International Review of Management and Marketing

ISSN: 2146-4405

available at http: www.econjournals.com

International Review of Management and Marketing, 2025, 15(3), 275-286.

Knowledge, Attitudes, and Practices of Tourism and Hospitality Management Students towards Innovative Plastic Waste Management using Solar Energy

Mark Alvin H. Abad*, Roberto V. Reyes Jr.

Nueva Ecija University of Science and Technology, Nueva Ecija, Philippines. *Email: travelsmoker84@gmail.com

Received: 15 October 2024 **Accepted:** 25 March 2025 **DOI:** https://doi.org/10.32479/irmm.17660

ABSTRACT

The primary objective of this study was to evaluate the plastic waste management knowledge, attitudes, and practices among tourism and hospitality management students at Nueva Ecija University of Science and Technology. The study involved 292 participants thru mixed method techniques. Significant results presented the potential to contribute towards the formulation of effective strategies and interventions aimed at reducing plastic waste and promoting recycling in the tourism and hospitality industry. Moreover, the research explored the feasibility of designing an innovative solar-powered pot-making machine for transforming plastic waste, specifically within educational institutions. This endeavor aligns with the global movement towards sustainable technologies and the principles of a circular economy.

Keywords: Plastic Waste Management, Solar-Powered Pot-Making Machine, Innovation
JEL Classifications: Q53, O31

1. INTRODUCTION

Plastic waste has become a pressing global environmental issue, threatening ecosystems and human health (Geyer et al., 2017; Jambeck et al., 2015). The tourism and hospitality industry, being a major contributor to plastic waste generation, has recognized the need for sustainable waste management practices (Alshiha et al., 2024). Consequently, it is essential to assess the knowledge, attitudes, and practices of students in tourism and hospitality management programs, as they represent the future professionals who will shape the industry's approach to plastic waste management (Kim et al., 2021).

One of the primary solutions is plastic waste management. This refers to the systematic handling, disposal, and recycling of plastic materials to minimize their environmental impact. It involves various processes and strategies aimed at reducing plastic waste generation, promoting recycling and reuse, and ensuring proper disposal of plastic waste (Purnomo et al., 2021).

Some of the key aspects of plastic waste management are Source Reduction, recycling, waste-to-energy conversion, landfill disposal, and education and awareness. To wit:

Source reduction is considered the first step in plastic waste management to reduce the generation of plastic waste at its source (Bourlakis et al., 2020). This can be achieved through measures like using alternatives to single-use plastics, promoting sustainable packaging solutions, and encouraging consumers to adopt eco-friendly habits (Kim et al., 2021).

Recycling plays a significant role in plastic waste management. It involves collecting plastic waste, sorting it by type, and processing it into reusable raw materials (Huang et al., 2021). Recycled plastics can be used to manufacture new products, reducing the need for virgin plastic production. Recycling initiatives often involve community recycling programs, industrial recycling facilities, and dedicated recycling infrastructure (Amaral et al., 2020).

In Waste-to-Energy Conversion, some plastic waste that cannot be effectively recycled can be converted into energy through processes like incineration or pyrolysis (Zhao et al., 2020). These technologies generate heat or electricity by burning or decomposing plastic waste in controlled environments.

However, it is essential to consider the environmental implications and emissions associated with these processes (Donadio et al., 2019).

Education and Awareness also plays a significant part since campaigns are vital for effective plastic waste management (Lozano et al., 2017). Informing individuals about the environmental consequences of plastic pollution, promoting responsible plastic use, and encouraging recycling practices can help shift attitudes and behaviors towards more sustainable choices (Chen & Zhang, 2021).

This research determined the knowledge, attitudes, and practices of tourism and hospitality management students at Nueva Ecija University of Science and Technology (NEUST) regarding plastic waste management.

The significance of this research lies in its potential to contribute to the development of effective strategies for plastic waste management in the tourism and hospitality sector. By focusing on students' knowledge, attitudes, and practices, the study will shed light on areas where educational interventions can be implemented to foster sustainable practices and attitudes toward plastic waste management (Kim et al., 2021; Purnomo et al., 2021).

Furthermore, the investigation of a solar-powered pot-making machine as a transformative solution aligns with the global trend toward sustainable technologies and circular economy principles (Nuñez González, 2025).

1. How may the level of knowledge among tourism and hospitality management students at NEUST regarding plastic waste management be described in terms of:
   a. Plastic waste generation understanding
   b. Plastic waste management environmental impact
   c. The different strategies and technologies for managing plastic waste.

2. What are the attitudes of tourism and hospitality management students at NEUST towards plastic waste management in terms of:
   a. Perception of the severity of the plastic waste issue
   b. Motivation to engage in sustainable practices
   c. Willingness to adopt environmentally friendly alternatives

3. What are the practices and behaviors of tourism and hospitality management students at NEUST regarding plastic waste management in terms of:
   a. Disposal habits
   b. Recycling practices
   c. Use of single-use plastics,
   d. Participation in initiatives related to plastic waste reduction

4. Proposed and design an innovative Solution: Explore the potential for designing a solar-powered pot-making machine for plastic waste transformation within educational institutions.

2. RESEARCH METHODOLOGY

The study fundamentally used mixed approaches thru survey and data collections. The survey was conducted through an online questionnaire, which was distributed through various social media platforms.

The questionnaire was designed to gather information on the knowledge, attitudes, and practices of the respondents regarding plastic waste management. It included questions related to the socio-demographic profile of the respondents, their understanding of plastic waste generation and its environmental impact, their awareness of different strategies and technologies for managing plastic waste, their attitudes towards plastic waste management, and their practices and behaviors related to plastic waste management.

The study also utilized descriptive research design to collect data, analyze patterns, and present an accurate depiction of the phenomena that were investigated.

The respondents of the study are the tourism and hospitality management students of NEUST. There were 292 students/ respondents.

Using www.raosoft.com's sample size calculator, it was found that a total of 292 respondents were necessary for the survey with a confidence level of 95% and an error margin of 5% from the total population of 1,200 students studying in Nueva Ecija University of Science and Technology Hospitality and Tourism Management Department for the academic year 2022-2023 (Raosoft, 2004).

In presenting the profile of the respondents: Frequency and Percentage Distribution was used to the respondent's profile. In addition, to assume the level of understanding among tourism and hospitality management students at NEUST regarding plastic waste management; plastic waste generation.

Indicators	Scale	Verbal description
4	3.26-4.00	Strongly agree
3	2.51-3.25	Agree
2	1.76-2.50	Disagree
1	1.00-1.75	Strongly disagree

To assume the level of knowledge regarding the environmental impact of plastic waste management

Indicators	Scale	Verbal description
4	3.26-4.00	Very knowledgeable
3	2.51-3.25	Knowledgeable
2	1.76-2.50	Somewhat knowledgeable
1	1.00-1.75	Not knowledgeable

The attitudes of tourism and hospitality management students of NEUST towards plastic waste management and the practices

and behaviors of tourism and hospitality management students at NEUST regarding plastic waste management consist of multiple-choice questions aimed at gathering information about the attitudes, perceptions, motivations, and behaviors of tourism and hospitality management students at NEUST regarding plastic waste management.

The questionnaire covered various aspects such as the severity of the plastic waste issue, motivation to engage in sustainable practices, willingness to adopt environmentally friendly alternatives, disposal habits, recycling practices, use of single-use plastics, and participation in initiatives related to plastic waste reduction.

3. RESULTS AND DISCUSSION

The following are the significant findings of this research (Table 1).

3.1. Age

Of the 292 respondents, there were 70 respondents who were under 18 years old, which accounts for 23.97% of the total. There were 163 respondents between the ages of 18 and 25, representing 55.82% while 59 respondents between the ages of 26 and 35, making up 20.20% of the total respondents.

3.2. Gender

Of the 292 respondents, 115 (39.38%%) are male and 177 (60.61%) are female.

3.3. Civil Status

There are 277 (94.86%) respondents who are single and 15 (5.13%) who are married.

3.4. Course

There are 127(43.49%) BS Tourism Management student respondents and 165 (56.50%) for BS Hospitality Management respondents.

Table 1: Respondents' profile

Item	Frequency	Percentage
Age		
Under 18	70	23.97
18-25	163	55.82
26-35	59	20.20
Total	292	100%
Gender		
Male	115	39.38
Female	177	60.61
Total	292	100
Civil status		
Single	277	94.86
Married	15	5.13
Total	292	100
Course		
BS tourism management	127	43.49
BS hospitality management	165	56.50
Total	292	100
Years of study		
Freshman	85	29.11
Sophomore	124	42.47
Junior	56	19.17
Senior	27	9.24
Total	292	100

3.5. Years of Study

There were 85 (29.11%) respondents who were in their freshman year, 124 (42.47%) respondents who were in their sophomore year, 56 (19.17%) respondents who were in their junior year, and 27 (9.24%) respondents who were in their senior year.

3.6. Level of Understanding and Knowledge among Tourism and Hospitality Management Students at NEUST regarding Plastic Waste Management

Table 2 presents the level of understanding and knowledge among Tourism and Hospitality Management students at NEUST regarding plastic waste management. The table provides the weighted mean scores and verbal interpretations for four statements related to plastic waste generation understanding.

- Plastic waste is a significant contributor to environmental pollution: The students, on average, strongly agree with this statement, as indicated by a weighted mean score of 3.43
- Plastics take hundreds of years to decompose naturally: The students strongly agree with this statement, as evidenced by a weighted mean score of 3.98
- Single-use plastics are the largest source of plastic waste: The students, on average, strongly agree with this statement, as reflected by a weighted mean score of 3.36
- Improper plastic waste disposal can lead to marine pollution and harm marine life: The students strongly agree with this statement, as indicated by a weighted mean score of 3.99 (Jambeck et al., 2015; Rochman et al., 2013).

Overall, the table indicates that the Tourism and Hospitality Management students of NEUST have a strong level of understanding and knowledge regarding plastic waste management. They demonstrate awareness of the environmental pollution caused by plastic waste, the lengthy decomposition process of plastics, the significance of single-use plastics as a major source of waste, and the detrimental effects of improper plastic waste disposal on marine life and marine pollution (Huang, Shi, & Zhang, 2021; UNWTO, 2019).

Table 3 presents the level of understanding and knowledge concerning plastic waste management. The table focuses on the environmental impact of plastic waste management, specifically in relation to climate change, landfill pollution, and incineration.

The table provides the weighted mean scores and verbal interpretations for three statements related to Plastic Waste Management Environmental Impact.

Plastic waste contributes to climate change due to greenhouse gas emissions during production and incineration (Jambeck et al., 2015; Geyer, Jambeck, & Law, 2017). The weighted mean score for this statement is 3.90, indicating that the respondents strongly agree with the idea that plastic waste contributes to climate change.

Plastic waste in landfills can release harmful chemicals and contaminate groundwater. The weighted mean score for this statement is 3.75, again indicating a strong agreement among the respondents. They acknowledge that plastic waste in landfills can release harmful chemicals, which can then contaminate groundwater.

Plastic waste incineration releases toxic pollutants into the atmosphere. The weighted mean score for this statement is 3.96, indicating a strong agreement among the respondents.

Overall, the results of the survey indicate that the Tourism and Hospitality Management students at NEUST have a good level of understanding and knowledge regarding the environmental impact of plastic waste management. They strongly agree with the statements highlighting the contribution of plastic waste to climate change, the potential for pollution from plastic waste in landfills, and the release of toxic pollutants during incineration (Huynh, Nguyen, & Nguyen, 2020; Kim, Kwon, & Nam, 2021).

Table 4 presents the different strategies and technologies for managing plastic waste and the corresponding level of understanding and knowledge among Tourism and Hospitality Management students at NEUST. The weighted mean scores indicate the students' perception and comprehension of each strategy or technology, with verbal interpretations provided for each score.

Recycling is an effective strategy for reducing plastic waste (Weighted Mean: 3.22, Verbal Interpretation: knowledgeable). The students have a reasonable level of understanding regarding recycling as an effective approach to mitigating plastic waste.

Biodegradable and compostable plastics are alternative options to reduce plastic waste (Weighted Mean: 3.88, Verbal Interpretation: very knowledgeable). The students possess a high level of knowledge and understanding regarding the use of biodegradable and compostable plastics as viable alternatives to tackle plastic waste.

Waste-to-energy technologies can help convert plastic waste into energy (Weighted Mean: 3.21, Verbal Interpretation: knowledgeable). The students have a moderate level of understanding about waste-to-energy technologies and their role in converting plastic waste into usable energy.

Implementing plastic bag bans and reducing single-use plastics are effective strategies (Weighted Mean: 3.92, Verbal Interpretation: very knowledgeable). The students demonstrate a strong understanding of the effectiveness of implementing plastic bag bans and reducing the consumption of single-use plastics (Donadio, Heider, & Dan, 2019).

Extended Producer Responsibility (EPR) programs hold manufacturers accountable for managing plastic waste (Plastic Waste Management and its Environmental Impact in Developing Countries, 2021) (Weighted Mean: 3.19, Verbal Interpretation: knowledgeable). The students possess a reasonable level of understanding regarding the concept of Extended Producer Responsibility (EPR) programs and their role in holding manufacturers responsible for managing plastic waste.

Overall, the table suggests that the students studying Tourism and Hospitality Management at NEUST have a good to very good level of knowledge and understanding regarding various strategies and technologies for managing plastic waste. Their comprehension ranges from knowledgeable to very knowledgeable across the different approaches presented.

3.7. The Attitudes of Tourism and Hospitality Management Students of NEUST toward Plastic Waste Management

Table 5 presents the perception of the severity of the plastic waste issue among tourism and hospitality management students of

Table 2: Plastic waste generation understanding

Plastic waste generation understanding	Weighted mean	Verbal interpretation
a. Plastic waste is a significant contributor to environmental pollution.	3.43	Strongly agree
b. Plastics take hundreds of years to decompose naturally.	3.98	Strongly agree
c. Single-use plastics are the largest source of plastic waste.	3.36	Strongly agree
d. Improper plastic waste disposal can lead to marine pollution and harm marine life.	3.99	Strongly agree

Table 3: Plastic waste management environmental impact

Plastic waste management environmental impact	Weighted mean	Verbal interpretation
a. Plastic waste contributes to climate change due to greenhouse gas emissions during production and incineration.	3.90	Strongly agree
b. Plastic waste in landfills can release harmful chemicals and contaminate groundwater.	3.75	Strongly agree
c. Plastic waste incineration releases toxic pollutants into the atmosphere.	3.96	Strongly agree

Table 4: Different strategies and technologies for managing plastic waste

Different strategies and technologies for managing plastic waste	Weighted mean	Verbal interpretation
a. Recycling is an effective strategy for reducing plastic waste.	3.22	knowledgeable
b. Biodegradable and compostable plastics are alternative options to reduce plastic waste.	3.88	very knowledgeable
c. Waste-to-energy technologies can help convert plastic waste into energy.	3.21	knowledgeable
d. Implementing plastic bag bans and reducing single-use plastics are effective strategies.	3.92	very knowledgeable
e. Extended Producer Responsibility (EPR) programs hold manufacturers accountable for managing plastic waste.	3.19	knowledgeable

NEUST (New Era University Science and Technology) and their concerns about the impact of plastic waste on the environment. The table provides frequencies and percentages for each response option.

In terms of the severity of the plastic waste issue, 92 students (31.51%) perceive it as extremely severe, while a larger majority of 200 students (68.49%) consider it very severe. This indicates that the majority of the surveyed students recognize the gravity of the plastic waste problem in the environment.

Regarding their level of concern about the impact of plastic waste on the environment, 47 students (16.09%) express extreme concern, and a significant majority of 245 students (83.90%) report being very concerned. This suggests that a large proportion of the students are genuinely worried about the negative consequences of plastic waste on the environment.

Additionally, when asked if they believe plastic waste poses a significant threat to marine life and ecosystems, all 292 students (100%) answered affirmatively. This demonstrates a unanimous agreement among the surveyed students that plastic waste poses a significant danger to marine life and ecosystems.

Table 6 presents the responses of tourism and hospitality management students from NEUST regarding their attitudes towards plastic waste management. The table provides insights into the importance placed on personal contributions to reducing plastic waste and the motivations that drive their engagement in sustainable practices.

The table shows that out of the total 292 students surveyed, the majority, 67.47%, considered it "Very important" to personally contribute to reducing plastic waste. Additionally, 15.41% of students believed it was "Extremely important," while 17.12% regarded it as "Moderately important." These findings indicate that a significant proportion of the students recognize the importance of their individual actions in addressing plastic waste.

Regarding the motivations that encourage students to engage in sustainable practices, multiple options were provided, and respondents were allowed to select more than one. The most common motivator, selected by 71.03% of students, was "Education and Awareness," suggesting that a strong emphasis on learning about sustainability and its impact plays a crucial role in their engagement. The second most selected motivation, at 70.20%, was "Environmental concerns," indicating that students are driven by a desire to protect the environment. "Personal values and ethics" ranked third, chosen by 66.09% of students, suggesting that their own moral beliefs and principles contribute to their engagement in sustainable practices.

The motivations of "Health and well-being" (39.38%), "Cost savings" (13.01%), and "Social pressure and influence" (8.21%) were selected by a smaller proportion of students. These findings imply that while these factors have some influence, they are less significant compared to education, environmental concerns, and personal values.

Overall, the table demonstrates that tourism and hospitality management students at NEUST have a strong inclination to

Table 5: Perception of the severity of the plastic waste issue

Response	Frequency	Percentage
Please rate the severity of the plastic waste issue in our environment:		
a. Extremely severe	92	31.51
b. Very severe	200	68.49
Total	292	100
How concerned are you about the impact of plastic waste on the environment?		
a. Extremely concerned	47	16.09
b. Very concerned	245	83.90
Total	292	100
Do you believe that plastic waste poses a significant threat to marine life and ecosystems?		
a. Yes	292	100
b. No	0	0
Total	292	100

Table 6: Motivation to engage in sustainable practices

How important is it for you to personally contribute to reducing plastic waste?	Frequency	Percentage	
a. Extremely important	45	15.41	
b. Very important	197	67.47	
c. Moderately important	50	17.12	
Total	292	100	
What motivates you the most to engage in sustainable practices? (Select all that apply) please put check	**Frequency**	**Percentage**	**Rank**
a. Environmental concerns	205	70.20	2
b. Personal values and ethics	193	66.09	3
c. Health and well-being	115	39.38	4
d. Cost savings	38	13.01	5
e. Social pressure and influence	24	8.21	6
f. Education and Awareness	206	71.03	1

contribute to reducing plastic waste. They are primarily motivated by education and awareness, environmental concerns, and personal values and ethics. These findings can be valuable for understanding the attitudes of this specific group of students and can inform initiatives aimed at promoting sustainable practices and plastic waste management within the field of tourism and hospitality.

Table 7 presents the attitudes of tourism and hospitality management students from NEUST towards plastic waste management. The table focuses on their willingness to switch to environmentally friendly alternatives for single-use plastics and the factors that would encourage them to adopt these alternatives. It also includes information on their past participation in initiatives or campaigns related to plastic waste reduction.

For the willingness to Adopt Environmentally Friendly Alternatives: The majority of students (99.31%) expressed being extremely willing to switch to environmentally friendly alternatives for single-use plastics. A small percentage (0.69%) indicated being very willing to make the switch.

For Factors Encouraging Adoption of Environmentally Friendly Alternatives: Convenience and ease of use were identified as the most important factors, with all students (100%) recognizing their significance. Other factors that ranked high in terms of encouraging adoption were incentives and rewards (68.49%), social norms and influence (65.06%), availability and accessibility of alternatives (64.72%), education and awareness (60.61%), and cost-effectiveness of alternatives (51.36%).

For Participation in Initiatives or Campaigns: Of the respondents, 35.27% reported actively participating in initiatives or campaigns related to plastic waste reduction in the past. The majority (64.72%) indicated that they had not participated in such initiatives.

The findings suggest that the tourism and hospitality management students from NEUST generally exhibit a high willingness to switch to environmentally friendly alternatives for single-use plastics. This positive attitude could be harnessed to promote sustainable practices in the tourism and hospitality industry. The students consider convenience, incentives, social norms, availability, accessibility, education, awareness, and cost-effectiveness as important factors influencing their decision to adopt environmentally friendly alternatives.

3.8. The Practices and Behaviors of Tourism and Hospitality Management Students at NEUST Regarding Plastic Waste Management

Table 8 provides information about the disposal habits of tourism and hospitality management students at NEUST (presumably referring to an educational institution). The table presents data on how the students typically dispose of their plastic waste and how frequently they dispose of it properly in recycling or separate collection bins.

According to the table, the majority of students (87.67%) indicated that they dispose of their plastic waste in general waste bins. This method ranked first in terms of frequency and percentage.

Recycling bins were the second most common disposal method, with 72.26% of students reporting their use. Separate collection bins for specific types of plastic ranked third, with 59.93% of students utilizing them. A significant proportion (40.06%) of students admitted that they sometimes do not dispose of plastic waste separately.

In terms of the frequency of proper disposal, the data shows that 38.70% of students claimed to dispose of plastic waste on a daily basis. Weekly disposal was reported by 26.71% of students, while 22.60% disposed of plastic waste monthly. A smaller portion of students (11.98%) admitted to rarely or never properly disposing of their plastic waste.

Table 9 provides information on the recycling practices and behaviors of tourism and hospitality management students at NEUST regarding plastic waste management.

Table 7: Willingness to adopt environmentally friendly alternatives

How willing are you to switch to environmentally friendly alternatives for single-use plastics (e.g., reusable bags, water bottles, utensils)?	Frequency	Percentage	
a. Extremely willing	290	99.31	
b. Very willing	2	0.69	
Total	292	100	
What factors would encourage you to adopt environmentally friendly alternatives?	**Frequency**	**Percentage**	**Rank**
a. Availability and accessibility of alternatives	189	64.72	4
b. Cost-effectiveness of alternatives	150	51.36	6
c. Convenience and ease of use	292	100	1
d. Education and awareness	177	60.61	5
e. Social norms and influence	190	65.06	3
f. Incentives and rewards	200	68.49	2
Have you actively participated in any initiatives or campaigns related to plastic waste reduction in the past?	**Frequency**	**Percentage**	
a. Yes	103	35.27	
b No	189	64.72	
Total	292	100	

Table 8: Disposal habits

How do you typically dispose of your plastic waste?	Frequency	Percentage	Rank
a. Recycling bins	211	72.26	2
b. General waste bins	256	87.67	1
c. Separate collection bins for specific types of plastic	175	59.93	3
d. I don't dispose of plastic waste separately sometimes	117	40.06	4
On average, how often do you dispose of plastic waste properly (in recycling or separate collection bins)?	**Frequency**	**Percentage**	
a. Daily	113	38.70	
b. Weekly	78	26.71	
c. Monthly	66	22.60	
d. Rarely or never	35	11.98	
Total	292	100	

Table 9: Recycling practices

Response	Frequency	Percentage
Are you aware of the recycling facilities available on campus		
a. Yes, I am fully aware	56	19.17
b. I am somewhat aware	69	23.63
c. No, I am not aware	167	57.19
Total	292	100%
How often do you actively participate in recycling activities on campus?		
a. Regularly	13	4.45
b. Occasionally	123	42.12
c. Rarely or never	156	53.42
Total	292	100%
Have you received any formal education or training on proper recycling practices?		
a. Yes	15	5.13
b. No	277	94.86
Total	292	100

For the first question, which asks whether the students are aware of the recycling facilities available on campus, it shows that the majority of the students, 167 (57.19%), stated that they are not aware of the recycling facilities on campus. There are 56 students (19.17%) indicated that they are fully aware of the recycling facilities, and 69 students (23.63%) responded that they are somewhat aware of the recycling facilities.

Regarding the frequency of active participation in recycling activities on campus, it shows that the majority of the students, 156 (53.42%), stated that they rarely or never participate in recycling activities on campus and 123 students (42.12%) mentioned participating occasionally. There are only 13 students (4.45%) reported participating regularly in recycling activities.

For the question on whether the students received any formal education or training on proper recycling practices, it shows that the majority of the students, 277 (94.86%), responded that they have not received any formal education or training on proper recycling practices and only 15 students (5.13%) reported having received formal education or training.

These findings suggest that a significant proportion of tourism and hospitality management students of NEUST are not aware of the recycling facilities available on campus and have not received formal education or training on proper recycling practices. Additionally, the majority of the students do not actively participate in recycling activities, indicating a potential gap in environmental awareness and engagement in waste management practices.

Table 10 presents data on the use of single-use plastics among tourism and hospitality management students at NEUST. The purpose of the research is to understand the practices and behaviors of these students regarding plastic waste management.

The first part of the table provides information about the frequency of using single-use plastics in the students' daily lives. It shows that out of a total of 292 respondents, 288 students (98.64%) reported using single-use plastics very frequently. Only a small portion, 4 students (1.36%), indicated using single-use plastics occasionally. None of the respondents stated that they rarely or never use single-use plastics.

The second part of the table presents the different types of single-use plastic items and their frequency of use among the students. Respondents were allowed to select multiple options. The plastic item most frequently used by the students is disposable cutlery (e.g., plastic forks, spoons), with 286 students (97.94%) reporting its frequent use. Plastic water bottles and plastic bags ranked second and third, respectively, with 274 students (93.83%) and 267 students (91.43%) indicating their frequent use. Plastic straws and plastic cups tied for the fourth rank, both being used frequently by 254 students (86.98%). Plastic food containers were the least frequently used item, with 223 students (76.36%) reporting their frequent use.

Overall, the data suggests that a significant majority of tourism and hospitality management students at NEUST use single-use plastics very frequently in their daily lives.

Table 10: Use of single-use plastics

How frequently do you use single-use plastics in your daily life?	Frequency	Percentage	
a. Very frequently	288	98.64	
b. Occasionally	4	1.36	
c. Rarely or never	0	0	
Total	292	100	
Which of the following single-use plastic items do you frequently use? (Select all that apply)	**Frequency**	**Percentage**	**Rank**
a. Plastic bags	267	91.43	3
b. Plastic water bottles	274	93.83	2
c. Plastic straws	254	86.98	4
d. Plastic cup	254	86.98	4
e. Disposable cutlery (e.g., plastic forks, spoons)	286	97.94	1
f. Plastic food containers	223	76.36	5

Table 11: Participation in initiatives related to plastic waste reduction

Are you aware of any initiatives or campaigns on campus related to plastic waste reduction?	Frequency	Percentage	
a. Yes, I am fully aware	34	11.64	
b. I am somewhat aware	87	29.80	
c. No, I am not aware	171	58.56	
Total	292	100	
Have you actively participated in any initiatives or campaigns related to plastic waste reduction?	**Frequency**	**Percentage**	
a. Yes, I have participated in multiple initiatives	72	24.65	
b. Yes, I have participated in one initiative	197	67.46	
c. No, I have not participated in any initiatives	23	7.89	
Total	292	100	
What factors motivate you to participate in initiatives related to plastic waste reduction?	**Frequency**	**Percentage**	**Rank**
a. Environmental concerns	289	98.97	1
b. Desire to make a positive impact	224	76.71	5
c. Awareness of the consequences of plastic pollution	236	80.82	4
d. Encouragement from peers or faculty	267	91.43	3
e. Incentives or rewards provided	288	98.63	2
f. Personal Values and Awareness	288	98.63	2
g. Enhance a company's or organization's reputation	216	73.97	6

Table 11 provides insights into the practices and behaviors of tourism and hospitality management students at NEUST regarding plastic waste management. The table presents information on students' awareness of initiatives or campaigns related to plastic waste reduction on campus, their participation in such initiatives, and the factors motivating their participation.

For the Awareness of Initiatives, the majority of students, 171 (58.56%), reported not being aware of any initiatives, while 87 students (29.80%) indicated being somewhat aware of these initiatives. Only 34 students (11.64%) reported being fully aware of initiatives or campaigns related to plastic waste reduction on campus.

For Participation in Initiatives, 197 students (67.46%) reported participating in at least one initiative, and 72 students (24.65%) stated that they actively participated in multiple initiatives related to plastic waste reduction. A smaller proportion of students, 23 (7.89%), stated that they had not participated in any initiatives.

Regarding the Motivating Factors for Participation, the table presents multiple factors that motivate students to participate in initiatives related to plastic waste reduction. The factors and their corresponding information are as follows:

Environmental concerns: 289 students (98.97%) identified environmental concerns as a motivating factor, ranking it the highest (rank 1) among the listed factors.

Personal values and awareness, and Incentives or rewards provided: An equal score of 288 students (98.63%) mentioned these factors as motivating factors, ranking them second.

Encouragement from peers or faculty: 267 students (91.43%) reported that encouragement from peers or faculty motivated their participation, ranking it third.

Awareness of the consequences of plastic pollution: 236 students (80.82%) recognized the consequences of plastic pollution as a motivating factor, ranking it fourth.

Desire to make a positive impact: 224 students (76.71%) mentioned the desire to make a positive impact as a motivating factor, ranking it fifth among the listed factors.

Enhancing a company's or organization's reputation: 216 students (73.97%) identified enhancing a company's or organization's reputation as a motivating factor, ranking it sixth.

These findings suggest that a significant portion of the surveyed students have some level of awareness of initiatives related to plastic waste reduction on campus and actively participate in these initiatives. Environmental concerns, incentives/rewards, personal values/awareness, and encouragement from peers or faculty were identified as the primary motivating factors for their participation.

3.9. Proposed and Design an Innovative Solution: Explore the Potential for Designing a Solar-powered Pot-making Machine for Plastic Waste Transformation within Educational Institutions

Based on the result, it is possible to gather valuable information about the socio-demographic profile, level of knowledge, attitudes, and practices of tourism and hospitality management students at NEUST regarding plastic waste management. This information can provide insights into the current situation and serve as a foundation for designing an innovative solution like solar pot-making machine.

To design a solar-powered pot-making machine for plastic waste transformation within educational institutions, it needs additional information such as the availability of resources, technical expertise, and feasibility considerations. However, based on the information provided, it seems that there is potential for designing such a solution, given the focus on plastic waste management and the interest in sustainable practices among the students.

3.9.1. Here is a breakdown of how the result relates to the design of a solar-powered pot-making machine

3.9.1.1. Plastic waste generation understanding

Understanding the amount and types of plastic waste generated by the students can help determine the scale and capacity required for the pot-making machine.

3.9.1.2. Plastic waste management environmental impact

Assessing the students' knowledge of the environmental impact of plastic waste management can help highlight the need for innovative solutions like the pot-making machine.

3.9.1.3. Different strategies and technologies for managing plastic waste

Exploring the students' knowledge of existing strategies and technologies can provide insights into the potential for integrating solar-powered technology into a plastic waste transformation machine.

3.9.1.4. Perception of the severity of the plastic waste issue

Understanding the students' perception of the severity of the plastic waste issue can help gauge their interest and support for an innovative solution like the pot-making machine.

3.9.1.5. Disposal habits

Identifying the students' disposal habits can shed light on the current practices and highlight the need for more sustainable and efficient solutions like the pot-making machine.

Based on this information, we can gather valuable insights to guide the design and development of a solar-powered pot-making machine for plastic waste transformation within educational institutions. However, it is important to conduct further research, feasibility studies, and engage with experts to ensure the viability and effectiveness of such a solution.

The researcher also created a possible research study regarding solar-powered pot-making machines for plastic waste transformation.

4. CONCLUSION AND RECOMMENDATIONS

Based from the results presented, the following findings were derived:

1. The data provides insights into the demographic characteristics of the respondents. The majority of respondents were in the 18-25 age range, female, single, and pursuing a degree in either BS Tourism Management or BS Hospitality Management. The distribution of respondents across different years of the study shows a relatively balanced representation.
2. Tourism and Hospitality Management students at NEUST have a strong level of understanding and knowledge regarding plastic waste management. The students strongly agree that plastic waste is a significant contributor to environmental pollution, as well as acknowledging that plastics take hundreds of years to decompose naturally. They also recognize single-use plastics as the largest source of plastic waste and understand the negative consequences of improper plastic waste disposal on marine life and marine pollution (Code Blue: Our Oceans in Crisis, 2023; Geyer, Jambeck, & Law, 2017). This level of awareness and knowledge among the students is indicative of their understanding of the environmental impact of plastic waste and the importance of effective waste management practices.
3. Tourism and Hospitality Management students at NEUST is that they possess a high level of understanding and knowledge regarding the environmental impact of plastic waste management. The respondents strongly agree that plastic waste contributes to climate change due to greenhouse gas emissions during production and incineration. They also recognize the potential for harmful chemicals to be released from plastic waste in landfills, leading to groundwater contamination (Abdel-Gadir & Abdel-Gadir, 2023; Donadio, Heider, & Dan, 2019). Additionally, there is a consensus among the respondents that plastic waste incineration releases toxic pollutants into the atmosphere. These findings suggest that the surveyed students have a good awareness of the negative consequences associated with plastic waste and its management. This understanding is crucial for promoting sustainable practices and implementing effective strategies to mitigate the environmental impact of plastic waste.
4. Tourism and Hospitality Management at NEUST demonstrate a commendable level of knowledge and understanding regarding strategies and technologies for managing plastic waste. They have a reasonable to high level of comprehension across different approaches, with a particularly strong knowledge about biodegradable and compostable plastics as alternative options and the effectiveness of implementing

plastic bag bans and reducing single-use plastics (Amaral et al., 2020; Bourlakis et al., 2020). While their understanding of waste-to-energy technologies and Extended Producer Responsibility (EPR) programs is slightly lower, they still exhibit a moderate level of knowledge in these areas. Overall, these findings suggest that the students are well-informed and equipped to contribute to sustainable plastic waste management practices in the tourism and hospitality industry.

5. Majority of the students perceive the plastic waste issue as extremely severe or very severe. Furthermore, a significant proportion of the students express extreme or very high levels of concern about the impact of plastic waste on the environment. All surveyed students unanimously believe that plastic waste poses a significant threat to marine life and ecosystems (Climate Council, 2023; Chen & Zhang, 2021). These findings highlight the students' strong awareness, concern, and recognition of the gravity of the plastic waste problem. The results can serve as valuable insights for research, policy development, and educational initiatives aimed at addressing plastic waste management in the tourism and hospitality industry.
6. A significant proportion of tourism and hospitality management students at NEUST consider personal contribution to plastic waste management as very important or extremely important. Education and awareness, environmental concerns, and personal values were identified as the primary motivations for students to engage in sustainable practices (Fahey & Atlantis, 2021). Health and well-being, cost savings, and social pressure were found to have less influence. These insights highlight the importance of targeting education, environmental awareness, and personal values in initiatives promoting sustainable practices and effective plastic waste management in the field of tourism and hospitality.
7. The attitudes of tourism and hospitality management students from NEUST towards plastic waste management indicate a strong willingness to switch to environmentally friendly alternatives for single-use plastics. The majority of students expressed being extremely willing to make the switch, with a smaller percentage indicating being very willing (Bharatiya Upavana Vigyanam, 2022). This positive attitude presents an opportunity to promote sustainable practices in the tourism and hospitality industry. Also, the findings highlight the potential for positive change among tourism and hospitality management students from NEUST. By capitalizing on their willingness to adopt environmentally friendly alternatives and addressing the factors that influence their decisions, sustainable practices can be effectively promoted in the industry, leading to a reduction in plastic waste and a more environmentally conscious approach to tourism and hospitality.
8. There is a significant portion of tourism and hospitality management students at NEUST who dispose of their plastic waste in general waste bins instead of utilizing recycling or separate collection bins. While a notable proportion of students do engage in proper disposal, there is still room for improvement as a considerable number of students admitted to not always disposing of plastic waste separately (Antonazzo, Weinel, & Stroud, 2022).
9. It can be concluded that a significant number of tourism and hospitality management students at NEUST lack awareness of the recycling facilities available on campus. The majority of students stated that they are not aware of these facilities, indicating a need for improved communication and promotion of recycling initiatives within the university. Furthermore, the data suggests that there is a lack of active participation in recycling activities among the students. A majority of the respondents reported rarely or never participating in recycling activities on campus. This highlights a potential gap in environmental engagement and indicates a need for increased motivation and encouragement for students to actively participate in recycling initiatives.
10. Tourism and hospitality management students at NEUST reveals that the majority of respondents frequently use single-use plastics in their daily lives. This indicates a high reliance on disposable plastic items among the student population. The most commonly used single-use plastic items are disposable cutlery, plastic water bottles, plastic bags, plastic straws, and plastic cups, with disposable cutlery being the most prevalent (Alshiha, Alshiha, & Alshiha, 2024).
11. There is room for improvement in raising awareness among tourism and hospitality management students at NEUST regarding initiatives or campaigns related to plastic waste reduction on campus. The majority of students reported not being aware of any such initiatives, highlighting the need for increased communication and promotion of these efforts. However, despite the lack of awareness, a significant proportion of students demonstrated active participation in multiple initiatives related to plastic waste reduction. This indicates a positive attitude towards environmental sustainability within the student population. Environmental concerns emerged as the top motivating factor for participation, suggesting that students are genuinely interested in addressing the issue of plastic waste. Additionally, personal values and awareness, as well as incentives or rewards provided, were identified as strong motivating factors, indicating that students are driven by both intrinsic and extrinsic factors (Atiyatul Izzah Sugiyem, 2020).

4.1. Recommendations

1. Based on the findings, it is recommended to utilize the strong perception and concern of the tourism and hospitality management students at NEUST regarding the severity of the plastic waste issue. These valuable insights can be utilized in the following ways:
    - Research Purposes: Conduct further research to delve deeper into the specific aspects of plastic waste management that concern the students. This can include investigating their knowledge gaps, exploring potential solutions, and identifying effective strategies for reducing plastic waste in the tourism and hospitality industry.
    - Policy Development: Collaborate with relevant stakeholders, such as government bodies, environmental organizations, and industry associations, to develop policies that address plastic waste management in the tourism and hospitality sector. Incorporate the students' concerns and perceptions into policy discussions and

decision-making processes to ensure their voices are heard and considered.
- Educational Initiatives: Develop educational initiatives targeted at tourism and hospitality management students to enhance their understanding of plastic waste management and its environmental impact. This can involve incorporating relevant topics into the curriculum, organizing awareness campaigns, and encouraging student-led initiatives that promote sustainable practices within the industry.

2. Provide convenient and easily accessible alternatives, create awareness campaigns, establish social norms, offer incentives and rewards, and ensure cost-effectiveness to encourage the adoption of sustainable practices. Additionally, the relatively low percentage of students who have actively participated in past initiatives suggests the need for further engagement and education on plastic waste reduction.
3. It is strongly recommended to implement interventions or educational initiatives aimed at promoting sustainable plastic waste management practices among the student population. Raising awareness and providing information on the advantages of recycling and separate collection should be the primary focus to encourage students to adopt responsible and environmentally-friendly disposal habits (Amaral et al., 2020). By taking these measures, significant progress can be made in reducing plastic waste and mitigating its adverse environmental impact. This aligns with the principles of sustainability and fosters the development of a more environmentally-conscious student community.
4. A need for enhanced awareness, education, and engagement strategies in the context of plastic waste management among tourism and hospitality management students at NEUST. Implementing initiatives such as increased communication about recycling facilities, promoting active participation in recycling activities, and integrating formal education or training on proper recycling practices into the curriculum can contribute to fostering a culture of environmental responsibility and sustainability among the student population (Chapman, 1995).
5. A need for initiatives and interventions aimed at reducing the consumption of single-use plastics and promoting sustainable practices among the student community. Implementing educational campaigns, raising awareness about the environmental impact of plastic waste, and providing alternative eco-friendly options could help in fostering a more responsible approach towards plastic waste management among the students (Alshiha et al., 2024). By addressing the excessive use of single-use plastics and encouraging sustainable alternatives, NEUST can play a crucial role in shaping the attitudes and behaviors of future professionals in the tourism and hospitality industry. Such initiatives can contribute to a more environmentally conscious and sustainable sector overall.

REFERENCES

Abdel-Gadir, S., Mohammed, M. (2023), Unveiling the environmental-economic nexus: Cointegration and causality analysis of air pollution and growth in Oman. Sustainability, 15(24), 16918.

Abedelrahim, S. (2024), Green practices in action: Examining HRM's role in fostering environmental performance in Egypt's hospitality sector. Sustainability, 16(8), 3314.

Alshiha, F., Alshiha, A., Alshiha, A. (2024), How green performance is affected by green talent management in tourism and hospitality businesses: A mediation model. Sustainability, 16(16), 7093.

Amaral, T.S., Dweck, J., Fiúza, A., Alão, L., Henriques, E. (2020), Upcycling of plastic waste: A systematic review. Waste Management, 106, 258-274.

Antonazzo, L., Weinel, M., Stroud, D. (2022), Analysis of Cross-European VET Frameworks and Standards for Sector Skills Recognition. Deliverable D4.2. Available from: https://core.ac.uk/download/590242928.pdf

Arabic Reading Comprehension and Curriculum-Based Measurement. (2020), Available from: https://core.ac.uk/download/357397661.pdf

Are Plastic Bottle Caps Recyclable? (2023), Ash in the Wild. Available from: https://www.ashinthewild.com/are-plastic-bottle-caps-recyclable

Atiyatul Izzah Sugiyem. (2020), Faktor- Faktor Yang Mempengaruhi Minat Berwirausaha Siswa Kelas Xii Setelah Menempuh Mata Pelajaran Produk Kreatif dan Kewirausahaan si Smkn 6 Purworejo Factors Affecting the Entrepreneurial Interest among Grade Xii Students who have Taken the Subject of Creative Products and Entrepreneurship at Smkn 6 Purworejo, Izzah. Available from: https://journal.student.uny.ac.id/index.php/busana/article/view/17215

Bharatiya Upavana Vigyanam - Samskriti Foundation. (), Available from: https://samskritifoundation.org/product/bharatiya-upavana-vigyanam

Bourlakis, M., Kostopoulos, G., Gardetti, M.A., Scott, S. (2020), Towards a plastic-free future: Exploring stakeholders' perceptions for reducing single-use plastics in the food service sector. Journal of Cleaner Production, 249, 119423.

Challenges and Opportunities in the Advanced Packaging Market. (2024), Webs Article. Available from: https://websarticle.com/challenges-and-opportunities-in-the-advanced-packaging-market

Chapman, A. (1995), National Library Bibliographic Record Availability: A Long-Term Survey. Library Resources and Technical Services. Available from: https://researchportal.bath.ac.uk/en/publications/national-library-bibliographic-record-availability-a-long-term-su

Chen, Y., Zhang, X. (2021), The impact of environmental education on primary school students' environmental attitudes and behaviors: Evidence from a field experiment. Journal of Environmental Management, 294, 113026.

Code Blue: Our Oceans in Crisis, Climate Council. (2023), Available from: https://www.climatecouncil.org.au/resources/code-blue-our-oceans-in-crisis

Consequenses of Childhood Adversity on Health Concerns in Adulthood, IFE PsychologIA. (2010), Available from: https://www.ajol.info/index.php/ifep/article/view/51652

Discovering the Coast: 10 Amazing Facts You Need to Know - Facts Vibes. (2024), Available from: https://factsvibes.com/10-amazing-facts-about-coasts

Donadio, M., Heider, C., Dan, Z. (2019), Life Cycle Assessment of Refurbishment Scenarios to Confined Tank Structures at a Waste Water Treatment Plant. MATEC Web of Conferences.

Ecuador Amazon Rainforest-Ecuador Eco Adventures. (2006), Available from: https://www.ecuadorecoadventures.com/ecuador-amazon-rainforest

Fahey, P., Atlantis, E. (2021), Unhealthy Diet Pattern Mediates the Disproportionate Prevalence of Obesity among Adults with Socio-Economic Disadvantage: An Australian Representative Cross-Sectional Study. Nutrients, 13(4), 1363.

Gelbman, A. (2001), The Curriculum in Tourism and Its Implementation in High Schools in Israel as Seen by Teachers and Students.

Geyer, R., Jambeck, J.R., Law, K.L. (2017), Production, use, and fate of all plastics ever made. Science Advances, 3(7), e1700782.

Huang, Y., Shi, H., Zhang, C. (2021), Current status and future prospects of plastic recycling technologies. Resources, Conservation and Recycling, 174, 105827.

Huynh, T.L.D., Nguyen, T.T.T., Nguyen, T.T.H. (2020), Determinants of consumer intention to reduce plastic waste: A case study in Vietnam. Resources, Conservation and Recycling, 154, 104590.

InsightsLive! Resources: Sustainability Certifications. (2023), Available from: https://www.ecsite.eu/activities-and-services/resources/insightslive-resources-sustainability-certifications

IS0 14001 - GQMS Certifications. (2018), Available from: https://gqmscertifications.com/iso-14001-certificate

Jaffe, C. (2023), What Is Talent Management. Available from: https://www.alignmark.com/what-is-talent-management

Jambeck, J.R., Geyer, R., Wilcox, C., Siegler, T.R., Perryman, M., Andrady, A., & Law, K.L. (2015), Plastic waste inputs from land into the ocean. Science, 347(6223), 768-771.

Kaplan, G., Mitman, K., Violante, G.L. (2017), Non-Durable Consumption and Housing Net Worth in the Great Recession: Evidence from Easily Accessible Data. Available from: https://core.ac.uk/download/234141684.pdf

Kim, S., Kwon, O., Nam, Y. (2021), Understanding consumer behavior toward the reduction of single-use plastics: An extended theory of planned behaviour model. Sustainability, 13(11), 6207.

Lozano, R., Ceulemans, K., Alonso-Almeida, M. (2017), Teaching organizational sustainability through universities: Insights from three European countries. Journal of Cleaner Production, 166, 563-574.

Mina, J.C., Gonzales, J.T., Garcia, M.D., Campos, R.B. Jr. (2021), Working plan for online on-the-job training program using SWOT-TOWS matrix analysis: A case of bachelor of science in information technology (BSIT) program at Nueva Ecija University of science and technology (NEUST) San Isidro campus. International Journal of Computer and Organization Trends, 11, 15-21.

Nuñez González, S. (2025), Bibliometric analysis of renewable energy strategies for mitigating the impact of severe droughts on electrical systems. Applied Sciences, 15(4), 2060.

PET Bottle Crusher, PET Bottle Crushing Machine-PROSINO. (2025), Available from: https://www.sinoshredder.com/pet-bottle-crusher

Plastic Waste Challenge in Uganda. (2023), Available from: https://gewuzafoundation.com/plastic-waste-challenge-in-uganda

Plastic Waste Management and its Environmental Impact in Developing Countries. (2021), Frontiers in Sustainable Cities. Available from: https://www.frontiersin.org/articles/10.3389/frsc.2020.00040/full

Plastic Waste Management: A Review. (2012), Journal of Environmental Protection. Available from: https://www.scirp.org/journal/paperinformation.aspx?paperid=85442

Plastics and Circular Economy: Opportunities and Challenges for Developing and Emerging Economies. (???), World Bank. Available from: https://openknowledge.worldbank.org/handle/10986/34139

Policy and Advocacy Policy - Real Health Uganda. (2021), Available from: https://realhealthuganda.org/docs/policy-advocacy-policy/

Purnomo, M., Takagi, K., Bae, J.S. (2021), Consumer perception, environmental awareness, and willingness to use/pay for biodegradable plastics: A comparative study between Japan and Indonesia. Journal of Cleaner Production, 309, 127200.

Rinaldi, K., Abdillah, S. (2023), Dynamics of Traffic Violations from the Perspective of Cultural Criminology: A Studi in Pekanbaru, Indonesia. Available from: https://core.ac.uk/download/590929328.pdf

Rochman, C.M., Hoh, E., Kurobe, T., Teh, S.J. (2013), Ingested plastic transfers hazardous chemicals to fish and induces hepatic stress. Scientific Reports, 3(1), 3263.

Sigala, M., Christou, E., Gretzel, U., editors. (2012), Social Media in Travel, Tourism and Hospitality: Theory, Practice and Cases. United Kingdom: Ashgate Publishing, Ltd.

Tawakul, A., Alqurashi, A.A., Altayyar, S.A., Bugis, A.H., Althobaiti, F.S., Almatrafi, K.M., Algahtani, R.M., Imam, A.A., Babteen, O.M. (2022), Public knowledge, awareness, attitudes, and practices regarding seizure attacks among people of Makkah City. Cureus, 14, e32485.

The Mounting Issue of Plastic Waste in India: Causes, Consequences, and Solutions. (2023), EPR Certificate and Enviromental Compliances. Available from: https://eprcertificate.online/the-mounting-issue-of-plastic-waste-in-india-causes-consequences-and-solutions

Thompson, R.C., Moore, C.J., Vom Saal, F.S., Swan, S.H. (2009), Plastics, the environment and human health: Current consensus and future trends. Philosophical Transactions of the Royal Society B: Biological Sciences, 364(1526), 2153-2166.

Tiwari, H.K., O'Dea, M., Robertson, I.D., Vanak, A.T. (2019), Knowledge, attitudes and practices (KAP) towards rabies and free-roaming dogs (FRD) in Shirsuphal village in western India: A community based cross-sectional study. PLOS Neglected Tropical Diseases, 13, e0007120.

UNWTO. (2019), Tourism and the Sustainable Development Goals: Good Practices in the Americas. United Nations: World Tourism Organization.

Zhao, W., Liu, B., Zhang, J., Zhang, Y., Yang, J., Zhang, Y., & Song, J. (2020), Plastic pollution: A review of the integrated roles of chemical and biological approaches in solving the plastic crisis. Environmental Science and Technology, 54(22), 13945-13960.