

## **AN INNOVATIVE METHOD FOR OPTIMIZING BUSINESS PROCESSES IN INDUSTRY 4.0 USING AI-BASED IOT**

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### **Abstract**

This article highlights the creative and innovative methods that help in optimising the business process in Industry 4.0 by using artificial intelligence (AI) based IoT. This article has enlightened the fact that AI and IOT share a deep bond that significantly provides greater efficiency by improving the decision-making process and reducing overall costs. Here the importance of AI-based IoT in developing innovative ways has been jotted down. Moreover, the lean management theory has been used to provide a better understanding of this research topic. This article has followed the secondary qualitative method to analyse the role of AI-based IoT in industry 4.0. Apart from this, the limitations and future scope of this article have been provided.

**Keywords:** AI-based IoT, industry 4.0, revenue, business operation, technology-based operation

### **INTRODUCTION**

#### **Introduction**

Industry 4.0 is a considerable process that can enhance industrial business procedures and AI-based IOT can integrate different business approaches related to things by following differential analytical methods crucially. High-quality services can bring innovation and exponential business attributes crucially to have quality business procedures.

This chapter illustrates and explains the background of the study with more statistical information and all of them are crucial in making the analytical procedure smoother. All the research questions are made in such a manner so that a link can be created with the proper significance of the study. All of such research questions as well as objectives are made to have future study prospects.

### **Research objectives**

The research objectives for this article are represented as below:

- To analyse the business processes in Industry 4.0 using AI Based IoT
- To evaluate the innovation aspect of this business with the help of Industry 4.0 using AI Based IoT
- To outline the challenges related to the business processes in Industry 4.0 using AI-Based IoT

### **Research questions**

RQ1: What are the effects of business processes in Industry 4.0 using AI Based IoT?

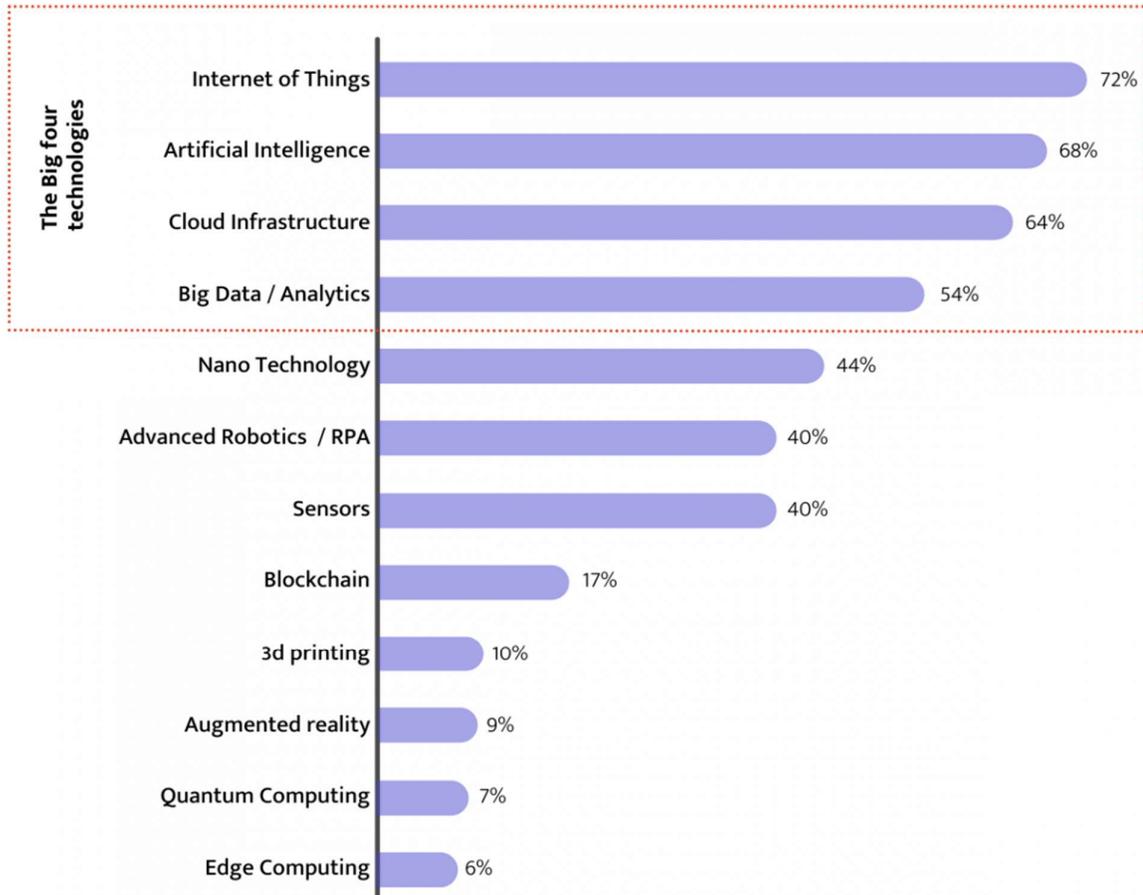
RQ2: How to evaluate the innovation aspect of this business with the help of Industry 4.0 using AI Based IoT?

RQ3: What are the challenges related to the business processes in Industry 4.0 using AI Based IoT?

### **Background**

The IoT is such an important process that can help the management to have a personalised service-based procedure within the industry. This process is important in having a sensor to sensor communication. As stated by Jamwal *et al.* (2021), this process of communication system is important in increasing the overall production attributes considerably. Industry 4.0 companies are achieving value for innovation attributes in reducing as well as in increasing the system-based aspects.

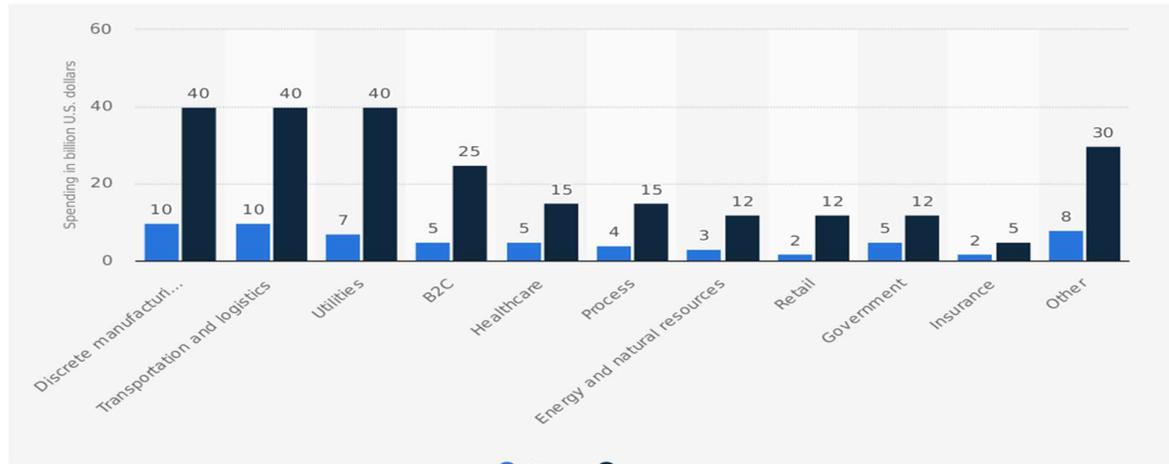
## Importance of IoT in Industry 4.0



**Figure 1: Importance of AI-based IoT practices**

(Source: Wang *et al.* 2020)

It is also a glorious fact that companies with 4.0 procedures are considerably availing of important aspects and also prone to apply innovation significantly. As per the critical analysis by Nica & Stehel (2022), important company attributes can be altered with this innovative approach crucially. From this figure, it is evaluated that IoT can be applied in different scopes and aspects of business practices and it can systematically enhance the subjective attributes of the company.



**Figure 2: Increased acceptance of AI-based IoT practices**

(Source: Tsaramirsiset *al.* 2020)

Moreover, the spending habits of the industries have been considerably changed according to the significant needs of the business scenarios crucially and the total expenses in these attributes have also changed in recent days. As stated by Tsaramirsis *et al.* (2022), the link between bringing smart practices as well as innovation can change the existing business perspectives of the companies. Moreover, figure 2 is intended to show that increased acceptance of IoT procedures is a consideration as well as a distinct concept that is considerably related to each other and it can change the perspectives of the business scenario.

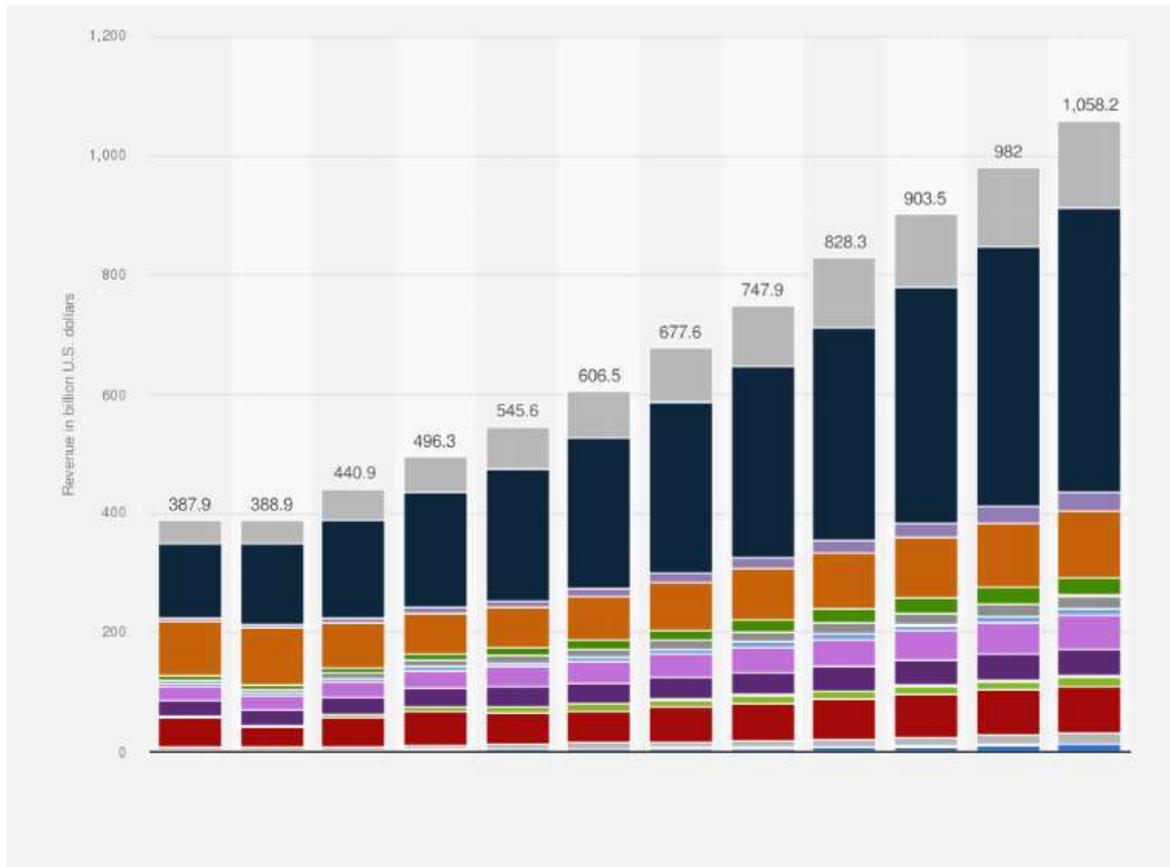
## LITERATURE REVIEW

### Introduction

The chapter literature review is important as well as intended to provide an important analysis of the given concept of literature. These are subjectively connected to the important attributes of the business procedures for industry 4.0 using AI Based IoT. The given analysis is important in taking evaluation-based analysis on the given concept of research significantly. Moreover, this approach is important in bringing effective business attributes to the company procedures.

### Benefits of AI-based IoT in bringing innovation-based industry

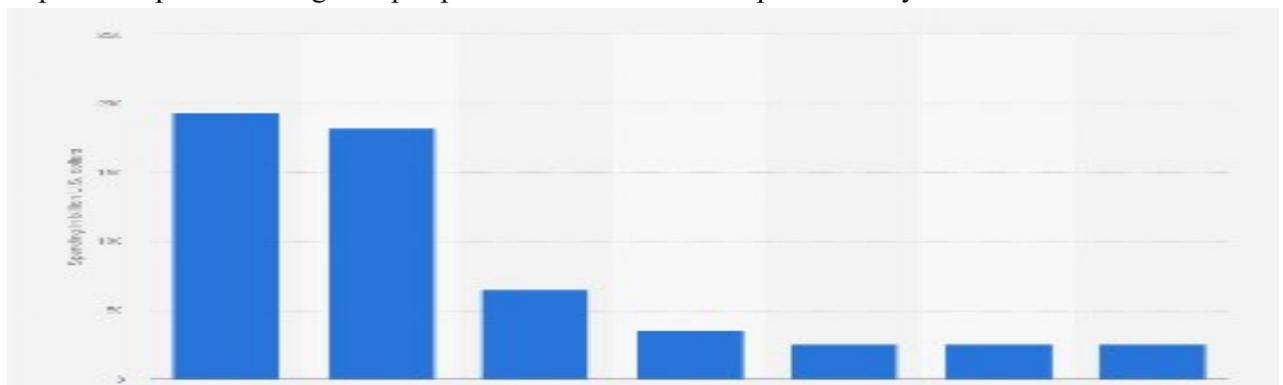
Different business and industrial manufacturing procedures can be optimised as well as changed according to the IoT-based industrial procedures for the industry significantly. As stated by Choi *et al.* (2022), the marketing trends and global business procedures can be evolved with effective business procedures and this can be achieved only by using AI Based IoT. effective business procedures can attain flexibility, higher production, increased business productivity, and innovation with the help of AI-based IoT practices considerably.



**Figure 3: Increased Revenue with effective AI Based IoT**

(Source: Statista, 2022)

These business procedures with effective AI Based IOT can bring increased as well as effective procedures within the business attribute considerably. The revenue generation after this application of AI-based IoT practices has increased up to 1058.2 billion US dollars in recent years (Statista, 2022). This process can provide huge benefits within the considerable business procedures for different industrial aspects. Man, Machine, Materials and Method are such important aspects to change the perspectives of the business aspects reliably.

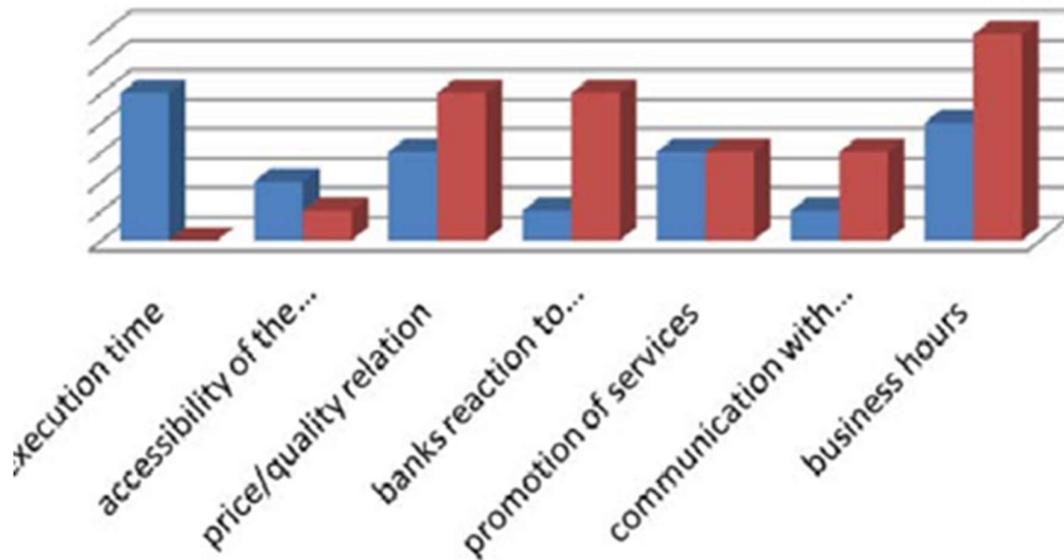


**Figure 4: Effective AI Based IOT to change business perspectives in recent years**

(Source: Statista, 2022)

These IoT based practices are highly innovative in bringing more effective procedures within the industrial practices. As commented by Wang *et al.* (2020), the AI based IoT practices are

important in providing improved management and personalised services and effective operations with censored communication procedures. It stated the effective approach of communication is highly relevant in cleaning business doubts to have profound business and it is also changing the spending perspectives. As per the figure 4, this process is also very much relevant in managing the significant business attributes for different industries crucially. It recolonizes important company manufacturing attributes and also improves the business products.



**Figure 5: Different approach of using AI based IoT in 4.0 industries**

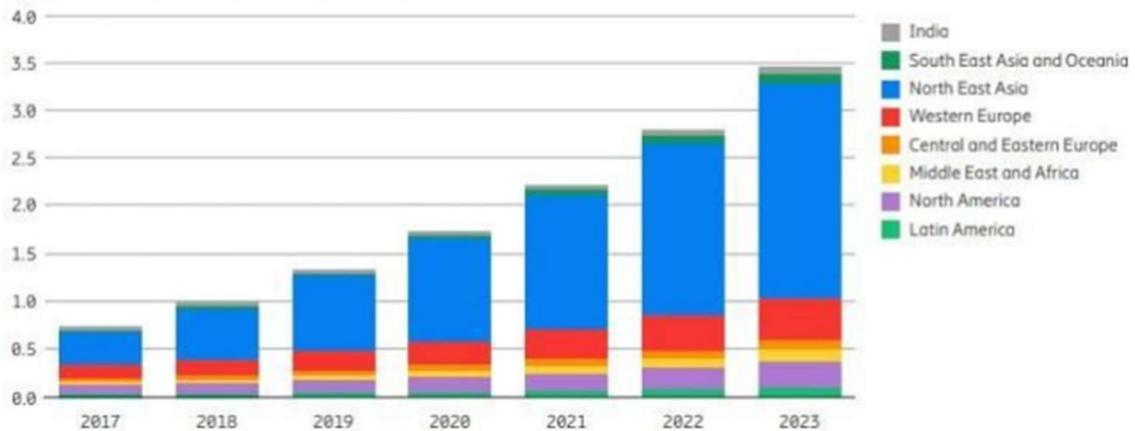
(Source: Ahmed *et al.* 2022)

AI and the approach of effective machine learning is significant in facilitating higher production volume for any industrial attribute. According to figure 5, AI based procedures have a significant effect on differential business perspectives considerably, such as manufacturing time, revenue, quality production, and communication. As stated by Lim *et al.* (2021), strategic implementations for different business practices are considered relevant in this significant business attribute. It increases the efficiency of the existing business procedures and also manages all sorts of business needs for the company and people. Moreover, it accelerates the process of innovation within the effective business aspects.

#### **Relation between AI-based IoT and industry 4.0**

IoT-based procedures are a considerable part of increasing the business aspects of the 4.0 industry. As stated by Sassanelli *et al.* (2022), this business approach increases the total communication perspectives and is also responsible for increasing the overall business aspects considerably. As stated by Benotsmane *et al.* (2022), it increases the overall business activities of the firms and also enhances the ways to increase the overall revenue.

As stated by Ferreira *et al.* (2022), big data, IoT, and AI-based procedures are highly incredible in changing the business credibility of the industry. Moreover, this process can facilitate well-defined business procedures for the firm.



**Figure 6: Future scope of AI based procedures**

(Source: Tsaramirsis *et al.* 2022)

The business practices in IoT-based procedures are highly sensitive in taking quality perspectives of the industrial procedures and according to figure 6, it is assumed that the business approach based on AI based procedures has a great future scope and people are becoming more prone to adopt these technological procedures considerably.

### Theory

#### Lean Management theory

The lean management theory is developed in such a manner so that it can optimise all sorts of business time values crucially. As stated by Spanaki *et al.* (2021), with the systematic approach of the lean management theory all the procedures that consume important business times are taken to save production time. This approach to business aspects causes poor quality and creates complications within the business times. Moreover, this theory sets important management aspects within consumable business procedures. All sorts of business methods are supported with the help of crucial managerial dimensions to ensure quality work and the best working conditions for all employees. As stated by Sassanelli *et al.* (2022), purpose, process, people, and performance are impactful attributes of the lean management theory.

#### METHODOLOGY

This study is processed with the help of a secondary qualitative method and all the information is collected from different scholarly sources of research. Additionally, only the relevant information is collected and evaluated in this study aspects and perspectives to have more attainable results in these significant business procedures considerably. Moreover, as critically mentioned by Ahmed *et al.* (2022), the secondary method of research is also very much reliable in taking significant as well as critical analysis of the firm procedures. Moreover, the secondary method of research is highly cost-effective and it can help in obtaining better results within the organisational procedures in the context of AI-based IoT practices. Moreover, it helps in collecting real images within the organizational practices and it is also highly important in taking brief considerations of the total research perspectives. However, thematic analysis is performed by taking the considerations of all sorts of research valuable aspects and a review of the quality data is important in measuring the study outcomes.

### RESULT

#### Quality review

<b>Authors</b>	<b>Study design</b>	<b>Number of resources</b>	<b>Measured outcomes</b>	<b>Result</b>	<b>Quality review</b>
Jamwal <i>et al.</i> 2021	Secondary qualitative	22	Industrial 4.0 procedures are highly considerable in ensuring manufacturing sustainability if the firms	Industrial 4.0 procedures are crucial in ensuring manufacturing sustainability of industries that are taken 4.0 procedures	High
Benotsmane, Kovács & Dudás, 2019	Secondary qualitative	28	The economic, social and operational impact of the smart industries with 4.0 is focused on their accepted collaborating artificial intelligence and simulation procedures	AI procedures in 4.0 industries have a great impact on the social, economic, and operational procedures	High
Rahman <i>et al.</i> 2020	Secondary qualitative	18	AI based activities in industry 4.0 services can be applied in security process enhancement through software-	AI based approaches in industries 4.0 are used in increasing security aspects with block chained procedures	Moderate

			defined networking-IoT enabled architecture		
Nica &Stehel, 2021	Secondary qualitative	20	Internet of things sensing networks, artificial intelligence-based decision-making algorithms, and real-time process monitoring is helpful in maintaining sustainability	Different AI based procedures can change the monitoring aspects to maintain the sustainability of industrial procedures	High

**Table 1: Quality review**

(Source: By learner)

**Thematic coding**

Author	Code	Themes
Jamwalet <i>et al.</i> 2021	Industrial 4.0 procedures, manufacturing sustainability	Industrial 4.0 procedures are highly considerable in ensuring manufacturing sustainability if the firms
Rahman <i>et al.</i> 2020	AI, IoT, security aspects, blockchain	AI based approaches in industries 4.0 are used in increasing security aspects with block chained procedures

**Table 2: Thematic coding**

(Source: By learner)

**Industrial 4.0 procedures are highly considerable in ensuring manufacturing**

### sustainability if the firms

Recent developmental and sustainable manufacturing processes can increase the industrial procedures for different firms. As stated by Jamwal *et al.* (2021), manufacturing, data management, and production procedures are important in optimising all sorts of industrial procedures. 4.0 industrial practices are a considerably broad domain and it enables a wide range of technological attributes of the firm crucially. Business strategies are also required to be made in such a manner so that they can be significant in maintaining the sustainability procedures for the firm reliably. However, the sustainability agenda 2030 is set in such a manner that it includes smart manufacturing techniques within the firm procedures considerably.



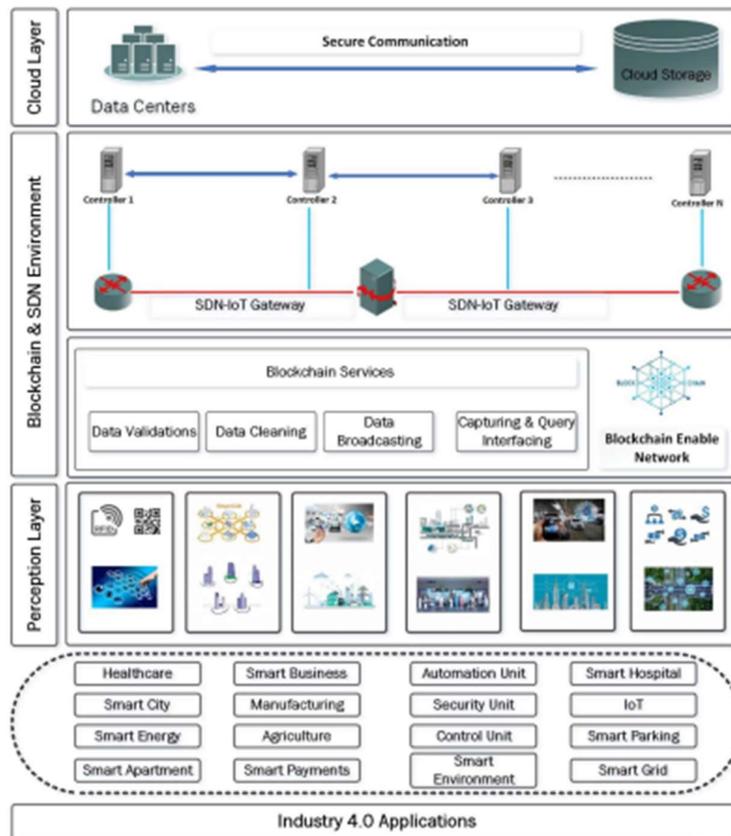
**Figure 7: Total publication of AI based sustainability studies**

(Source: Jamwal *et al.* 2021)

The acceptance of the smart manufacturing attributes is shown in this figure 8. Sustainability business strategies are made according to the norms of the United Nations (UN) and different modern technologies are important in bringing energy-efficient procedures within the industries (Asif, 2020).

### AI based approaches in industries 4.0 are used in increasing security aspects with block chained procedures

The AI based monitoring procedures emerge from the modern attributes and technological supremacy of different firms. As stated by Meindl *et al.* (2021), efficient technologies are highly considerable in mentioning challenges related to these business attributes crucially. “Internet of Things (IoT), Big Data, Artificial Intelligence (AI), Software Defined Networking (SDN), and Blockchain (BC)” for managing security aspects of the data are taken into consideration. Block chain procedures are significant in taking as well as maintaining robust approach and confidentiality of the desired system of the firms.



**Figure 8: Blockchain procedures for Industry 4.0**

(Source: Rahman *et al.* 2020)

Industry 4.0 has successfully applied this blockchain technology to manage the overall systematic procedures of the operational procedures of the firms. Finally, performance agendas are taken into procedure to manage the considerable blockchain procedures of the firms. As stated by Benotsmane *et al.* (2019), this process is highly compatible with controlling the manufacturing mechanisms of firms.

### Discussion

From the overall analysis, it has been evaluated that the AI-based IoT procedures are important in increasing the operational efficiency and revenue creation aspects for the firms in 4.0 industries. As stated by Sassanelli *et al.* (2022), well-developed technology is important in increasing the manufacturing efficiency of firms.

### CONCLUSION

The AI based IoT practices are highly considerable in taking effective procedures for optimising the manufacturing procedures. Moreover, effective technologies are important in increasing the business approaches for the firm crucially. Effective strategy-making in increasing AI based procedures is important in taking consideration of the subject-based procedures of the firms. However, competitive manufacturing is also a part of this advanced business approach and it is also remarkable in bringing effective aspects to the firm crucially. operational practices are also very much important in this aspect and it can change the organisational perspectives of the firms crucially. AI based IoT procedures in 4.0 industries are also relevant in increasing business efficiency and revenue.

**Limitations**

This study is based on secondary research and this method has a few drawbacks as it restricts the total study practices crucially and this method is also lacking statistical information relevant to the total research procedures considerably. Moreover, the mono method of the data is also limited in having the true analysis of the research approach based on the AI based IoT practices on 4.0 industries.

**FUTURE SCOPE**

There are many areas that have been covered in this study aspect considerably. This study has mentioned differential aspects based on the AI based IoT practices and from this analysis future strategic approach to enhance the 4.0 industrial situation can be taken and optimised.

## Reference list

Ahmed, I., Jeon, G., & Piccialli, F. (2022). From artificial intelligence to explainable artificial intelligence in industry 4.0: a survey on what, how, and where. *IEEE Transactions on Industrial Informatics*, 18(8), 5031-5042. Retrieved from: <https://ieeexplore.ieee.org/abstract/document/9695219/> [on 6<sup>th</sup> October, 2022]

Ahmed, I., Jeon, G., & Piccialli, F. (2022). From artificial intelligence to explainable artificial intelligence in industry 4.0: a survey on what, how, and where. *IEEE Transactions on Industrial Informatics*, 18(8), 5031-5042. Retrieved from: <https://ieeexplore.ieee.org/abstract/document/9695219/> [on 6<sup>th</sup> October, 2022]

Asif, M. (2020). Are QM models aligned with Industry 4.0? A perspective on current practices. *Journal of Cleaner Production*, 258, 120820. Retrieved from: <https://www.sciencedirect.com/science/article/pii/S0959652620308672> [on 6<sup>th</sup> October, 2022]

Benotmane, R., Kovács, G., & Dudás, L. (2019). Economic, social impacts and operation of smart factories in Industry 4.0 focusing on simulation and artificial intelligence of collaborating robots. *Social Sciences*, 8(5), 143. Retrieved from: <https://www.mdpi.com/458724> [on 6<sup>th</sup> October, 2022]

Benotmane, R., Kovács, G., & Dudás, L. (2019). Economic, social impacts and operation of smart factories in Industry 4.0 focusing on simulation and artificial intelligence of collaborating robots. *Social Sciences*, 8(5), 143. Retrieved from: <https://www.mdpi.com/458724> [on 6<sup>th</sup> October, 2022]

Choi, T. M., Kumar, S., Yue, X., & Chan, H. L. (2022). Disruptive technologies and operations management in the Industry 4.0 era and beyond. *Production and Operations Management*, 31(1), 9-31. Retrieved from: <https://search.proquest.com/openview/1165add5dab4befab6947686f730a8f2/1?pq-origsite=gscholar&cbl=2045090> [on 6<sup>th</sup> October, 2022]

Ferreira, L., Putnik, G. D., Varela, M. L. R., Manupati, V. K., Lopes, N., Cunha, M., ... & Castro, H. (2022). A Framework for Collaborative Practices Platforms for Humans and Machines in Industry 4.0–Oriented Smart and Sustainable Manufacturing Environments. In *Smart and Sustainable Manufacturing Systems for Industry 4.0* (pp. 1-24). CRC Press. Retrieved from: <https://www.mdpi.com/458724> [on 6<sup>th</sup> October, 2022]

Ferreira, L., Putnik, G. D., Varela, M. L. R., Manupati, V. K., Lopes, N., Cunha, M., ... & Castro, H. (2022). A Framework for Collaborative Practices Platforms for Humans and Machines in Industry 4.0–Oriented Smart and Sustainable Manufacturing Environments. In *Smart and Sustainable Manufacturing Systems for Industry 4.0* (pp. 1-24). CRC Press. Retrieved from: <https://www.mdpi.com/458724> [on 6<sup>th</sup> October, 2022]

Jamwal, A., Agrawal, R., Sharma, M., & Giallanza, A. (2021). Industry 4.0 technologies for manufacturing sustainability: a systematic review and future research directions. *Applied*

*Sciences*, 11(12), 5725. Retrieved from: <https://www.mdpi.com/1157056> [on 6<sup>th</sup> October, 2022]

Lim, C. H., Lim, S., How, B. S., Ng, W. P. Q., Ngan, S. L., Leong, W. D., & Lam, H. L. (2021). A review of industry 4.0 revolution potential in a sustainable and renewable palm oil industry: HAZOP approach. *Renewable and Sustainable Energy Reviews*, 135, 110223. Retrieved from: <https://www.sciencedirect.com/science/article/pii/S1364032120305128> [on 6<sup>th</sup> October, 2022]

Meindl, B., Ayala, N. F., Mendonça, J., & Frank, A. G. (2021). The four smarts of Industry 4.0: Evolution of ten years of research and future perspectives. *Technological Forecasting and Social Change*, 168, 120784. Retrieved from: <https://www.emerald.com/insight/content/doi/10.1108/JIC-09-2019-0224/full/html> [on 6<sup>th</sup> October, 2022]

Nica, E., & Stehel, V. (2021). Internet of things sensing networks, artificial intelligence-based decision-making algorithms, and real-time process monitoring in sustainable industry 4.0. *Journal of Self-Governance and Management Economics*, 9(3), 35-47. Retrieved from: <https://search.proquest.com/openview/1165add5dab4befab6947686f730a8f2/1?pq-origsite=gscholar&cbl=2045090> [on 6<sup>th</sup> October, 2022]

Rahman, A., Sara, U., Kundu, D., Islam, S., Islam, M., Hasan, M., ... & Nasir, M. K. (2020). Distb-sdoindustry: Enhancing security in industry 4.0 services based on distributed blockchain through software defined networking-iot enabled architecture. *arXiv preprint arXiv:2012.10011*. Retrieved from: <https://arxiv.org/abs/2012.10011> [on 6<sup>th</sup> October, 2022]

Sassanelli, C., Arriga, T., Zanin, S., D'Adamo, I., & Terzi, S. (2022). Industry 4.0 Driven Result-Oriented PSS: An Assessment in the Energy Management. *Int. J. Energy Econ. Policy*, 12(4), 186-203. Retrieved from: [https://www.researchgate.net/profile/Claudio-Sassanelli/publication/362121433\\_Industry\\_40\\_Driven\\_Result-oriented\\_PSS\\_An\\_Assessment\\_in\\_the\\_Energy\\_Management/links/62de5434f3acdd5dc21835dc/Industry-40-Driven-Result-oriented-PSS-An-Assessment-in-the-Energy-Management.pdf](https://www.researchgate.net/profile/Claudio-Sassanelli/publication/362121433_Industry_40_Driven_Result-oriented_PSS_An_Assessment_in_the_Energy_Management/links/62de5434f3acdd5dc21835dc/Industry-40-Driven-Result-oriented-PSS-An-Assessment-in-the-Energy-Management.pdf) [on 6<sup>th</sup> October, 2022]

Sassanelli, C., Arriga, T., Zanin, S., D'Adamo, I., & Terzi, S. (2022). Industry 4.0 Driven Result-Oriented PSS: An Assessment in the Energy Management. *Int. J. Energy Econ. Policy*, 12(4), 186-203. Retrieved from: [https://www.researchgate.net/profile/Claudio-Sassanelli/publication/362121433\\_Industry\\_40\\_Driven\\_Result-oriented\\_PSS\\_An\\_Assessment\\_in\\_the\\_Energy\\_Management/links/62de5434f3acdd5dc21835dc/Industry-40-Driven-Result-oriented-PSS-An-Assessment-in-the-Energy-Management.pdf](https://www.researchgate.net/profile/Claudio-Sassanelli/publication/362121433_Industry_40_Driven_Result-oriented_PSS_An_Assessment_in_the_Energy_Management/links/62de5434f3acdd5dc21835dc/Industry-40-Driven-Result-oriented-PSS-An-Assessment-in-the-Energy-Management.pdf) [on 6<sup>th</sup> October, 2022]

Spanaki, K., Karafili, E., & Despoudi, S. (2021). AI applications of data sharing in agriculture 4.0: A framework for role-based data access control. *International Journal of Information Management*, 59, 102350. Retrieved from: <https://onlinelibrary.wiley.com/doi/abs/10.1111/poms.13622> [on 6<sup>th</sup> October, 2022]

Statista, 2021, *AI based procedures in worldwide 2021, by metric* Retrieved from: [https://www.statista.com/statistics/1192298/AI based procedures-score-worldwide-by-aspect/](https://www.statista.com/statistics/1192298/AI-based-procedures-score-worldwide-by-aspect/) [on 6<sup>th</sup> October, 2022]

Tsaramirsis, G., Kantaros, A., Al-Darraji, I., Piromalis, D., Apostolopoulos, C., Pavlopoulou, A., ... & Khan, F. Q. (2022). A modern approach towards an industry 4.0 model: From driving technologies to management. *Journal of Sensors*, 2022. Retrieved from: <https://www.hindawi.com/journals/js/2022/5023011/> [on 6<sup>th</sup> October, 2022]

Tsaramirsis, G., Kantaros, A., Al-Darraji, I., Piromalis, D., Apostolopoulos, C., Pavlopoulou, A., ... & Khan, F. Q. (2022). A modern approach towards an industry 4.0 model: From driving technologies to management. *Journal of Sensors*, 2022. Retrieved from: <https://www.hindawi.com/journals/js/2022/5023011/> [on 6<sup>th</sup> October, 2022]

Wang, M., Wang, C. C., Sepasgozar, S., & Zlatanova, S. (2020). A systematic review of digital technology adoption in off-site construction: Current status and future direction towards industry 4.0. *Buildings*, 10(11), 204. Retrieved from: <https://www.mdpi.com/889546> [on 6<sup>th</sup> October, 2022]

Wang, M., Wang, C. C., Sepasgozar, S., & Zlatanova, S. (2020). A systematic review of digital technology adoption in off-site construction: Current status and future direction towards industry 4.0. *Buildings*, 10(11), 204. Retrieved from: <https://www.mdpi.com/889546> [on 6<sup>th</sup> October, 2022]