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Issue Article

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INNOVATED MULTI-PURPOSE FOOD REDUCTION MACHINE

Abstract: *This research developed and evaluated the multi-purpose food waste reduction machine. A multi-purpose food waste reduction machine is developed and tested at Cebu Technological University-Pinamungajan Campus in 2022–2023. Cluster random sampling selected research participants. It has 60 first-year hospitality management students, 14 teachers, and 10 university partner vendors/hospitality industry managers. The school's Hospitality Management Laboratory and Maintenance System needs an Innovated Multi-purpose Food Waste Reduction Machine. Technology Diffusion, an Innovated Multi-purpose Food Waste Reduction Machine, meets standards and guides the Hospitality Management Laboratory and Campus Maintenance System after thorough research study analysis and interpretation. It explores Circular Economy (CE) concepts and the Developed Innovative Multipurpose Food Waste Reduction Machine's utility, usability, and customer satisfaction. The program's effectiveness and participants' understanding of CE themes were very high, and the association between these factors was moderately positive. The Hospitality Management Laboratory should adopt, generate, and share the latter for students and instructors.*

Key words: *Innovation, food waste reduction machine, organic fertilizer, acceptability, quality dimension.*
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Introduction

Global food waste costs money, ethics, and the environment. Food production uses the most resources and emits the most CO_2 emissions. Despite occupying 34% of the territory the population is growing, with 69% being the water's primary cause of deforestation and habitat loss, 1.3 billion tons of food are lost every year around the world, are uneaten food [1]. Similarly, it is estimated 30.8 million tons of waste is generated by Small and Medium Enterprises (SMEs) in England [2].

Moreover, Global economic, environmental, and social structures prioritize the circular economy. [3], and this transition to a more sustainable future is gaining traction in political and business thinking [4][5]. Likewise, CE is important because of its ability to attract both the business and policy-making communities to sustainability work [6], however, it is also suggested using circular economy ideas to accelerate business and create a more sustainable experience for all stakeholders in the hotel and tourism industry [7]. On the other hand, Hospitality businesses must manage solid waste [8]. To this effect, it is found that hoteliers' waste management techniques initially achieved 76% Sorting is used, along with 39% recycling, 29% reduction, and 0.8% composting... Hotel size affected trash management [9]. However, it was revealed that large hotels manage their solid waste well, helping them survive the crisis [10]. Thus, hotel MSW differs widely. Each hotel guest generates 0.89 kg of MSW daily [11]. Due to all these findings, [12] to fulfill the UN-SDGs, strong policies should prioritize investments in solid waste decentralization, supply chain localization, recycling, green recovery, information exchange, and global cooperation. Thus, it was found that strengths were the ability to recycle garbage, improve the environment, reduce, greenhouse gas emissions and costs; stimulate cooperation, bio-based chemical, and energy

production; creating jobs, new investments by developing based on organic waste, and enhancing green solution companies [13].

MATERIALS AND METHODS

This paper is employed an Embedded mixed-method design to collect data on how well participants understood circular economy and how well the developed "innovative multipurpose food waste reduction machine" was received in the hospitality management sector in terms of its perceived usefulness, ease of use, and clients' satisfaction.

It is anchored to the following theoretical and philosophical framework on Circular Economy (CE) Theory wherein the concept of circular energy-material flow originally appeared in Kenneth E. Boulding's book in 1966, which advises a "cyclical" production system. Lately, it was highlighted]as one of the oldest social science theories. Circular economies (CEs) are production and consumption systems strategy that reuses and recycles materials and products for the longest possible [14]. CE emphasizes the design-based application of the model's three basic principles address to global issues like climatic change, biodiversity loss, waste, and pollution. The circular economy demands waste and pollution reduction, circulating products, materials, and natural regeneration "A circular economy is a zero-waste, pollution-free economy throughout the life cycles from materials environmental extraction, industrialization, consumers and applies all ecosystems." At the end of their lives, materials return to an industrial process or, in the case of treated organic residuals, to the environment. Thus, establishing business monitoring systems to measure resource use and waste is the first step to informed change procedures. [15], while [16] highlighted that finding an equilibrium between economic and environmental needs is crucial to truly embrace environmental sustainability.

RESEARCH METHODOLOGY

This study Descriptive Quantitative Research Design utilizing an online Google form and the questionnaire is the principal data collection method. Descriptive research methods especially surveying will be this study. Questionnaires will be given to sixty 1st year Bachelor of Industrial Technology students, ten (10) faculty, and ten (10) vendors/hospitality industry managers, serving as experts to assess. Total weighted points, weighted mean, t-test, and analysis and Pearson correlation to test whether there is a significant relationship between the respondents' perceptions of the concepts of circular economy and the developed food waste machine.

RESULTS AND DISCUSSION

The assessment and determining the effectiveness of the innovative multipurpose food waste reduction machine Technological University-Pinamungajan Campus during the Academic Year 2022-2023 basis on Technology Model.

There are existing prior arts related to food waste reduction machines. This is a device powered by an electric motor for grinding food refuse and disposing of it through the plumbing drainage pipelines; may be installed in a residence without a grease trap. The waste disposal unit was devised in 1927 by John W. Hammes, a Racine, Wisconsin-based architect [17].

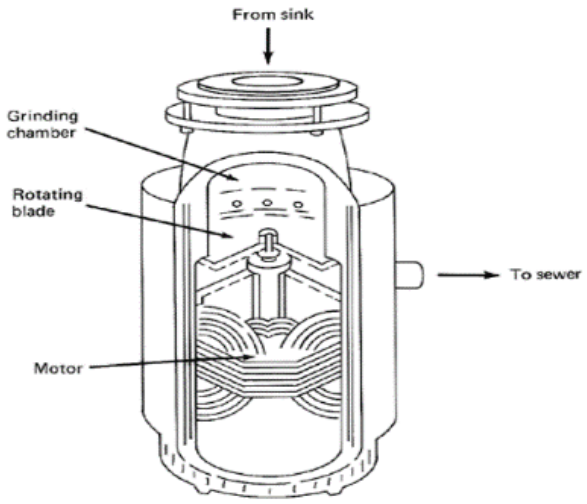

Figure 1. Prior Art Food Waste Disposer.

The Innovated Multipurpose Food Waste Reduction Machine was designed to be utilized for instruction and community skills training. The design of the machine was to crash all types of kitchen waste

into agricultural organic fertilizer. The Innovated Multi-purpose machine has technical requirements such as design, features, ergonomics, safety, materials, tool, and equipment. It was also included in the process such as fabrication, installation, and operations of the innovative multipurpose food waste reduction machine.

THE LEVEL ON THE CONCEPTS OF THE CIRCULAR ECONOMY ON THE COUNTRY'S ECONOMY SOCIETY AND INDIVIDUAL

The level of knowledge of the participants on their concepts of circular economy (CE). The current online survey consists of 20 items that measure the stakeholders' awareness on the concepts of circular economy (CE) in relation to the following: (1) Climate Change; (2) Biodiversity Loss; (3) Waste; and (4) Pollution.

Climate Change

The threat that climate change poses to the viability of cities and their societies must be adequately addressed.

Table 3.
Participants' Knowledge on Climate Change

Item No.	Descriptive Statistics CLIMATE CHANGE	Mean	Std. Deviation	N	Description
1	Does your company/university design products that help in solving climate change?	4.10	.77	84	Agree
2	Does your company/university align circular economy initiatives with climate goals?	4.10	.89	84	Agree
3	Does your company/university scale reuse models in addressing climate change?	4.17	.62	84	Agree
4	Does your company/university utilize strategies in reducing greenhouse gas emissions?	4.04	.83	84	Agree
5	Does your company/university provide techniques that minimizes the use of the world's resources to prevent climate change?	4.06	.88	84	Agree
	Valid N (pairwise) Composite mean	4.09	0.80		Agree/High

Legend:
4.21 – 5.00 Strongly Agree (SA)/ Very High
3.41 – 4.20 Agree (A)/ High
2.61 - 3.40 Neither Agree nor Disagree (NAND)/Fair
1.81 – 2.60 Disagree (D)/Low
1.00 – 1.80 Strongly Disagree (SD)/ Very Low

Urban environments (cities) generate a substantial amount of greenhouse gas emissions, which are the primary cause of climate change [18] Table 3 above presents the Participants' Knowledge on Climate Change Concept of Circular Economy (CE). Thus, there is insufficient and contradictory evidence to support a straightforward causal relationship between climate change and conflict. Emerging consensus suggests that climatic factors are just one of many conflict drivers. Others, such as very low economic development and social and political instability are prevalent [19].

Biodiversity Loss

Both widespread extinctions and habitat-specific extinctions or reductions of species cause biological diversity loss. The latter can be short-term or long-term depending on whether ecological restoration or resilience can reverse the environmental degradation that caused the loss (e.g. through land loss). Human activities have exceeded planetary boundaries, causing a biodiversity crisis that has caused the current global extinction (called the Anthropocene extinction) and is irreversible [20][21][22]. Below is Table 4 Participants' Knowledge of the Concepts on Circular Economy (CE) under Biodiversity Loss.

Table 4.

Participants' Knowledge on Biodiversity Loss

Item No.	Descriptive Statistics BIODIVERSITY LOSS	Mean	Std. Deviation	N	Description
1	Does your company /university provide biodiversity conservation activities?	4.07	.69	84	Agree
2	Does your company/university support local communities in addressing biodiversity loss?	4.17	.66	84	Agree
3	Does your company/university provide interventions in minimizing impacts on biodiversity?	4.02	.85	84	Agree
4	Does your company/university encourage the use of products for as long as possible, through repairing, recycling and redesign – so they can be used again and again?	4.11	.76	84	Agree
5	Does your company/university provide more information to go circular in addressing biodiversity loss?	4.05	.71	84	Agree
	Valid N (pairwise) Composite mean	**4.08**	**0.73**		**Agree/High**

Legend:

4.21 – 5.00 Strongly Agree (SA)/ Very High
3.41 – 4.20 Agree (A)/ High
2.61 - 3.40 Neither Agree nor Disagree (NAND)/Fair
1.81 – 2.60 Disagree (D)/Low
1.00 – 1.80 Strongly Disagree (SD)/ Very Low

Table 4 above shows the respondents' mean responses ranging from 4.02 with a standard deviation of .85 to 4.17 with a standard deviation of .66 and a composite mean of 4.08 with a standard deviation of 0.73 interpreted as "high". This reflected participants' biodiversity loss knowledge, a Circular Economy concept (CE). Participants also knew that their university support local communities in addressing biodiversity loss. However, they were equally aware that school implementation on innovative food waste machine of the university provided it as interventions in minimizing impacts on biodiversity. Thus, it is concluded that dwindling biodiversity may exacerbate the phenological shifts caused by rising global temperatures [23].

Waste

Reducing waste is one of the key tenets of lean, but it has been taken for granted that everyone has the same definition of waste [24].

Table 5.

Participants' Knowledge on Waste

Item No.	Descriptive Statistics WASTE	Mean	Std. Deviation	N	Description
1	Does your company/university sell a product out of waste?	3.86	.78	84	Agree
2	Does your company/university participate in selling of goods out of a waste material?	3.95	.74	84	Agree
3	Does your company/university buy back or take back goods and reuse the products?	3.80	.80	84	Agree
4	Does your company/university refurbish goods and/or parts?	4.07	.60	84	Agree
5	Does your company/university recycle and/or recover material?	4.25	.66	84	Strongly Agree
6	Does your company/university use recovered material to produce new products?	4.17	.86	84	Agree
	Valid N (pairwise) Composite mean	**4.02**	**0.74**		**Agree/High**

Legend:

4.21 – 5.00 Strongly Agree (SA)/ Very High
3.41 – 4.20 Agree (A)/ High
2.61 - 3.40 Neither Agree nor Disagree (NAND)/Fair
1.81 – 2.60 Disagree (D)/Low
1.00 – 1.80 Strongly Disagree (SD)/ Very Low

Responses ranged from a low of 3.80 and a very high of 4.25 (both with standard deviations of .80 and .66, respectively) to a combined mean of 4.02 and a standard deviation of 0.74 (both interpreted as "high"). This result is in line with the participants' knowledge with waste management as a key element of the Circular Economy (CE). Participants' knowledge with the fact that the university recycle and/or recover material is very high. They also know that the university buy back or take back goods and reuse the products, which is similarly high though it's the lowest. Hence, focusing on ways to lessen plate trash's negative effects on the environment. Also included are specific steps that can be taken to lessen the carbon footprint (CF) of food waste at China's educational institutions [25].

Table 6.
Participants' Knowledge on Pollution

Item No.	Descriptive Statistics POLLUTION	Mean	Std. Deviation	N	Description
1	Does your company/university sell up-recycled products to lessen the probability of pollution?	4.01	.74	84	Agree
2	I am considering rethinking my business model to incorporate CE principles in the work activities we do to minimize pollution.	4.20	.58	84	Strongly Agree
3	Does your company/university provide intervention campaigns targeted at promoting pro-environmental attitudes and reducing consumer demand? (e.g., plastic pollution and food waste products)	4.18	.62	84	Agree
4	Does your company/university utilize strategies in cutting waste to reduce carbon emissions?	4.20	.69	84	Strongly Agree
	Valid N (pairwise) Composite mean	**4.15**	**0.66**		**Agree/ High**

Pollution

Table 6 above, showed the participants response varying from the lowest mean of 4.01 with a standard deviation of .74 to the highest mean of 4.20 with a standard deviation of .69 and a composite mean of 4.15 and a standard deviation of 0.66 interpreted as "high". This corresponds to the level of the participants' knowledge on pollution, as one of the concepts of Circular Economy (CE). The stakeholders were equally high in knowledge that the university sell up-recycled products to lessen the probability of pollution and provide intervention campaigns targeted at promoting pro-environmental attitudes and reducing consumer demand? (e.g., plastic pollution and food waste products) All these items were to reduce pollution. However, they have very high level of knowledge on incorporating CE principles in the work activities they do to minimize pollution and utilize strategies in cutting waste to reduce carbon emissions.

When there is the possibility of harm, pollution occurs. Sense offences and property damage are all considered forms of harm to humans, so even if odors and noises do not directly cause harm, they can still be considered pollutant. Causes of harm to living organisms include both direct health effects and indirect harm to the ecological systems of which they are a part [26].

The primary objective of the circular economy is the prolonged use of already present economic resources. To this end, many eco-friendly initiatives have been put into place, including decreased reliance on fossil fuels, increased recycling, decreased emissions, and so on [27].

CONCLUSION

After rigorous examination and interpretation of the research investigation, the data indicate that Technology Diffusion an Innovated Multi-purpose Food Waste Reduction Machine meets the required standards and is a precise guide in Hospitality Management Laboratory and for Campus Maintenance System. Moreover, findings also suggest that more research should be conducted on the extensive information dissemination on CE concepts pertinent to the use of the Developed Innovative Multipurpose Food Waste Reduction Machine to ensure the innovation's viability.

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