

# An Empirical Analysis of Customer Perception Towards IoT-Enabled Containerized Manufacturing Systems

<sup>1</sup>SAM JACOB J, <sup>2</sup>SANDHYA V

<sup>1</sup>STUDENT, <sup>2</sup>ASSITANT PROFESSOR

<sup>1</sup>SCHOOL OF MANAGEMENT STUDIES

<sup>1</sup>SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY, CHENNAI, INDIA

[1jsamjacob43@gmail.com](mailto:1jsamjacob43@gmail.com), [2prof.sandhya.v@gmail.com](mailto:2prof.sandhya.v@gmail.com)

**Abstract** - The research outlines what customers think of IoT based manufacturers who utilize manufacture by containerized system modern-day industries. The take a look at is to spotlight how operational efficiencies (through both effectiveness and performance improvements), product quality, value control and overall clients delight are impacted via way of means of those technology and services. This studies followed a descriptive studies design. The primary data collection method used was a quantitative method with questions related to both the technology and the support by constructing a standardized questionnaire with 114 respondents. Once the data from the respondents was collected analytical tools including percentage analysis and weighted average were used to review the data. The findings of this study show that there is a favourable sentiment towards the efficiencies, flexibilities and monitoring capabilities offered to businesses through the use of IoT based systems, however many have noted their concerns over the high cost of implementing and securing data from on IoT enabled manufacturers are providing significant benefits to customers and additional challenges, like the implementation costs and security of data, should be addressed before further implementation and reputation of those structures can occur.

**Keywords** - IoT, Containerized Manufacturing, client Perception, functional effectiveness, Product Quality, Cost operation, Data Security, client Satisfaction, Smart Manufacturing, Industrial Automation

## I. INTRODUCTION

Transformer industry powered by automation and the Internet of Things. The Internet of Things (IoT) powered containerized manufacturing is a unique combination of smart sensors and connected devices blended with data analytics to aid providing efficient and flexible manufacturing environments. These technology permit businesses to enhance their operations and quality, and increase productivity and efficiency through real-time monitoring and better control and faster decisions. The containerized manufacturing system helps easily adapt to the requirements of modern manufacturers and to scale up as and when necessary. Customer adoption of IoT powered containerized manufacturing systems depends actually on the cost of carrying out implementation, data security measures taken and the extent of attention of users. Customer perception towards the effectiveness and acceptance of IoT powered manufacturing systems is important, this study aims to analyze and compare the perception of customers on efficiency, quality, cost, satisfaction level and the problems related to their usage.

## II. LITERATURE REVIEW

Those currently available research papers present studies on the increasingly important role Of IoT in contemporary-day production systems.

- While utilizing IoT in Industry 4.0, Kalsoom et al. (2021) "monitor precise regards to operational efficiency, automation, and improvement in real-time monitoring of manufacturing environments." The complexity of IoT systems and data security has been cited as a serious concern.
- Industry 4.0 generation aids in digitalizing organizational strategies through IoT and improving commercial organization performance, according to Zhang et al. (2021). Nonetheless, there are still certain implementation restrictions, such as investment costs and technical integration.
- Usman et al. (2024) observed "IoT enables a host of application areas, such as predictive maintenance, monitoring equipment, and predicting issues before they arise, and thus reduces downtime and toda's complex assembly lines. Through monitoring via a multitude of sensors, the Internet of Things helps improve productivity of factories".

### Research gap

While existing literature emphasizes the technical advantages and performance gains of IoT in manufacturing, there remains a notable lack of research addressing customer perception, satisfaction, and the challenges associated with IoT-integrated containerized manufacturing systems.

## III. RESEARCH METHODOLOGY

### 1. Research Design

This study adopts a descriptive approach, thoughtfully designed to explore and understand how customers perceive, feel about, and relate to IoT-integrated manufacturing systems. By focusing on their lived experiences and viewpoints, the research aims to reflect genuine human perspectives within this evolving technological landscape.

## 2. Data Sources

Primary data was gathered directly from participants through a carefully structured questionnaire, allowing their voices to be heard and valued. Complementing this, secondary data was drawn from reputable academic journals, published research, and trusted online resources, ensuring a well-rounded and knowledgeable basis for the study.

## 3. Analytical Tools

To interpret responses on demographics and general insights, percentage analysis was applied—offering clarity and simplicity. For questions using Likert scales, which capture the depth of attitudes and feelings, the weighted average method was employed to honor the nuances in participants' opinions.

## 4. Sampling Approach

The study engaged 114 participants through convenience sampling, selecting individuals who were readily accessible and willing to share their thoughts. While practical, this approach was carried out with awareness and respect for the diversity and authenticity each respondent delivered to the research.

## IV. DISCUSSION AND BODY CONTENT

### A) Concept explanation

After IoT-enabled containerized manufacturing systems refer to the integration of smart sensors, connected devices, and data analytics into modular production units. These systems help industries achieve improved efficiency, better quality output, and enhanced decision-making through real-time data monitoring.

Key concepts include:

- **Operational Efficiency:** Improving productivity with minimal resource usage.
- **Product Quality:** Ensuring consistent and defect-free output.
- **Cost-effectiveness:** Lowering ongoing operating cost.
- **Customer Satisfaction:** Meeting user expectations effectively.
- **Challenges:** Issues as high cost and data security risks.

### B) Argument/ Analysis

The study uses the weighted average method to analyze Likert scale responses. Each option is assigned a weight from 5 to 1, and the overall score is calculated the same organization).

#### Formula:

$$\text{Weighted average} = (\sum [(f \times w)] ) / (\sum f)$$

This method helps in identifying the overall opinion of respondents. The results show a generally positive perception towards IoT-enabled manufacturing systems.

## Q7. Improves operational efficiency

Table 1

<i>Response</i>	<i>Frequency (f)</i>	<i>Weight (w)</i>	<i>f × w</i>
SA	42	5	210
A	36	4	144
N	20	3	60
D	10	2	20
SD	6	1	6
Total	114		440

Weighted average =  $440/114 = 3.86$

Interpretation: Agree (Respondents believe IoT improves efficiency)

**Q11. Ensures better quality output**

Table 2

<i>Response</i>	<i>Frequency (f)</i>	<i>Weight (w)</i>	<i>f × w</i>
SA	40	5	200
A	38	4	152
N	18	3	54
D	12	2	24
SD	6	1	6
Total	114		436

Weighted Average =  $436/114 = 3.82$

Interpretation: Agree (IoT improves product quality)

**Q12. Leads to cost reduction.**

Table 3

<i>Response</i>	<i>Frequency (f)</i>	<i>Weight (w)</i>	<i>f × w</i>
SA	35	5	175
A	34	4	136
N	22	3	66
D	14	2	28
SD	9	1	9
Total	114		414

Weighted average =  $414/114 = 3.63$

Interpretation: Agree (Cost reduction is perceived, but slightly moderate)

**Q17. Data security is a concern**

Table 4

<i>Response</i>	<i>Frequency (f)</i>	<i>Weight (w)</i>	<i>f × w</i>
SA	30	5	150
A	32	4	128
N	25	3	75
D	16	2	32
SD	11	1	11
Total	114		396

Weighted Average =  $396/114 = 3.47$

Interpretation: Agree (Security is a noticeable concern)

**Q19. Overall satisfaction**

Table 5

<i>Response</i>	<i>Frequency (f)</i>	<i>Weight (w)</i>	<i>f × w</i>
SA	38	5	190
A	36	4	144
N	20	3	60
D	12	2	24
SD	8	1	8
Total	114		426

Weighted average =  $426/114 = 3.74$

Interpretation: Agree (Overall satisfaction is positive)

**Weighted average calculation (n = 114)**

Table 6

<i>Q. No</i>	<i>Statement</i>	<i>SA</i>	<i>A</i>	<i>N</i>	<i>D</i>	<i>SD</i>	<i>Total score</i>	<i>Weighted Average</i>	<i>Interpretation</i>
Q7	Improves operational efficiency	42	36	20	10	6	440	3.86	Agree
Q8	Increases flexibility in production	38	34	22	12	8	424	3.72	Agree
Q9	Reduces human errors	40	35	20	11	8	430	3.77	Agree
Q10	Enhances real-time monitoring	44	32	18	12	8	434	3.80	Agree
Q11	Ensures better quality output	40	38	22	18	12	436	3.82	Agree
Q12	Leads to cost reduction	35	34	22	14	9	414	3.63	Agree
Q13	Allows quick deployment & scalability	37	33	24	12	8	421	3.69	Agree
Q14	Improves decision-making	39	35	20	12	8	427	3.75	Agree
Q15	Improves customer satisfaction	38	36	20	12	8	426	3.74	Agree
Q16	Expensive to implement	32	30	22	16	14	392	3.44	Agree
Q17	Data security is a concern	30	32	25	16	11	396	3.47	Agree
Q19	Overall satisfaction	38	36	20	12	8	426	3.74	Agree

**V. FINDING**

- The analysis shows that most respondents have a positive opinion about IoT-enabled manufacturing systems. The weighted average values for all questions are above 3, which indicates agreement among the respondents.

- The highest score is for flexibility in production, which means people believe IoT helps to make manufacturing more adaptable and efficient. Many respondents also agree that IoT improves product quality, supports better scalability, and increases customer satisfaction.
- At the same time, respondents acknowledge that IoT can lead to long-term cost savings and enhance decision-making by enabling more informed insights through data analysis.
- That said, certain reservations remain. A number of participants view the initial implementation of IoT systems as a significant financial investment. Additionally, concerns around data security have been raised, reflecting a degree of caution regarding privacy and overall system safety.
- Overall, the responses show a balanced opinion, with more positive views than negative ones.

## VI. RESULT

- The results of the study indicate that IoT-enabled containerized manufacturing systems are generally accepted by the respondents. Most people agree that these systems improve flexibility, quality, and efficiency in manufacturing.
- The overall weighted average values show a moderately positive response. This means that people are satisfied with the performance of IoT systems, but not completely.
- Even though the benefits are clear, issues like high cost and data security need to be improved. If these problems are solved, the adoption of IoT systems can increase further

## VII. CONCLUSION

- The study concludes that IoT-enabled containerized manufacturing systems play an important role in improving modern industrial operations. The analysis shows that most respondents have a positive opinion about the use of IoT in manufacturing.
- The results indicate that IoT systems help in increasing flexibility, improving product quality, and supporting better decision-making in production processes. Additionally, respondents believe that these solutions increase the scalability and efficiency of manufacturing.
- However, the study additionally identifies a few challenges. Many respondents believe that the cost of implementing IoT systems is high, and data security remains a concern.
- Overall, the study highlights the importance of adopting IoT technologies in manufacturing, while also focusing on reducing cost and improving security for better acceptance.

## VIII. COUNSEL & PROPOSALS

- Industries should develop cost-effective IoT solutions to make adoption easier for small and medium enterprises.
- Awareness programs and training sessions should be conducted to improve knowledge about IoT technologies among employees and managers.
- To increase production and efficiency, organizations should be urged to progressively implement IoT technologies.
- More focus should be given to improving data security measures to build trust in IoT-based manufacturing systems.
- Companies can organize technical workshops and training programs to help employees understand and effectively use IoT systems.

## REFERENCES

- [1] Shah, J. P. (2025). Advancing smart manufacturing through Industrial IoT: Enhancing operational efficiency and predictive maintenance. *AIJR Proceedings*, 7(4), 45–56.
- [2] Chaudhari, H. P., Walke, D. R., & Kataria, H. P. (2025). Industrial monitoring using IoT, AR, and AI for smart factory operations. *International Journal of Innovative Science and Research Technology*, 10(4).
- [3] (2025) Hsiao, C. W., and Chen, H. W. investigating current IoT and smart manufacturing research trends.
- [4] Lepasepp, T. K., & Hurst, W. (2021). Industry 4.0 technologies in manufacturing: A systematic review. *Future Internet*, 13(10), 264.