Understanding Food Waste Reduction Behavior oof Young Adults in Developing Countries: Application of TIB And IMB Skills Integrated Model

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Approximately one-third of the world food is wasted annually. Food waste is causing drastic economic, social, and environmental damages. Though the young consumers are now more concerned about the consequences of food waste leading to momentous changes in their behavior. This study helps to identify the factors contributing to the reduction of food waste by integrating TIB with the IMB skills model. This research also helps in validating the measuring food waste reduction behavior parsimoniously as a higher order construct consisting of 3R's i.e., reduce, reuse and recycle. Quantitative data was collected from 385 university students of Pakistan through an online survey. Smart PLS 4 was used to analyze the measurement and structural model. The results of this study indicate that information, habits and intention play a significant role in the reducing of food waste whereas, motivation facilitating conditions and behavioral skills does not play a significant role in food waste reduction. This study also validates that food waste reduction behavior can be used as a high order construct of 3Rs. Based on this research improvements can be made in the universities and food waste management policies can be made to facilitate the university students.

Keywords: Theory of Interpersonal Behavior, Information Motivation Behavioral Skills Model, Young Consumers, Food Waste Reduction.

Introduction

Food waste is increasing as modern lifestyle prioritizes convenience seeking among consumers leading to wasteful behaviour and thoughtless attitudes (Lazell, 2016). Globally around 14 percent of the world's food, having a value of $400 billion, is wasted every year between production and the retail end. (FAO, 2019). If a fourth of the food currently wasted can be preserved, it will feed 870 million hungry people. The United Nations, Sustainable Development Goals (SDGs) 2 and 12 have targeted zero-hunger, responsible production and consumption, emphasizing the significance of reducing food waste (Kaur, Dhir, Talwar & Alrasheedy, 2020). Food wasted at the last stage of the food supply chain is mainly due to the

behavior, habits, and attitudes of consumers. (Principato et al., 2020). Therefore, alongside sustainable innovation and corporate social responsibility in the food industry, the pro-environmental behavior of consumers towards reducing food waste will be needed to achieve SDG targets (Bhatti, Saleem, Zakariya & Ahmad, 2023).

Food waste among young adults is alarmingly high (Kaur et al., 2020; Ellison et al., 2019). Paradoxically though there is also growing consciousness among them to reduce wastage (Zhang et al., 2021). Literature shows that there are several differences between consumers based on age when it comes to the understanding of food waste and its consequences. Compared to older consumers, young adults waste more food (Knezevic, Kurnoga & Anic, 2019). Yet at the same time, the health and sustainable survey by Global Scans (2021) shows that Gen Z is the most likely to express concern about healthy lifestyles and environmental protection. Along with that the growing interaction with social media also play a vital role as it has been observed that there is a significant relationship between consumer's intention to decrease food waste and actual food waste reduction behavior (Attiq et al., 2024).

In all developing economies, youth comprise the largest segment of the population and there exists a challenge to convert youth bulge into youth dividend. Responsible consumption on the part of young adults is therefore critical to address consumer food wastage in developing countries. Further, as developing countries are faced with food insecurity and insufficient income, resource wastages need to be plugged. Also, the value of food at the consumer's end is far more than any other stage of the food supply chain, developing countries cannot afford to overlook consumer food waste (Bhatti et al., 2023). On an individual level food waste generation in developed countries is higher as compared to developing countries, but on aggregate the total generation of developing countries is almost equal to that of developed countries as the population of the latter is larger (Thi, Kumar & Lin, 2015). Therefore, the solution to global food waste requires special attention to developing countries.

The theory of Planned Behavior (TPB) and the Norm Activation Model (NAM) are the most common theories that have been used to study waste behavior. These models use awareness of consequences, ascription of responsibility, attitude, subjective norms, personal norms, and perceived behavioral control, as explanatory variables of an individual's intention and behavior (Ajzen, 2001; Schwartz, 1977). As these models adopt a cognitive approach to explore human behaviors (Xu et al., 2016), they offer a lower explanatory power in food waste reduction behavior (Attiq et al., 2021). Affective, environmental and skill related variables are missing in these models. So it has been suggested to investigate pro-environmental behavior through models other than TPB and NAM to broaden the scope of research related to waste-aversive behavior (Werff & Steg, 2014). Our paper addressed this theoretical gap by combining the Theory of Interpersonal behavior (TIB) and the IMB skills model. TIB focuses on the impact of habits and facilitating conditions on pro-environmental behavior. IMB skills model focuses on the impact of Information, motivation, and behavioral skills on an individual's propensity to act in a certain way. While originally applied in the health sector, this theory is also being applied to environmental contexts. Liu and Wang (2022) tested an integrated framework with the IMB

skills model and TIB, in the USA to explain recycling behavior. We are using the adapted version of their model to understand food waste reduction behavior from a sustainability perspective based on all three aspects of food waste reduction behavior namely Reduce, Reuse, and Recycle (3Rs).

Following are the objectives of the current study:

1. To investigate the pro-environmental role of young adults in reducing food waste in a developing country context.
2. To test the validity of measuring food waste reduction behavior parsimoniously as a higher-order construct consisting of 3R's.
3. To explain the food waste reduction behavior through the lens of the TIB and IMB skills integrated model.

Literature Review

Food Waste Reduction Behavior as A Type of Pro-Environmental Behavior

Pro-environmental behavior is a demonstration of concern for the environment to diminish any negative consequences for the environment. Consumers who exhibit pro-environmental behavior are remarkably averse to food wastage (Graham-Rowe et al., 2019). Pro-environmental behavior relates closely to sustainable and responsible consumption (Welch, Swaffield & Evans, 2018). Consumers who consume responsibly are in effect helping attainment of sustainable development. Prior literature has also explored drivers which helps in engaging food waste reduction behavior such as emotions and extensive thinking and specially the antecedents which builds up gen z food waste reduction behavior (Boyd & Mul, 2024; Ding & Jiang, 2023). These consumers show intention to make any necessary changes in behavior to minimize consumption impacts, and they are also motivated to engage in anti-food waste behavior (Poonia et al., 2021). Reduction of food wastage, reusing leftover food, and recycling food waste are all related to sustainability. For example, recycling food waste can improve environmental conditions and soil fertility. These aspects are well known by the pro-environmental consumer (Attiq et al., 2021).

Integration of Theory of Interpersonal Behavior (TIB) and IMB Skills Model

Consumer behavior is an outcome not only of rational choice but affective, contextual, and personal capacity-based factors also come into play. Therefore, we have incorporated habits and facilitating conditions from the TIB into our model. TIB underpins expectancy-value and normative effects of consumer behavior. TIB posits that individual's capacity to make rational decisions is phased out as consumer develops habitual behavior (Bamberg & Schmidt, 2003). In the current study, TIB is combined with the Information Motivation Behavioral skills model to account for the role of knowledge and motivation which tend to mold and build behavioral skills.The basic assumption of the IMB model is that information, motivation, and behavioral skills are key determinants of behavior as it related to adoption and adherence to certain practices (Fisher et al., 2003). IMB emphasizes the importance of information exposure. Information is

particularly important for food waste aversion behavior because a paucity of information may result in debilitating a consumer's capacity to take action related to food waste reduction, reusing, and recycling (Liu & yang, 2022). Motivation is also critical as it gauges consumers' desire to engage in waste reduction behavior. The third component of the IMB model is behavioral skills, which is important because without having the ability to engage in a target behavior, consumers anti-food wastage intentions would only be a wish (Ehret et al., 2019).

FOOD Waste REDUCTION BEHAVIOR

From a sustainability perspective, food waste reduction behavior comprises of three aspects. These 3Rs include: "Reduce" implying a reduction of waste generation; "Reuse" implying utilization of food products in some other form; "Recycling" implying use of food parts as materials for creating other useful items (Mumtaz et al., 2022). Although, food waste reduction behavior is recognized as a combination of 3Rs, most empirical studies looking into its causes relate it to recycling only (Barone, Grappi & Romani, 2019). In this study, 3Rs are treated as a univariate to measure the food waste reduction behavior. We are of the view that as consumer food waste behavior takes place at all stages, from meal planning to disposal of left overs, minimizing food wastages entails reducing unnnecessary food purchases and consuming what has been purchased. It also entails reuse of food items by eating them again later or sharing them with others. And it entails food waste recycling behavior such as separating food from other garbage to be put to some other use (Kim et al., 2019).

Information

Within the IMB skills model, information determines of proper and consistent action especially as the accuracy of information brings about positive behavioral change. Conversely, inaccurate information restricts positive change in behavior (Liu & yang, 2022). Information related to food waste reduction has three aspects: Procedural Knowledge or information about how and when to reduce wastage; Impact Knowledge meaning being aware of the consequences of wastage; and Normative Knowledge alluding to being perceptive of others' wasteful behavior (Schultz, 2002). Consumers having procedural knowledge would be more likely to develop behavioral skills required to stop food wastage. Similarly, researchers have found that the more knowledgeable a consumer the more concern is shown regarding the environmental consequences of wastage. Further, young consumers are more aware of the negative consequences of food wastage as they usually have more access to environment-related information (Seacat & Northrup, 2010).

H1: Information positively influences the intention to reduce food waste.

H2: Information positively influences behavioral skills

.**Motivation**

Another construct of the IMB skills model is motivation. It exists on individual and social levels. At a personal level, motivated people have a positive attitude toward engaging in

activities due to their belief that they can be successful in their endeavors and that the outcome of their behavior will be good for them. Social motivation, on the other hand, is due to an individual's realization that social norms are supportive towards a desirable behavior (Seacat & Northrup, 2010). Motivation also means the ascription of responsibility in terms of developing aversion to wastage and desire toward activities involving reducing, reusing and recycling of food(Liu & yang, 2022).

H3: Motivation positively influences the intention to reduce food waste.

H4: Motivation positively influences behavioral skills.

Intention To Reduce FW

While behavioral intention is widely acknowledged as being conceptually different from behavior (Sheeran and Webb 2016), nevertheless behavioral intentions are a critical predictor of actual behavior (Azjen, 1991). For behaviors that can be performed with ease, information, and motivation exert a direct influence on behavior. Conversely, when engaging in behavior is complicated, behavioral skills are the linkage through which information and motivation impact behavioral intention (Liu & yang, 2022).

H5: Intention to reduce food waste has a positive influence on food waste reduction behavior.

H6: Intention to reduce food waste mediates the relationship between information and food waste behavior.

H7: Intention to reduce food waste mediates the relationship between motivation and food waste behavior.

Behavioral Skills

IMB skills model considers the impact of skills on behavior. Skills consist of a person's actual capacity to perform an act as well as one's perceived self-efficacy or confidence in being able to perform (Seacat & Northrup, 2010). The IMB model proposes both a direct and indirect role of skills on behavior. The more the level of information and motivation an individual has, the stronger this individual's belief that engaging in the target behavior is beneficial, and the higher the chances of acquiring the skills needed to demonstrate the behavior (Ehret et al., 2019).

H8: Behavioral skills have a positive influence on food waste reduction behavior.

H9: Behavioral skills mediate the relationship between information and food waste behavior.

H10: Behavioral skills mediate the relationship between motivation and food waste behavior.

Facilitating Conditions

Within TIB, facilitating conditions are defined as the actual availability of resources to enable a behavior as one well as the belief that these resources exist (Mumtaz et al., 2022). Situational factors for the uptake of waste aversive behavior or impediments towards adoption of such practices demonstrate facilitating and limiting conditions (Issock et al., 2020). Researchers found that the lack of facilities for wastage avoidance such as food availability only in large portions, limited storage space, no opportunity to sort garbage etc., all hinder the consumers desire to engage in food waste reduction behaviour (Ting et al., 2019).

H11: Facilitating conditions have a positive influence on food waste reduction behavior.

Habits

TIB also considers consumer habits. These are defined as patterns of behavior which remain consistent over time and which are reinforced due to repetition. Habits do not require conscious thought and become automatic processes unlike intentional actions (Russell et al., 2017). Steg and Vlek (2009) noted that pro-environmental behavior is often habitual for someone who has adopted this as a lifestyle choice. Research indicates that habits are a highly significant predictor of food waste reduction behavior and have a strong influence on all three aspects of food waste reduction behavior (Attiq et al., 2021).

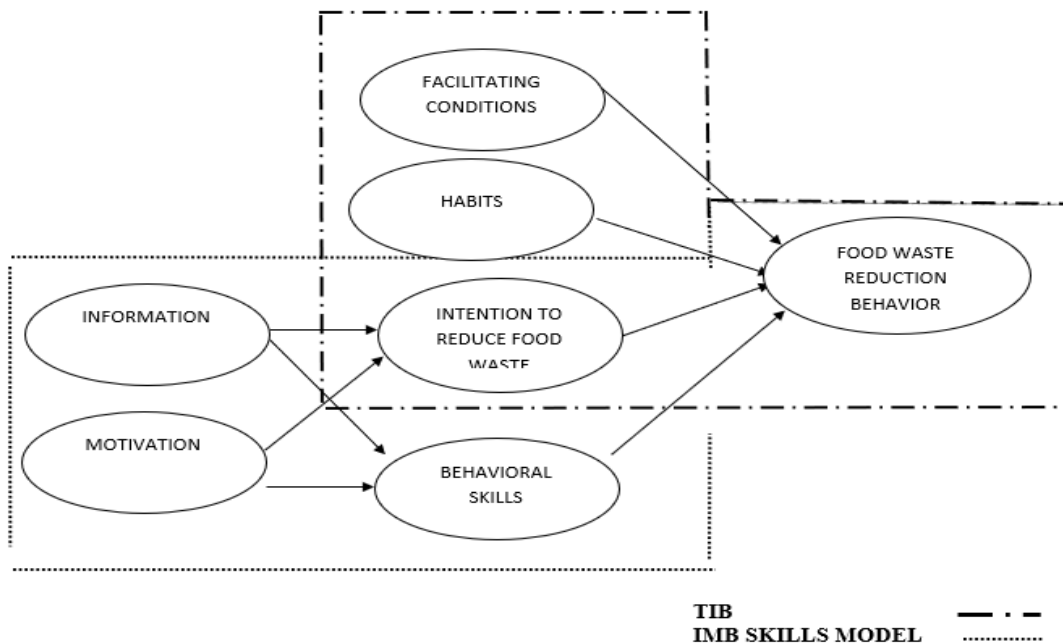H12: Habits have a positive influence on food waste reduction behavior.

Figure 1: Conceptual Framework

Research Methodology

To test the proposed conceptual model, we collected primary data from 385 students from different universities in Pakistan through an online survey. The target population was young consumers. Data was collected using a purposive sampling technique. To calculate the appropriate sample size, we used an online sample size calculator using Calculator.net (Calculator.net, 2015). Sample size estimates using the Krejcie & Morgan (1970) table and the item-to-response ratio by Schwab (1980) would have been in a similar range. All survey items were measured using a 5-point Likert scale.

Table 1: Summary of measures

Variables	No of items	Instrument Authors
Information	3	Amico et al. (2007)
Motivation	6	Liu & Yang (2022)
Behavioral skills	5	Liu & Yang (2022)
Facilitating Conditions	3	Liu & Yang (2022)
Habits	4	Attiq et al. (2021)
Intention to reduce FW	3	Soorani & Ahmadvand (2019)
Food waste reduction behavior (Reduce, Reuse, Recycle)	13	Attiq et al. (2021)

Analysis of data was done through Smart PLS 4. To establish the food waste reduction behavior as a high construct order for 3R's (reduce, reuse and recycle) we have adopted Higher Construct Modelling (HCM) methodology following Becker et al., (2022). The configuration that we have used is reflective-reflective as this is the most commonly used type of higher construct modeling. Further, this configuration implies one-dimensionality of the single construct and redundancy of separate measures (Sarstedt et al., 2019).

Results and Discussion
Demographic Variables

The 60% of respondents were male, with majority having graduate degrees (66.5%). As the largest province of Pakistan in terms of population is Punjab, 57.4% of respondents belonged to this region. Economic groups ranging from middle to upper middle class were represented in our sample. We had included 2 screening questions to identify students with pro-environmental concerns and 15% of the survey participants were screened out.
Measurement Model

Reliability and Validity Testing

As shown in Table 2, Cronbach's alpha values and composite reliabilities are higher or very close to the threshold value 0.7 (Fornell and Larcker, 1981). Further, the factor loadings of all constructs are statistically significant, and their coefficients are all larger than 0.50 demonstrating model robustness (Chin, 1998; Hulland, 1999). Convergent validity is established as AVE values for all constructs are greater than 0.50, exceeding the threshold of 0.5.

Discriminant validity is established based on Fornell and Larcker criterion. As presented in Table 3, each construct's square root of AVE is significantly larger than the correlation between that construct and the other constructs (Fornell and Larcker, 1981). Finally, we established the goodness of fit by measuring R^2 depicting model's predictive accuracy and predictive validity of the latent constructs in the model using Stone–Geisser's Q^2 test (Geisser, 1975; Stone, 1974) shown in Table 3.

Table 2: Summary of measurement model analysis

Construct and Indicators	Mean	Outer loadings	Cronbach Alpha	Composite Reliability	AVE
Information			0.760	0.773	0.544
I1	3.431	0.495			
I2	3.527	0.812			
I3	3.499	0.853			
Motivation			0.733	0.815	0.453
M1	3.418	0.677			
M2	3.151	0.668			
M3	3.283	0.439			
M4	3.491	0.679			
M5	3.444	0.725			
M6	3.473	0.697			
Behavioral Skills			0.806	0.866	0.563
BS1	3.483	0.755			
BS2	3.434	0.751			
BS3	3.197	0.776			
BS4	3.286	0.746			
BS5	3.242	0.722			
Facilitating Conditions			0.704	0.833	0.624
FC1	3.125	0.768			
FC2	3.151	0.822			
FC3	3.221	0.779			
Habit			0.696	0.775	0.546
H1	3.678	0.752			
H2	3.691	0.815			
H3	3.790	0.605			
H4	3.551	0.531			
Intention to Reduce Food Faste			0.765	0.780	0.617
INT1	3.491	0.706			
INT2	3.545	0.822			

INT3	3.930	0.676			
Food Waste Reduction Behavior			0.825	0.862	0.507
FWRB1 (Reduce)	3.992	0.850			
FWRB2	3.873	0.683			
FWRB3	3.644	0.477			
FWRB4 (Reuse)	3.764	0.697			
FWRB5	3.662	0.764			
FWRB6	3.738	0.713			
FWRB7	3.808	0.782			
FWRB8	3.678	0.669			
FWRB9 (Recycle)	3.434	0.685			
FWRB10	3.694	0.743			
FWRB11	3.543	0.753			
FWRB12	3.673	0.725			
FWRB13	3.618	0.596			

*AVE: Average Variance Extracted

Table 3: Discriminant Validity (Fornell Larker's Criteria)

Variables	1	2	3	4	5	6	7
1. Behavioral Skills	**0.750**						
2. FWRB	0.116	**0.579**					
3. Facilitating Conditions	0.609	0.128	**0.790**				
4. Habits	0.124	0.616	0.132	**0.685**			
5. Information	0.523	0.182	0.427	0.091	**0.737**		
6. Intention to reduce FW	0.287	0.479	0.166	0.461	0.301	**0.738**	
7. Motivation	0.636	0.056	0.390	0.069	0.549	0.191	**0.655**

*Bold values on diagonals are square root of AVE of each construct and off diagonal values are correlation results among constructs

Table 4: Model Fitness

Variables	R-square	Q-square
Behavioral Skills	0.447	0.331
Food Waste Reduction Behavior	0.430	0.369
Intention to reduce FW	0.092	0.202
Recycle	0.758	0.287
Reduce	0.325	0.247
Reuse	0.773	0.247

Structural Model

Hypothesis Testing

Figure 1 is the representation of our structural equation model. We found support for 9 out of the 12 hypotheses, with insignificant results for the other three hypotheses. Table 5 summarizes both the hypothesized direct relationships and any mediating effects. In line with the IMB skills model and TIB, the results suggest strong support for Hypotheses 1, 2, 4, 5, 11 & 12 respectively. Hypotheses 4, 8, and 11 are not supported. The motivation and facilitating conditions linkages turned out to be weak in our sample probably due to lower social motivation in developing countries where the majority of the population does not have information regarding the environmental impact of food wastage. Also facilitating conditions may be missing due to the overstretched budgets of universities. Mediating effects are all significant showing that the integrated model is appropriate for the evaluation of aversion to food waste. Finally, Model Fitness indicators of 3Rs show that food waste reduction behavior can be examined as a single higher-order variable.
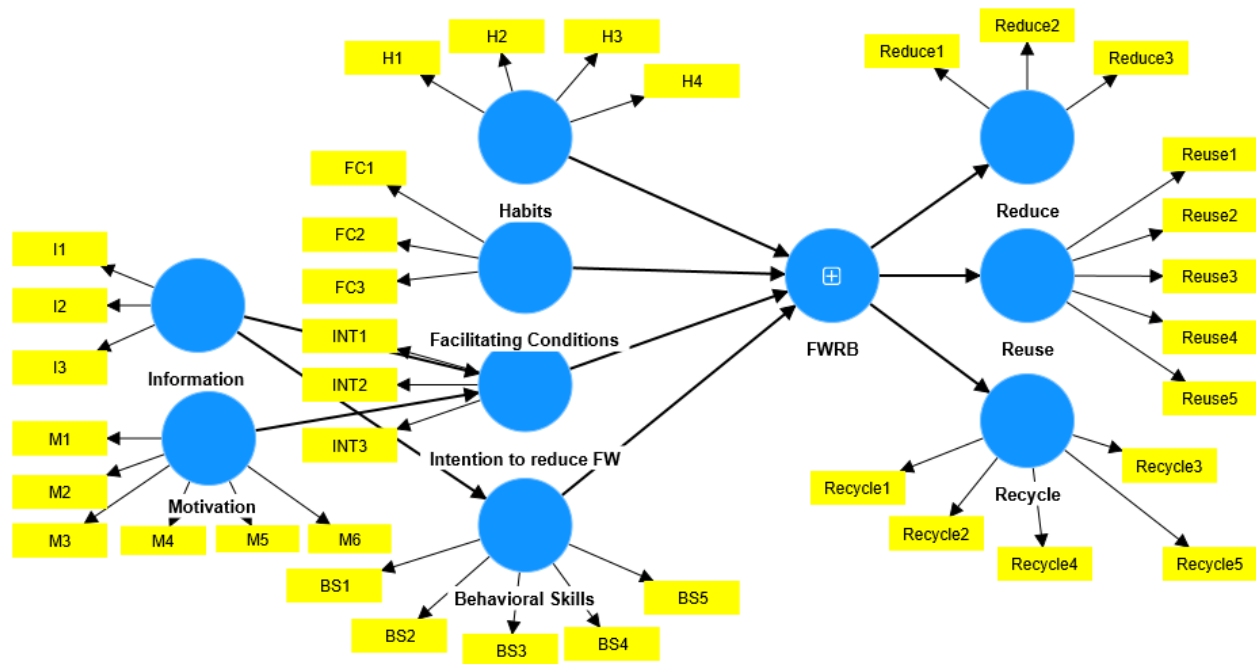

Table 5: Hypothesis Results

Hypotheses	Effects	Estimates	P-value
	DIRECT EFFECTS		
H1	Information -> Intention to Reduce FW	4.328	0.000
H2	Information -> Behavioral Skills	4.220	0.000
H3	Motivation -> Behavioral Skills	8.171	0.051

H4	Motivation -> Intention to Reduce FW	0.586	0.558
H5	Intention To Reduce FW -> FWRB	4.188	0.000
H8	Behavioral Skills -> FWRB	1.085	0.278
H11	Facilitating Conditions -> FWRB	1.152	0.249
H12	Habits -> FWRB	10.620	0.000
	INDIRECT EFFECTS		
H6	Information -> Intention to reduce FW -> FWRB	4.540	0.000
H7	Motivation -> Intention to reduce FW -> FWRB	2.311	0.001
H9	Information -> Behavioral Skills -> FWRB	2.129	0.003
H10	Motivation -> Behavioral Skills -> FWRB	4.346	0.000

Conclusion

Our results validate our integrated model and establish that aversion to food waste in our population can be measured parsimoniously as a higher-order construct consisting of 3R's (Reduce, Reuse, Recycle). Further, we have found that Facilitating Conditions such as the availability of smaller portions of food, storage of leftovers, and separate bins for disposal of food waste need further investigation in future research. Also critical are the behavioral skills of young adults, regarding their abilities and perceived self-efficacy in performing pro-environmental behaviors. Our research highlights the need for designing interventions in educational institutions that make it easier for students to reduce the amount of food wastage and teach them the skills to consume food responsibly. In developing countries where youth are the largest segment of society, such a change in behavior can be the most significant solution to the problem of food wastage.

These findings have important implications for policy makers, educators and practitioners seeking to develop interventions which aims to reduce squandering food. By addressing both the knowledge gaps and motivational barriers identified in this study, interventions can be designed to promote sustainable behavior and contribute to global efforts to combat food waste.

The results also help in expanding the body of literature by providing insights into the behavior of young adults. One notable aspect of the findings is the importance of social influence in shaping young adults' attitudes and intentions towards food waste reduction. This underscores the need for interventions that leverage social networks and peer influence to promote sustainable behaviors. Additionally, the study highlights the role of personal norms in driving individual behavior, suggesting that interventions should focus on cultivating a sense of responsibility and moral obligation towards reducing food waste.

Furthermore, the integration of the TIB and IMB Skills Integrated Model provides a comprehensive framework for understanding the complex interplay of informational and

motivational factors influencing behavior change. By addressing both knowledge gaps and motivational barriers, interventions can be designed to effectively target key determinants of behavior and promote long-term sustainability.

However, this research withholds some limitations as other factors which also explains the food waste reduction behavior can be explored by using a qualitative approach. This research can also be conducted by using experimental research design which will provide better insights on the food waste reduction behavior of young consumers.

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