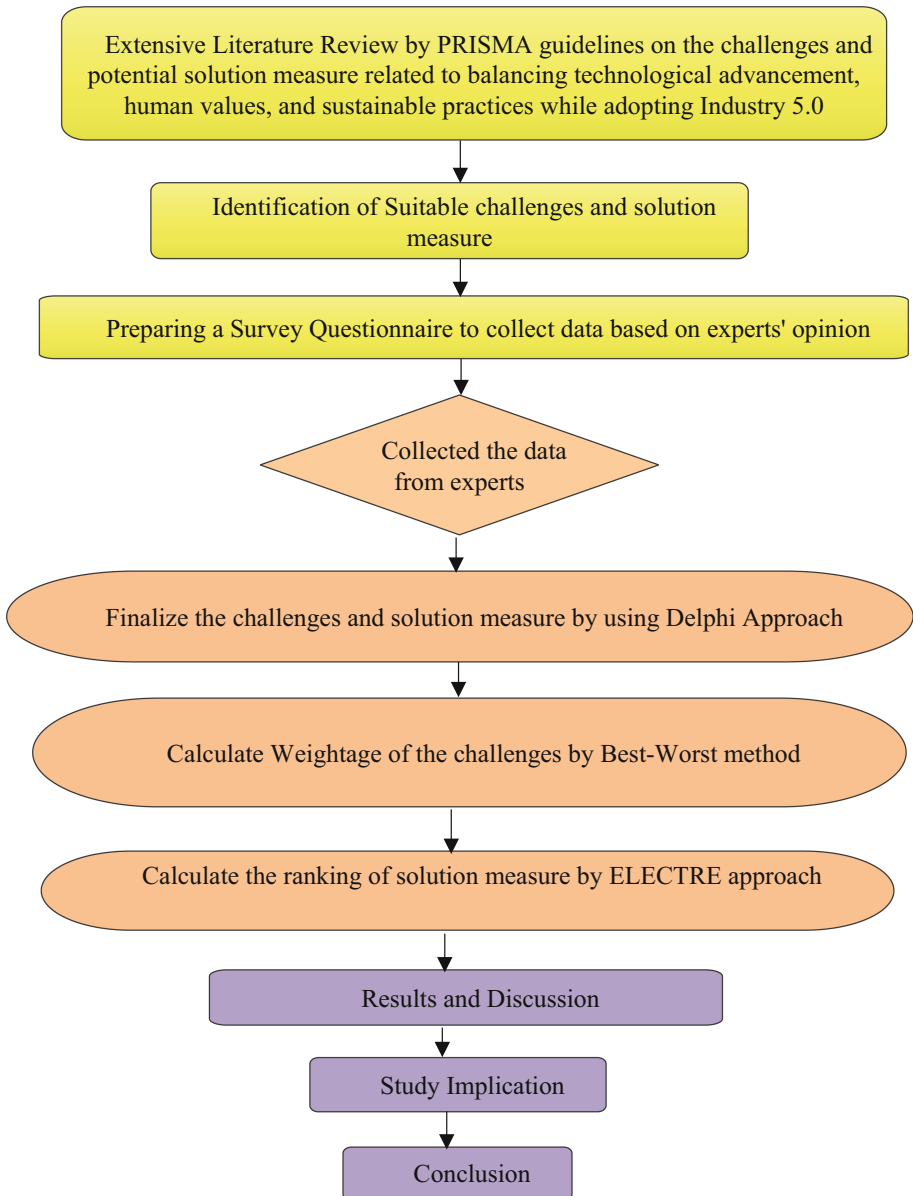
Extensive Literature Review by PRISMA guidelines on the challenges and potential solution measure related to balancing technological advancement, human values, and sustainable practices while adopting Industry 5.0

Identification of Suitable challenges and solution measure

Preparing a Survey Questionnaire to collect data based on experts' opinion

Collected the data from experts

Finalize the challenges and solution measure by using Delphi Approach

Calculate Weightage of the challenges by Best-Worst method

Calculate the ranking of solution measure by ELECTRE approach

Results and Discussion

Study Implication

Conclusion

Fig. 1. The present research workflow

5   Conclusion

The results of this study will help us figure out how to balance advancements in technology, human values, and sustainable practices during the Industry 5.0 adoption process. The results of this study will be useful for policymakers, business leaders, and others who

have a stake in bringing Industry 5.0 to action. The study will show the possible challenges and solution measures of Industry 5.0, and it will help decision-makers to decide about the Industry 5.0 future. In the end, the results of this study will help to make policies and plans that encourage Industry 5.0 to be used in a responsible way. By finding a balance between technological progress, human values, and sustainable practices, we can make sure that Industry 5.0 is good for society as a whole while minimizing the negative effects possible on individuals and the environment.

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