DOI: https://doi.org/10.59983/s2025030107
AgroEnvironmental Sustainability, 2025, 3(1), 58-63

RESEARCH

Utilizing Temple Floral Waste to Address the Resource Crunch in the Perfume Industry: A Case Study of Kannauj District, Uttar Pradesh, India

Prankur Shukla [1, *] and Murad Ali [1]

[1] Department of Business Management, Veer Bahadur Singh Purvanchal University, Jaunpur 222003, India
[*] Author responsible for correspondence; Email: shuklaprankur@gmail.com.

ARTICLE HISTORY
Received: 10 January 2025
Revised: 20 February 2025
Accepted: 03 March 2025
Published: 15 March 2025

KEYWORDS
environmental pollution
floral waste
sustainability
waste management

EDITOR
Pankaj Kumar

eISSN 2583-942X

Abstract

Temples have long served as centers of devotion, where offering flowers is a significant ritual. However, this practice generates substantial floral waste, with renowned temples like Sheetala Chaukiya, Diyawan Mahadev, and Markandeya Mahadev collectively disposing of several quintals of flowers daily in Kannauj district of Uttar Pradesh, India. These discarded flowers are often dumped into water bodies or open pits, contributing to environmental pollution. Addressing this challenge, the present study explores the sustainable conversion of floral waste into *Itra* (perfume) using various extraction techniques. The study employed a convenience sampling method, gathering data from 500 respondents involved in the perfume industry in Kannauj. Statistical analysis revealed a significant positive correlation between increased profit and the success of the perfumery industry ($r = 0.567$, $p < 0.01$), as well as between financial assistance and business success ($r = 0.643$, $p < 0.01$). These findings underscore the potential of floral waste conversion to enhance economic outcomes for stakeholders. The perfume extraction process demonstrated efficiency, supporting entrepreneurship and providing employment opportunities. Additionally, residual floral waste can be repurposed for composting, contributing to sustainable waste management practices. Overall, this study presents an eco-friendly solution to floral waste pollution while promoting economic development through value-added product generation. This approach not only aids in environmental sustainability but also supports socio-economic growth by encouraging local entrepreneurship and reducing waste disposal issues.

Citation: Ali, M. & Shukla, P. (2025). Utilizing Temple Floral Waste to Address the Resource Crunch in the Perfume Industry: A Case Study of Kannauj District, Uttar Pradesh, India. *AgroEnvironmental Sustainability*, 3(1), 58-63. https://doi.org/10.59983/s2025030107

Statement of Sustainability: The present work supports sustainability by converting temple flower wastes into useful products such as *Itra* (fragrances), vermicompost, and biofertilizers. Through eco-friendly extraction and recycling techniques, the work helps control environmental pollution and promotes prudent disposal of waste. The practice saves natural resources as well as contributes to entrepreneurship and employment, both of which can fuel economic growth. It is a prime example of the circular economy paradigm with minimum wastage and full use of all byproducts. This eco-friendly practice not only protects the environment but also imparts economic value, and therefore, it has a balance of ecological accountability and community development.

1. Introduction

India, renowned for its deep-rooted spirituality, is home to diverse religious traditions where flowers hold significant cultural and spiritual value (Yadav et al., 2022). Daily, substantial quantities of flowers are offered to deities in temples and other religious sites across the country. However, once these flowers fulfill their religious purpose, they are typically discarded into water bodies or left around sacred trees—practices that contribute to environmental degradation (Akanksha, 2022). This improper disposal leads to the accumulation of floral waste, causing water and land pollution and creating breeding grounds for harmful microorganisms (Kumar et al., 2023). Traditionally, sacred water bodies like the River Ganga have been primary sites for the disposal of floral waste. For instance, during the Maha Kumbh-2025 at the confluence of the Ganga and Yamuna rivers in Prayagraj, nearly a million tons of flowers were offered (Kumar et al., 2018). This influx of floral waste contributes to microbial growth and poses significant risks to aquatic life and human health. Like other developing nations, India faces challenges related to solid waste management and the environmental

implications of improper disposal practices (Soni et al., 2023; Hima et al., 2025). Despite being biodegradable (Gupta et al., 2023), floral waste demands sustainable management strategies. Proper utilization can transform this waste into valuable resources for industries like perfumery, essential oils, natural dyes, vermicomposting, and fertilizer production (Figure 1).

In the context of the perfume industry, there is a clear distinction between luxury fragrances and mass-market products. Luxury fragrances, characterized by high-quality ingredients and sophisticated packaging, cater to niche markets and are often available through exclusive retailers. In contrast, mass-market perfumes, typically made from synthetic materials, are affordable and distributed widely through department stores, drug stores, and general retail outlets (Ginting and Dellyana, 2023). The success of a perfume brand relies on strategic marketing approaches, which are essential for product positioning and consumer engagement (Misra et al., 2021). The global perfume industry has witnessed significant growth, with an increasing number of businesses entering the market to meet rising consumer demand (Sharmeen et al., 2021).

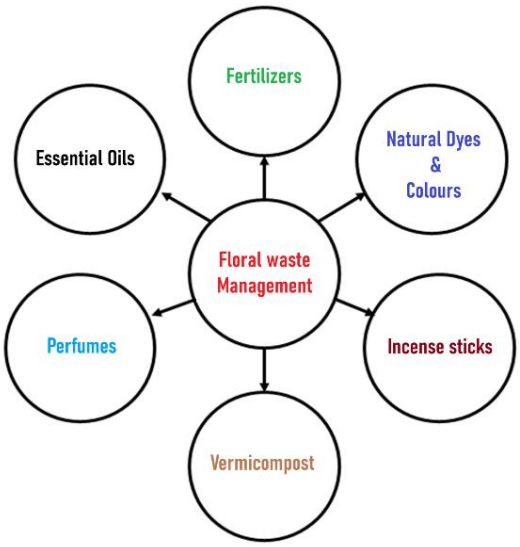

Figure 1. Floral waste management is tackled through various industries.

A critical concern for the perfume industry is the sustainable sourcing of raw materials. Floral waste from temples, particularly varieties such as rose, marigold, chameli, and bela, offers an untapped potential for perfume extraction. Utilizing this waste not only supports resource optimization but also aligns with sustainable waste management practices. Post-extraction, the residual biomass can be repurposed into bio-fertilizers, further enhancing environmental benefits. This study explores the feasibility of converting temple floral waste into valuable products, thereby addressing both environmental concerns and resource scarcity in the perfume industry.

2. Methodology and Extraction Procedure of Perfumes from Floral Waste

2.1. Sampling Methods

The study employed a purposive convenience sampling approach to select respondents from the Kannauj district, known for its perfume industry. Purposive sampling, also referred to as deliberate or non-probability sampling, involves the intentional selection of participants who are most relevant to the research objectives (Kothari, 2004). Convenience sampling was applied to select easily accessible respondents actively involved in the perfume industry, including business owners, managers, and staff. This approach facilitated efficient data collection while ensuring relevance to the study's focus.

2.2. Population

The target population comprised stakeholders from the perfume industry in Kannauj district. This included individuals directly engaged in perfume production and business operations, such as owners, managers, and staff members.

2.3. Sample Size Calculation and Statistical Analysis

The study aimed for a representative sample to ensure the reliability of the findings. An initial questionnaire comprising 33 items was developed for data collection. To determine the adequacy of the sample size, the Kaiser-Meyer-Olkin (KMO) measure was considered, targeting a sample of 300–350 respondents. For statistical analysis, G*Power software (Figure 2) was utilized to calculate the minimum required sample size for the applied tests. Under standard conditions, the calculated sample size was determined to be 129 respondents, ensuring sufficient statistical power and validity for the analysis. Data suitability was assessed to ensure appropriate application of parametric or non-parametric tests. Only data meeting the assumptions for the respective statistical tests were included in the final analysis to ensure methodological rigor.

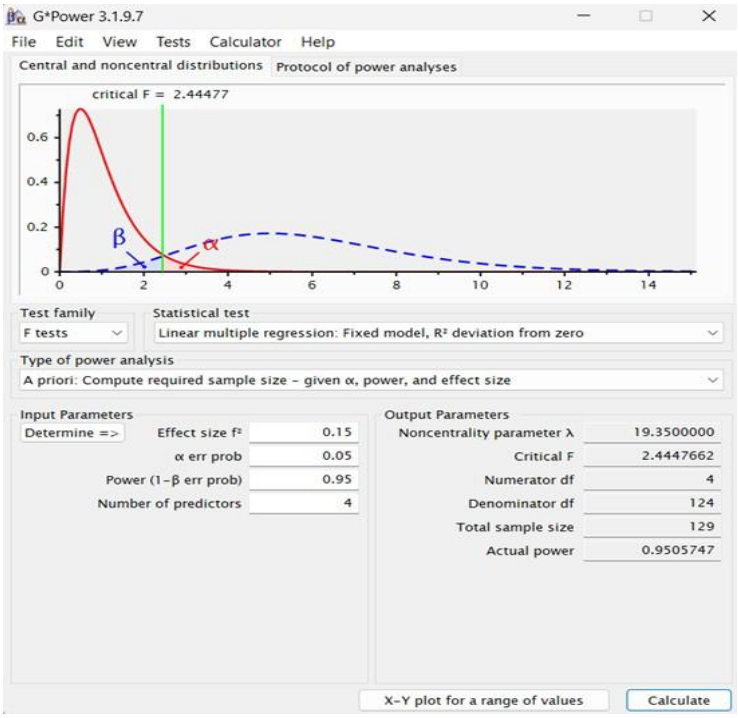

Figure 2. G-Power calculation of sample size.

Further for research with an infinite population size, sample size can be calculated with the help of proportion formula. Sampling size based on confidence interval for statistics is used to decide sampling size. The standard deviation of the population is unknown so there is a used proportion formula.

$$n = p\,(1-p)\,(Z/E)\,2$$

$$n = 0.050\,(1-0.50)\,(1.96/0.05)2$$

$$= 0.50\,(0.50)\,(39.2)2$$

$$= 0.50\,(0.50)\,(1536.64)$$

$$= 384.16$$

As the researcher cannot take a part of the large sample, so updating to the nearest integer, the minimum sample size will be 385. The respondents count 385, which also surpasses the G*power sample size of 129 for the F-test family tests. There may be some incomplete responses, so for the present study, the final data has been collected from 500 respondents (after eliminating the incomplete responses).

2.4. Hypotheses to be Tested

H01: There is no significant impact of the increase in profit on the success of the perfumery industry.

H02: There is no significant impact of financial assistance to the business in the success of the perfumery industry.

2.5. Procedure for Extraction of Perfumes

Several techniques can be employed for the extraction of floral essences from temple floral waste (Figure 3). The selection of an appropriate method depends on the type of flower, the desired quality of the extract, and economic feasibility. The primary techniques include:

- **Steam Distillation:** This is the most common method for extracting essential oils from flowers. The process involves passing steam through the floral material, causing the essential oils to evaporate. The vapor is then condensed and collected, separating the oil from the water.
- **Enfleurage:** A traditional method where flowers are placed on a layer of odorless fat, which absorbs the fragrance. The fat is then processed to extract the aromatic compounds. This method is suitable for delicate flowers that lose their aroma when subjected to heat.
- **Maceration:** Similar to enfleurage but involves immersing the floral material in warm fat or oil to absorb the fragrance. The resultant mixture is then subjected to further processing to isolate the essential oil.
- **Solvent Extraction:** In this method, volatile solvents such as hexane or ethanol are used to dissolve the aromatic compounds from the flowers. The solvent is then evaporated to obtain a concentrated substance known as an absolute.
- **Distillation:** Apart from steam distillation, hydro distillation can also be used, where flowers are submerged in water and heated, allowing the aromatic compounds to evaporate and be condensed.
- **Expression (Cold Pressing):** Although primarily used for citrus fruits, this method can also be applied to extract oils from certain types of floral materials by mechanically pressing them to release the essential oils.

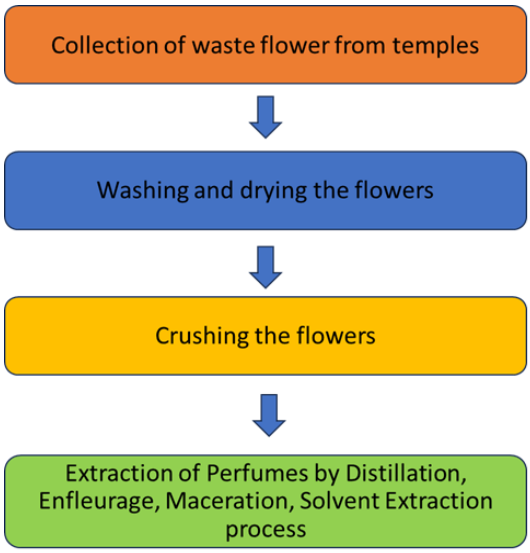

Figure 3. Process of Perfume (*Itra*) making.

3. Results and Discussion

3.1. Hypothesis 1

H01: There is no significant impact of the increase in profit on the success of the perfumery industry.

Table 1. Correlation between profit and success of the perfumery industry.

Parameters	Profit	Success of Perfumery
Profit	1	0.567**
Sig. (2-tailed)		0.000
N	500	500
Success of Perfumery	0.567**	1
Sig. (2-tailed)	0.000	
N	500	500

Note: Correlation is significant at the 0.01 level (2-tailed).

The Pearson correlation coefficient between profit and the success of the perfumery industry was found to be 0.567, indicating a moderate positive correlation (Table 1). The p-value (0.000) is less than 0.01, confirming that the correlation is statistically significant at the 1% level. This suggests that an increase in profits is significantly associated with the success of the perfumery industry. Therefore, the null hypothesis (H_{01}) is rejected, establishing that profit growth positively influences the industry's success. This finding aligns with the notion that profitability enables greater investment in product innovation, marketing, and quality enhancement, thereby fostering business sustainability and market expansion (Ginting & Dellyana, 2023).

3.2. Hypothesis 2

H02: There is no significant impact of financial assistance to the business in the success of the perfumery industry.

Table 2. Correlation between financial assistance and success of the perfumery industry.

Parameters	Financial Assistance	Success of Perfumery
Financial Assistance	1	0.643**
Sig. (2-tailed)		0.000
N	500	500
Success of Perfumery	0.643**	1
Sig. (2-tailed)	0.000	
N	500	500

Note: Correlation is significant at the 0.01 level (2-tailed).

The Pearson correlation coefficient between financial assistance and the success of the perfumery industry was 0.643, indicating a strong positive correlation. The p-value (0.000) confirms the significance of this correlation at the 1% level. Hence, the null hypothesis (H_{02}) is rejected, demonstrating that financial assistance significantly impacts the success of the perfumery industry. Access to financial support enhances business capacity by facilitating investments in advanced extraction techniques, infrastructure, and skilled labor. It also aids in expanding distribution networks and enhancing product quality. These factors collectively contribute to the industry's long-term growth and competitiveness (Misra et al., 2021).

3.3. Strategic Insights for Enhancing the Perfumery Industry in Uttar Pradesh

The analysis confirms that profitability and financial assistance are critical drivers of success in the perfumery industry. Based on these insights, the following recommendations can be proposed to strengthen the industry in Uttar Pradesh, particularly in Kannauj—India's traditional hub of perfumery. Government and financial institutions should streamline access to low-interest loans and grants to support small and medium-sized enterprises (SMEs) involved in perfume production. Training programs focusing on advanced extraction techniques, sustainable practices, and quality enhancement should be introduced to build capacity and foster innovation. Utilizing temple floral waste as a raw material for perfume extraction can minimize environmental impacts while providing an economical resource base. Investment in modern distillation facilities and storage units can improve efficiency and product quality. The industry should focus on global marketing strategies that emphasize the unique cultural heritage and natural ingredients of Kannauj perfumes, enhancing international competitiveness. Similarly, the traditional perfumery industry of Kannauj, with its centuries-old heritage, holds immense growth potential. By integrating sustainable floral waste management with innovative extraction processes, the industry can achieve environmental and economic sustainability. Thus, investing in this sector not only supports environmental conservation through waste utilization but also contributes to economic growth by fostering entrepreneurship, job creation, and rural development in Uttar Pradesh.

4. Conclusion

This study emphasizes an innovative approach to managing temple floral waste by transforming it into exotic *Itra* (perfumes), offering an eco-friendly alternative to improper disposal methods that contribute to environmental degradation. The proposed extraction process not only enables the sustainable production of perfumes but also promotes the circular economy by utilizing residual floral waste for the production of vermicompost and biofertilizers. This approach provides multiple benefits: a) reduces waste accumulation and minimizes pollution; b) encourages entrepreneurship and creates employment avenues, particularly in rural and small-scale sectors; and c) promotes the efficient use of floral waste, turning it into value-added products. Overall, this study demonstrates that integrating sustainable waste management with value-added production can contribute to environmental conservation, economic

empowerment, and the promotion of traditional industries such as perfumery. Such initiatives can play a significant role in supporting local economies and fostering sustainable development.

Author Contributions: Conceptualization: Prankur Shukla; Data curation: Prankur Shukla; Investigation: Prankur Shukla; Methodology: Prankur Shukla; Resources: Murad Ali; Software: Murad Ali; Supervision: Murad Ali; Validation: Murad Ali; Visualization: Murad Ali; Writing-original draft: Prankur Shukla; Writing- review & editing: Murad Ali. All authors have read and agreed to the published version of the manuscript.

Funding: The authors did not receive any funding during and after the completion of the study.

Acknowledgment: Prankur Shukla is immensely grateful to the Department of Business Management, Veer Bahadur Singh Purvanchal University, Jaunpur for providing research facilities. The authors express their heartfelt gratitude to the government authorities and researchers who have documented their work in the form of scientific publications.

Conflicts of Interest: No potential conflict of interest was reported by the author(s).

Institutional/Ethical Approval: Not applicable.

Data Availability/Sharing: Data will be made available on request to the corresponding author.

Supplementary Information Availability: Not applicable.

References

Akanksha, P. (2022). Conversion of temple flower waste into value added product for sustainable utilization – a review. *International Journal of Biology, Pharmacy and Allied Sciences*, 11, 5332-5345. https://doi.org/10.31032/IJBPAS/2022/11.11.6579

Ginting, P. Y., & Dellyana, D. (2023). Determinant influencing factors for customer preferences in local fragrance product (case study: Multitude fragrance). *Journal of Economics and Business*, 12, 63-78. https://doi.org/10.52644/joeb.v12i1.109

Gupta, S., Tewari, S. K., & Pathak, S. (2023). Temple floral waste for various bio-products in India. In Recent trends in solid waste management, pp 293-307. https://doi.org/10.1016/B978-0-443-15206-1.00008-6

Hima, B. K., Bharat, G., & Lingaraju, H. G. (2025). Sustainable strategies for floral waste–A review on valuable products from floral waste and their usage. *Journal of Materials and Environmental Science*, 16, 472-485.

Kothari C. R. (2004). Research Methodology methods and Techniques. New Age International (P) Limited Publishers, 2, pp. 1-398.

Kumar, D., Malik, D. S., & Gupta, V. (2018). Seasonal assessment of surface water quality in the middle stretch of river Ganga for suitability of fish and human health. *Journal of Experimental Zoology India*, 21(2), 667-677.

Kumar, D., Kumar, A., Malik, D., Sharma, R., & Gupta, V. (2023). Effect of barrages and anthropogenic activities on ecological integrity of the Ganga river: a Review on current issues and restoration efforts. *AgroEnvironmental Sustainability*, 1(1), 67-75.

Mehrotra, M. S., Sharma, S. D., & Jaiswal, G. (2018). A Systematic Review of Transformational leadership upon vital organizational aspects: An Imitation of Meta Analysis methodologies of PRISMA and Meta Essentials. *International Journal of Advance Research and Innovative Ideas in Education*, 4, 1615-1620.

Mehrotra, M. S., Sharma, S. D., & Jaiswal, G. (2019). A descriptive study of transformational leadership style on employees' innovative work behaviour and organizational performance (A case study on employees of Tata group). *Journal of Emerging Technologies and Innovative Research,* 6, 906-913.

Misra, R., Maurya, N. K., & Tewari, S. (2021). One District One Product (ODOP) Scheme: A Tale of Two Agricultural Products in Eastern Uttar Pradesh. *Productivity*, 62, 1-42. https://doi.org/10.32381/PROD.2021.62.01.4

Sharmeen, J. B., Mahomoodally, F. M., Zengin, G., & Maggi, F. (2021). Essential oils as natural sources of fragrance compounds for cosmetics and cosmeceuticals. *Molecules*, 26, 666. https://doi.org/10.3390/molecules26030666

Soni, A., Das, P. K., & Kumar, P. (2023). A review on the municipal solid waste management status, challenges and potential for the future Indian cities. *Environment, Development and Sustainability*, 25, 13755-13803. https://doi.org/10.1007/s10668-022-02688-7

Yadav, K. D., Sharma, D., & Prasad, R. (2022). Challenges and opportunities for disposal of floral waste in developing countries by using composting method. In Advanced Organic Waste Management, pp. 55-7.7 https://doi.org/10.1016/B978-0-323-85792-5.00018-6