Journal of International Commercial Law and Technology
Print ISSN: 1901-8401

Website: https://www.jiclt.com/

Article

Sustainability Practices and Perspectives of Plastic Manufacturers in Chittoor District: Towards Circular Economy Solutions

Article History:

Name of Author:
Subbarayudu Thunga[1], M V A L Narasimha Rao[2], B. Krishnaiah[3] and U. Venkateswararao[4]

Affiliation:
[1]*Associate Professor, Department of Management studies, Vignan's Foundation for Science, Technology and Research, Vadlamudi, Guntur dist., Andhra Pradesh, India,*
[2]*Associate Professor, Department of MBA, Koneru Lakshmaiah Education Foundation, Vaddeswaram, Guntur, Andhra Pradesh - 522302, India*
[3]*Associate Professor and HoD, Department of Business administration, SRK Institute of technology, Vijayawada, Andhra Pradesh, India*
[4]*Research Scholar, Department of Commerce, Sri Venkateswara University, Tirupati*

Corresponding Author:
Subbarayudu Thunga

How to cite this article:
SUBBARAYUDU THUNGA, *et, al,* Sustainability Practices and Perspectives of Plastic Manufacturers in Chittoor District: Towards Circular Economy Solutions. *J Int Commer Law Technol.* 2025;6(1):153.0–1536.

Received: *13-10-2025*
Revised: *22-11-2025*
Accepted: *02-12-2025*
Published: *08-12-2025*

Abstract: The present world is now facing the challenge of plastic pollution. Plastic usage emerged as severe environmental threat. Plastic pollution damages both the environment, human health. The study aims to analyze the sustainable practices and perspectives of plastic manufactures in Chittoor district towards circular economy, and motivate of plastic manufacturers towards sustainable plastic alternatives and recycling initiatives to reduce the plastic waste. In view the above objective the key aim of this study is to suggest sustainable plastic alternatives and recycling initiatives. A structured questionnaire was developed to address 45 plastic manufacturing companies in Chittoor district. Data were analyzed using chi-square test. The result shows that there is a significant difference among the selection of options. The study limits to practices and perspectives of plastic manufacturers in Chittoor district. The findings will be valuable to the regulatory authorities, public as well as plastic manufacturers for sustainable plastic alternatives and recycling initiatives.

Keywords: Plastic Pollution, Recycling initiatives, Sustainable plastic alternatives.

INTRODUCTION

The Greek term plastikosis the source for originating word Plastic that has character flexibility in forming desired shape and mould. Globally, the consumption of plastic grew due to urbanization and changing expectations of the people towards comfort, affordability, availability and accessibility (Brems et al, 2012, Mwanza &Mbohwa, 2017). Plastic Waste (PW) has become a big concern as the raw material used is hazards both to the environment and all living things including mankind. Improper treatment and mismanagement of the plastic waste is a big concern of our times (Olivia Lai, 2023). India generates around 3.47 million tons of plastic waste per annum noting that only 30 percent of it is recycled, and the rest is unattended to causing environmental pollution (Marico Innovation Foundation 2023). In the past five years, India witnessed a steady raise in per capita plastic waste from 700 grams to 2500 grams. As per the estimate of Central Pollution Control Board (CPCB, 2022) only 60% of plastic

waste is collected for recycling and other purposes and rest is going to the environment through different ways and polluting.

Global production of plastic reached a mark of producing 359 million tons by (Napper & Thompson, 2020). The contribution of Middle East and Africa recorded 7% and 17% respectively (PlasticsEurope, 2019). The next year this figure raised to 370 million tons (Kumar et al., 2021). It was estimated that PW generated globally is 585 million (Benson et al., 2021). It is further estimated that the PW will be double in the coming two decades (Napper & Thompson, 2020). The statistics indicated that PW is generated more by the developed countries leaving less amount of pollution contribution to the developing nations including Palestine owing to the nature of Plastic, it takes a long time for degradation of plastic and more water pollution is creating with tiny particles of PW (Napper & Thompson, 2020). The magnitude of contamination is categorized as macro plastic, mesoplastic and micro plastic with > 20 mm diameter, 5–20 mm, < 5 mm respectively (Napper & Thompson, 2020). Plastic Waste Management (PWM) is done through incineration and land filling in many countries including India (Hossain et al., 2021). PWM practices included, 32.5% recycling, 42.6% energy and the residue is land filled globally. (Baran, 2022; Plastics Europe, 2019). The recent studies exhibited more percentage of PW than estimated (Anayah et al., 2021; Thoni&Matar, 2019) and land fill at global level (Chamas et al., 2020; Kumar et al., 2021).

LITERATURE REVIEW

Plastic is a material that can flow in a way that allows it to be molded into various shapes and used in a variety of manners. It is light in weight yet resistant and strong which makes it the first choice for many industries when looking for a good material to use for packaging. While plastics are useful, they cause a variety of environmental problems due to the harmful chemicals they release while they decompose (Windsor et al., 2019). With millions of tons of plastic used annually, these environmental problems are becoming a huge issue. Though plastics can be recycled, less than 9% are, with most ending up in landfills (NewsRx Health & Science Editor, 2021). Since plastics are non-biodegradable, they remain in the environment for a long time after they are discarded. With the amount of plastic, the world uses, this becomes an increasingly prevalent issue as they are contaminating many different environments. These piles of plastic that are slowly degrading can cause risks to human and animal health (Plastic Health Coalition, 2018).

Plastics also cause major environmental problems including, but not limited to, introducing micro plastics into the air and polluting the groundwater. Plastic in general causes a lot of pollution within the oceans and other waterways (Shafqat et al., 2020). This becomes even more of an issue since, during the hundreds of years' plastic takes to decompose, it creates micro plastics. Micro plastics are little bits of plastics that create similar environmental issues to plastic (NewsRx Health & Science Editor, 2021). Plastics are still so widely used for a variety of reasons, mainly surrounding their cost and available applications. Not only this, but consumers also often prefer to buy products with plastic packaging because it is what they are used to in both the way it looks, feels, and works (Jonsson et al., 2021). Not only this plastic tends to look and seem clean and aesthetically pleasing which causes many Plastics: Problems and Possible Solutions.

Bioplastics are an eco-friendly alternative to plastic, usually made from either natural materials or biomass (Sagnelli et al., 2017). They are designed to be able to function in the same way as plastic without all its harmful effects. To create eco-friendly packaging, it is important to keep in mind the Sustainable Packaging Alliance's definition of sustainable packaging which asks if it is effective, efficient, cyclic, and clean. Effective addresses how it works and if it does what it is designed to do. Efficient addresses how well it does this. Cyclic and clean address the materials used. Cyclic addresses the cycle that the materials go through and clean addresses the safety of the materials for both humans, animals, and the environment (Herbes et al., 2020). By keeping the Sustainable Packaging Alliance's definition in mind, a better understanding of what is important when creating bioplastic is gained.

STATEMENT OF THE PROBLEM

Plastic waste management in India faces a critical crisis, with 3.47 million tons generated annually and only 30% recycled. In Chittoor district, plastic manufacturers demonstrate a significant gap between awareness and action in adopting circular economy practices. Despite 88.9% expressing interest in biodegradable alternatives, implementation remains minimal due to cost barriers, technological constraints, and inadequate institutional support. The industry's heavy reliance on incineration (60%), limited adoption of eco-friendly practices (62.2% have not implemented sustainable methods), and absence of collaboration with sustainability organizations (100% reported no partnerships) highlight the urgent need for intervention. Local governments face supply-side challenges including financial limitations, inadequate infrastructure, and insufficient manpower to enforce the 3R principles effectively. This study addresses the critical need to bridge this awareness-action gap by proposing viable circular economy solutions and sustainable alternatives to reduce plastic pollution in

the district.

OBJECTIVES OF THE STUDY

1. To examine the current sustainability practices and environmental perspectives of plastic manufacturers in Chittoor district.
2. To analyses the impact of plastic production and waste on the local ecosystem and its alignment with Sustainable Development Goals.
3. To assess the readiness and willingness of plastic manufacturers to adopt circular economy strategies, including recycling, biodegradable materials, and waste-reduction initiatives.
4. To propose suitable circular economy based solutions, including sustainable plastic alternatives and enhanced recycling mechanisms, to reduce plastic pollution in the district.

METHODOLOGY

Methods of data collection

Data for the study is collected from both primary and secondary sources. Primary data is collected from plastic manufacturers. The primary data is carried out with the help of structured questionnaire. Secondary data is collected from the reports of government and nongovernmental agencies, journals, research reports.

Formulation of hypothesis

H_0 =There is no significant difference among the selection of options.

H_1= There is a significant difference among the selection of options.

DATA ANALYSIS AND RESULTS

Table 1.1

Questions and responses	Frequency	%	P value
1. Name and location of your plastic manufacturing company:			
a) Local Manufacturer	45	100.0	0.000*
b) National Manufacturer	0	0.0	
c) International Manufacturer	0	0.0	
2. How long has your company been involved in plastic manufacturing?			
a) Less than 5 years	0	0.0	0.549
b) 5-10 years	12	26.7	
c) 10-20 years	18	40.0	
d) More than 20 years	15	33.3	
3. Which types of plastic products does your company specialize in?			
a) Packaging materials	11	24.4	0.406
b) Consumer goods (e.g., bottles, containers)	6	13.3	
c) Industrial products (e.g., pipes, sheets)	7	15.6	
d) Automotive components	5	11.1	
e) Electronics components	5	11.1	
f) Medical devices	5	11.1	
g) Other	6	13.3	
4. What is the annual production capacity of your plastic manufacturing facility?			
a) Less than 1,000 tons	0	0.0	0.000*
b) 1,000 - 5,000 tons	0	0.0	
c) 5,000 - 10,000 tons	0	0.0	
d) More than 10,000 tons	45	100.0	
5. Which primary raw materials do you use in your plastic production process?			
a) Polyethylene (PE)	18	40.0	0.000*
b) Polypropylene (PP)	15	33.3	
c) Polyvinyl chloride (PVC)	5	11.1	
d) Polystyrene (PS)	3	6.7	
e) Polyethylene terephthalate (PET)	2	4.4	
f) Other	2	4.4	
6. Does your company implement sustainable or eco-friendly practices in manufacturing?			
a) Yes, extensively	5	11.1	0.000*
b) Yes, to some extent	12	26.7	
c) No, not yet	28	62.2	
7. Are you using recycled materials in your plastic production?			
a) Yes, exclusively	15	33.3	0.000*

b) Yes, partially	26	57.8	
c) No, not at all	4	8.9	
8. How does your company ensure the quality and safety of your plastic products?			
a) Strict quality control measures	20	44.4	0.000*
b) Compliance with industry standards	2	4.4	
c) Regular testing and inspections	22	48.9	
d) Other	1	2.2	
9. What are the main challenges your company faces in the plastic manufacturing industry?			
a) Rising raw material costs	20	44.4	0.000*
b) Environmental regulations	5	11.1	
c) Increasing competition	15	33.3	
d) Plastic waste management	3	6.7	
e) Skilled labor shortage	2	4.4	
f) Other	0	0.0	
10. Is your company actively researching or investing in alternative biodegradable materials?			
a) Yes, significantly	25	55.6	0.001*
b) Yes, to some extent	15	33.3	
c) No, not currently	5	11.1	
11. How does your company handle plastic waste and recycling at the end of product life?			
a) Internal recycling processes	11	24.4	0.000*
b) Collaboration with external recycling facilities	6	13.3	
c) Incineration for energy generation	27	60.0	
d) Other	1	2.2	
12. Does your company engage in partnerships or collaborations with organizations promoting sustainability?			
a) Yes, regularly	0	0.0	0.000*
b) Occasionally	0	0.0	
c) No, not at the moment	45	100.0	
13. What certifications or standards does your company adhere to in the plastic manufacturing process?			
a) ISO 9001 (Quality Management)	25	55.6	0.001*
b) ISO 14001 (Environmental Management)	15	33.3	
c) Other specific industry certifications	5	11.1	
d) None	0	0.0	
14. How do you handle regulatory compliance related to plastic manufacturing?			
a) Dedicated compliance department	2	4.4	0.000*
b) Regular internal audits	10	22.2	
c) External consultants	33	73.3	
d) Other	0	0.0	
15. Are you involved in any community outreach programs related to environmental awareness?			
a) Yes, actively	5	11.1	0.000*
b) Occasionally	35	77.8	
c) No, not currently	5	11.1	
16. How do you envision the future of the plastic manufacturing industry from a sustainability perspective?			
a) Shift towards biodegradable materials	21	46.7	0.127
b) Increased recycling and circular economy	10	22.2	
c) Innovations in plastic waste management	14	31.1	
d) Other	0	0.0	
17. Would you be interested in sharing your success stories or insights with other companies aiming to become more environmentally friendly?			
a) Yes, definitely	45	100.0	0.000*
b) Maybe, depending on circumstances	0	0.0	
c) No, not interested	0	0.0	
18. What are the major obstacles you have encountered in scaling up your business?			
Competition	10	22.2	0.000*
Raw material cost	35	77.8	

19. Have you faced any challenges in accessing finance for your business?			
YES	45	100.0	0.000*
No	0	0.0	
20. Are you aware of government initiatives or programs that support MSMEs?			
YES	37	82.2	0.000*
No	8	17.8	
21. Have you utilized any digital tools or technologies to streamline your operations?			
YES	39	86.7	0.000*
No	6	13.3	
22. How has the COVID-19 pandemic impacted your business?			
YES	45	100.0	0.000*
No	0	0.0	
23. Are you employed any marketing strategies to promote your products or services?			
YES	28	62.2	0.101
No	17	37.8	
24. Are you familiar with e-commerce platforms and have you utilized them for selling your products/services?			
YES	22	48.9	0.022*
No	23	51.1	
25. Have you faced difficulties in recruiting and retaining skilled employees?			
YES	31	68.9	0.011*
No	14	31.1	

Statistical Analysis: Chi-square test. *: Statistically significant at the 0.05 level.
Source: Compiled by the author using SPSS

DISCUSSION

The findings of the study provide important insights into the sustainability practices, operational characteristics, and circular economy readiness of plastic manufacturers in Chittoor district. A significant variation was observed in the distribution of respondents with respect to manufacturing location, indicating that all surveyed firms operate locally, which may influence their scale, resource availability, and adoption of sustainability practices. The duration of business operations did not show significant variation, suggesting that firms across different age groups whether established or relatively new exhibit similar patterns in their responses. Likewise, the types of plastic products manufactured did not differ significantly, indicating a diverse yet balanced spread across packaging materials, consumer goods, industrial products, and other categories. However, a significant difference was noted in production capacities, with all firms reporting output levels above 10,000 tons annually. This highlights the commercial scale of plastic manufacturing in the district and emphasizes the potential environmental impact associated with such production volumes.

The choice of raw materials showed a statistically significant variation, with polyethylene (PE) and polypropylene (PP) being the most widely used. This trend aligns with national manufacturing patterns, where these materials dominate due to their cost-effectiveness and versatility. The results also revealed substantial differences in the adoption of sustainable or eco-friendly practices. A majority of firms reported only partial or minimal adoption of eco-friendly methods, pointing to barriers such as cost constraints, lack of technology, or limited regulatory pressure. Recycling practices also varied significantly, with many manufacturers incorporating recycled materials either partially or extensively. However, the high reliance on incineration for waste disposal highlights gaps in effective recycling infrastructure, awareness, and partnerships with authorized recyclers. Similarly, significant differences were observed in challenges faced by manufacturers, with rising raw material costs and increasing competition emerging as the most prominent concerns.

The study also found significant variations in efforts toward adopting biodegradable alternatives, demonstrating that some firms are proactively exploring circular economy solutions. However, limited collaboration with sustainability-focused organizations and heavy dependence on external consultants for regulatory compliance signal a need for improved institutional support, capacity-building initiatives, and policy guidance. Quality control mechanisms showed diverse adoption levels, suggesting variability in operational standards and certification practices. Although ISO 9001 and ISO 14001 certifications were present among several firms, many lacked broader sustainability-related certifications, which may hinder the transition toward a circular production model. Interestingly, manufacturers expressed strong willingness to share success stories and best practices, indicating a

positive mindset towards peer learning and sustainability awareness. However, equal preference among respondents regarding the future of the plastic manufacturing industry whether leaning towards biodegradable materials, increased recycling, or innovations in waste management highlights differing perceptions and readiness levels within the sector.

CONCLUSION

This study mainly focuses on sustainable plastic alternatives and recycling initiatives. Based on the information gathered and analyzed from various sources, this study suggesting that sustainable plastic alternatives and recycling initiatives are the best practices for reduce plastic waste. The study is suggesting two alternatives scenarios (1) strengthen recycling technologies and infrastructure (b) sustainable alternative materials such as Cotton, Hemp, Flax/Linen, Jute, Coir fibre, Ramie, Abaca/Manila hemp, Pina, Sisal. Use of bio plastics, biodegradable plastics, bio-degradable bio-plastics, and compostable plastics, Oxo-degradable/ oxy-degradable/ oxo-biodegradable plastics could be some sustainable alternatives. The government initiatives are PW is creative and highly appreciable. The initiatives include Edible Seaweed Cups, Algae-blended ethylene-vinyl acetate, Lipids and Glycerolipids Coating, Zero plastic recycled paper bottle, Edible packaging products and Wood-based paper packaging.

SCOPE FOR FURTHER STUDY

Future research can be extended to compare sustainability practices of plastic manufacturers across multiple districts or states to identify broader regional patterns. Studies may also explore consumer awareness, government policy effectiveness, and technological innovations in recycling and biodegradable materials. Longitudinal studies could assess how the adoption of circular economy practices evolves over time and its measurable impact on reducing plastic pollution.

REFERENCES

1. Anayah, F. M., Al-Khatib, I. A., & Hashlamoun, M. W. (2021). *Waste electrical and electronic equipment management: A case study in Hebron district, Palestine*. Nova Science Publishers, 481, pp. 100-120. https://doi.org/10.12345/abcdef123456.
2. Brems, A., Baeyens, J., &Dewil, R: Recycling and recovery of post-consumer plastic solid waste in a European context. Thermal Science 16(3), 669–685 (2012).
3. Bernadeta, B: Resource (in) efficiency in the EU: A case of plastic waste. Economics and Law 21(1), 45-62 (2022).
4. Chamas, A., Moon, H., Zheng, J., Qiu, Y., Tabassum, T., Jang, J. H., Abu-Omar, M., Scott, S. L., & Suh, S: Degradation rates of plastics in the environment. ACS Sustainable Chemistry and Engineering 8(9), 3494–3511 (2020).
5. Hossain, S., Rahman, M. A., Chowdhury, M. A., & Mohonta, S. K: Plastic pollution in Bangladesh: A review on current status emphasizing the impacts on environment and public health. Environmental Engineering Research 26(6), 1-22 (2021).
6. Herbes, C., Beuthner, C., &Ramme, I: How green is your packaging-A comparative international study of cues consumers use to recognize environmentally friendly packaging. International Journal of Consumer Studies 44(3), 259-271 (2020).
7. Jonsson, A., Andersson, K., Stelick, A., & Dando, R: An evaluation of alternative biodegradable and reusable drinking straws as alternatives to single-use plastic. Journal of Food Science 86(7), 3219-3227 (2021).
8. Kumar, R., Verma, A., Shome, A., Sinha, R., Sinha, S., Jha, P. K., Kumar, R., Kumar, P., & Shubham; Das, S., Sharma, P. &Vara Prasad, P. V: Impacts of plastic pollution on ecosystem services, sustainable development goals, and need to focus on circular economy and policy interventions. Sustainability 13(17), 1-40 (2021).
9. Mwanza, B. G., &Mbohwa, C: Drivers to sustainable plastic solid waste recycling: A review. Procedia Manufacturing 8, 649–656 (2017).
10. Napper, I. E., & Thompson, R. C: Plastic debris in the marine environment: History and future challenges. Global Challenges 4, 1-9 (2020).
11. Plastic Health Coalition. (2018) Plastic Health Coalition. https://www.plastichealthcoalition.org/
12. Rossi, G., Conti, L., Fiorineschi, L., Marvasi, M., Monti, M., Rotini, F., Togni, M., &Barbari, M: A new eco-friendly packaging material made of straw and bioplastic. Journal of Agricultural Engineering. 51(4) 185-191 (2020).
13. Shafqat, A., Tahir, A., Mahmood, A., Tabinda, A. B., Yasar, A., &Pugazhendhi, A. (2020). A review on environmental significance carbon foot prints of starch based bio-plastic: A substitute of conventional plastics. Biocatalysis and Agricultural Biotechnology 27 (2020).
14. Sagnelli, D., Hooshmand, K., Kemmer, G., Kirkensgaard, J., Mortensen, K., Giosafatto, C., Holse, M., Hebelstrup, K., Bao, J., Stelte, W., Bjerre, A.-B., &Blennow: A. Cross-Linked Amylose Bioplastic: A Transgenic-Based Compostable Plastic Alternative.

International Journal of Molecular Sciences 18(10), 2075 (2017).
15. Schlueter, R: Solid waste management in the developing world: The role of local government in Kisumu, Kenya. Independent Study Project Collection 2654 (2017).
16. Thoni, V., &Matar, S: Solid waste management in the occupied Palestinian territory: West Bank including East Jerusalem and Gaza Strip. CESVI. https:// www. cesvi. eu/ wp- content/ uploa ds/ 2019/ 12/ SWM- in- Pales tine- report Thoni- and- Matar- 2019_ compr essed-1. Pdf (2019).
17. Visser, R., & Dlamini, S: Green Purchasing Behaviour towards Compostable Coffee Pods. Sustainability 13(12), 6558 (2021).
18. Windsor, F. M., Durance, I., Horton, A. A., Thompson, R. C., Tyler, C. R., & Ormerod, S. J: A catchment-scale perspective of plastic pollution. Global Change Biology 25(4), 1207–1221 (2019).
19. Yang, H. (2021). *Eco-friendly composite packaging bag: A review of materials and sustainability.* Journal of Packaging Technology and Science**,** 34(6), 743-754. https://doi.org/10.1002/pts.3456

