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PRIMARY RESEARCH

Sustainable Consumption and Moral Marketing: Religiosity, Green Campus Climate, and Food Waste Reduction among University Students

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Abstract

Purpose: This study examines food waste reduction behavior (FWRB) among university students in Pakistan by extending the Value-Belief-Norm (VBN) framework. It conceptualizes food waste reduction as a moral marketing outcome, investigating how religiosity shapes environmental values and how Green Campus Climate (GCC) reinforces the translation of personal norms into sustainable food practices.

Design/Methodology/Approach: A cross-sectional online survey was administered to students across public and private universities. After screening and data cleaning, 488 valid responses were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to test both the extended VBN pathway and the moderating role of GCC.

Findings: Results confirm the sequential VBN mechanism, demonstrating that religiosity significantly predicts environmental values (EV), which in turn influence the New Ecological Paradigm (NEP), Awareness of Consequences (AC), Ascription of Responsibility (AR), and personal norms. Personal norms positively predict FWRB, and GCC significantly moderates this relationship, strengthening the likelihood that moral obligations translate into sustainable food practices.

Originality/Significance: This study broadens the classical VBN model by incorporating religiosity as an external moral antecedent and deepens it by introducing GCC as an institutional moderator. It expands the theoretical understanding of food waste reduction within religious, collectivist, and higher education settings.

Research Limitations/Implications: The study is based on cross-sectional self-reported data from Pakistani universities, which limits causal inference and generalizability. Future research may use longitudinal, experimental, or multi-level designs and explore additional contextual variables such as peer influence or sustainability culture.

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Practical and Social Implications: Universities can reduce food waste by embedding sustainability into campus operations and communication. Policies such as portion control, tray-less dining, food waste dashboards, donation initiatives, and green campaigns enhance GCC, making it easier for students to act on their moral norms. Faith-based and moral marketing messages aligned with Islamic teachings can further promote responsible consumption and support SDG 12 on responsible consumption and production.
KAUJIE Classification: P1, H21, H46
JEL Classification: Q56, Z12, M31

INTRODUCTION

Food waste has emerged as one of the most critical global sustainability challenges, carrying profound environmental, social, and economic implications. More than one-third of all food produced worldwide is discarded annually, amounting to over USD 1 trillion in losses and contributing nearly 10 percent of global greenhouse gas emissions (UN Environment Program, 2024). The consequences extend beyond ecological harm: food waste exacerbates global hunger, affecting over 735 million people (WHO, 2023), intensifies pressure on agricultural land and freshwater reserves, and undermines efforts toward responsible consumption outlined in the Sustainable Development Goals (SDG 12). As concerns over resource scarcity and ethical consumption grow, scholars and policymakers have increasingly emphasized the need to understand the psychological, cultural, and institutional factors that shape food-related behavior.

Although previous studies have extensively studied food waste in households and commercial businesses (restaurants and hotels) (Dhir et al., 2020; Filimonau et al., 2023), very little attention has been given to non-commercial settings (higher education institutions). Universities represent massive food services complexes with the serving of thousands of meals in cafeterias, hostel dining halls and campus activity. The activities result in large amounts of pre- and post-consumer waste, so HEIs are a significant but under-researched setting. In addition to the volume of their operation, HEIs possess a special power as the formative areas in which students form values, habits, and consumption patterns that can be transferred to adulthood (Ajina et al., 2024; Cohen et al., 2009). Understanding food waste in universities will lead to development of environmental sustainability as well as the long-term behavior of consumers and moral responsibility.

Beyond its environmental and social implications, food waste reduction in HEIs is increasingly recognized as a business, management, and marketing concern (Kaur et al., 2020; Zhang & Kwon, 2022). University food service operations are based on organized systems related to the service procurement, inventory management, menu planning, and daily food production processes similar to the hospitality and food-service sectors (Asyari et al., 2024; Costello et al., 2016). Excessive waste contributes towards operational expenses, forecasting demand and degradation of the sustainability performance of the institution. As consumers of food services, students are dynamic consumers of food whose portion decisions, eating habits, and disposal behaviors indicate their latent values, social norms and perceived moral responsibilities (Pandey et al., 2023). One of the ways to

promote responsible consumption is the use of green labels, nudges, and communication campaigns. These efforts are aligned with the Islamic moral messages that would discourage israf (wastefulness) and promote moderation, stewardship, and gratitude, especially in the context of Muslim majority country (Asyari et al., 2024; Khorakian et al., 2024). Food waste in HEIs is not only an environmental issue, but also a management and marketing challenge. Universities offer complex food-service operations whereby waste contributes to spending and low sustainability performance.

The VBN theory can be used to explain the psychological processes of FWRB (Stern et al., 1999). The VBN model states that the ecological worldview of people is founded on their EV which determined the NEP. Such a worldview promotes AC that triggers the AR to such consequences. Whenever people internalize this obligation, they come up with pro-environmental personal norms (PEPN) that inform sustainable behavior. The EV → NEP → AC → AR → PN has been a well-supported mechanism in sustainable consumption such as recycling, energy conservation, and food waste (Ajina et al., 2024; Han, 2015; Trautwein et al., 2023). However, the traditional VBN model focuses primarily on internal cognitive processes and often underestimates the influence of external cultural and institutional factors, making it less suited for complex social environments such as universities.

Two limitations of the classical VBN framework are particularly relevant in HEIs. First, the model assumes that environmental values are primarily internal and stable, overlooking external moral and cultural forces that shape value formation (Bouman et al., 2021; Perugini & Bagozzi, 2001). In religious societies such as Pakistan, religiosity plays a central role in guiding ethical judgments and daily behavior. Islamic teachings explicitly prohibit wastefulness and promote moderation, gratitude, and stewardship of natural resources (Elhoushy & Jang, 2021; Hassan, 2014). Religiosity therefore functions as a powerful external antecedent that can activate altruistic and biospheric values, influencing ecological concern and responsible consumption (Ghazali et al., 2018; Minton et al., 2020). Second, the traditional VBN framework assumes that personal norms reliably translate into behavior, yet research highlights a persistent norm–behavior gap wherein individuals recognize the moral importance of reducing waste but fail to act due to situational barriers, institutional constraints, or convenience (Quoquab et al., 2020; Werff & Steg, 2016). This gap is particularly pronounced in structured environments like HEIs, where institutional cues, social dynamics, and operational systems shape the feasibility of sustainable actions.

This study addresses these limitations by extending the VBN model in two ways. First, the model is broadened by integrating religiosity as an antecedent of environmental values, acknowledging that faith-based orientations provide external moral guidance that shapes ecological concern in Muslim-majority societies. Second, the framework is deepened by incorporating GCC as a moderator of the PN–FWRB relationship. GCC captures students' perceptions of their university's commitment to sustainability through policies, leadership communication, cafeteria practices, and student-driven initiatives (Dumont et al., 2017; Zafar et al., 2023). When students perceive strong institutional support for environmental responsibility, their moral commitments are more likely to translate into sustainable actions, thereby narrowing the norm–behavior gap.

Guided by this extended framework, the study investigates three key questions:

1. How does religiosity influence environmental values among university students?
2. How do the sequential VBN constructs (EV → NEP → AC → AR → PN) shape food waste reduction behavior?
3. To what extent does GCC strengthen the relationship between personal norms and FWRB?

The study offers two main contributions by addressing these research questions. First, the study broadens and deepens the VBN model by integrating religiosity and GCC, which enhances the understanding of moral, spiritual, and contextual determination of FWRB. Second, it provides insights for university administration and policymakers on how to leverage religious values and green climate to promote responsible food consumption behavior. Together, these contributions advance the discourse on moral marketing, ethical consumption, and responsible business conduct within HEIs operating in religious and collectivist contexts.

LITERATURE REVIEW

Food Wastage in HEIs

Food waste is a complex phenomenon that occurs on both stages pre-consumption (e.g., excessive production, excessive food preparation, poor storage, and serving large portions) and post-consumption (e.g., food leftover, half-eaten meals, and discarded food because of dissatisfaction with it) (Kaur et al., 2020). It may also be classified into avoidable waste, which consists of edible food that is thrown away because of careless consumption or poor planning, and unavoidable waste, which consists of inedible foods like peels, bones, or shells (Prescott et al., 2019). In the case of HEIs, food waste is avoidable because students often over-order subsidized foods, do not consume all the food at cafeteria or hostel because of peer pressure or abundance culture (Ajina et al., 2024).

While much of the existing literature has examined food waste in commercial contexts such as restaurants, hotels, and catering services, relatively little attention has been paid to non-commercial settings like HEIs (Sitompul et al., 2025). This is a critical gap, as universities represent environments where large populations consume food daily under subsidized or institutional arrangements, yet waste generation remains underexplored. Importantly, HEIs are not only food providers but also social and educational environments where students form lasting habits. Addressing food waste in these settings is vital, since behaviors learned in university years are likely to shape future household and workplace consumption practices.

VBN Theory

VBN theory is one of the prominent theories in explaining pro-environmental behavior, which provides a value-based process to explain the behavior (Stern et al., 1999). According to the theory, the individual values have an impact on the environmental beliefs that consequently activate personal norms, internalized moral obligations that determine sustainable behavior. VBN theory is based on value orientations that shape the interpretation of environmental problems in individuals based on cognitive beliefs including NEP, AC, and AR (Trautwein et al., 2023). This normative channel has been

implemented in other aspects of environmental psychology such as energy consumption, transportation, and waste minimization (Han, 2015; Jaini et al., 2019).

Recent studies are giving more attention to EV especially biospheric concern as an independent variable in the VBN model. EV represents the ecological interest of people and their concern in the natural environment, so it is very applicable in consumption-related situations such as food waste (Han, 2015). EV enhances conceptual clarity and is consistent with accumulating evidence that biospheric values appear to be better predictors of sustainability-oriented behaviour than other value orientations (Han, 2020). NEP, AC, and AR represent the belief structure that is normally presented in VBN model. Dunlap et al. (2000) explains that NEP incorporates beliefs regarding the relationship between humanity and nature including the boundaries of growth and capacity of human beings to disrupt ecological balance. NEP has extensively been employed in predicting environmental behavior and has been an cognitive filter by which people depict environmental problems (Quoquab et al., 2020; Trautwein et al., 2023). In the current study, NEP is applied to define food waste as an environmental problem that needs conscious consumption.

AC is an awareness of the harmful effects of behavior in the environment and on other people. It connects NEP with the moral responsibility by pointing to the real-world consequences of climate change and loss of resources (Stern et al., 1999; Trautwein et al., 2023). After AC, AR entails taking personal responsibility to help and reduce the damage to the environment (Stern et al., 1999). People with high scores in AC and AR have a higher propensity of internalizing PEPN, considering food waste reduction as an ethical responsibility (Ajina et al., 2024).

Extension of VBN theory

However, VBN theory provides a solid foundation in explaining pro-environmental behavior; it still has theoretical limitations in explaining behavior in institutional situations, like in higher education (Ajina et al., 2024). First, the model assumes that values are inherently stable and individually created, primarily arising from internalized orientations such as altruistic or biospheric concern (Hui et al., 2025; Perugini & Bagozzi, 2001). In practice, however, values are dynamic and shaped by external factors, including culture, social norms, media, and, most importantly, religiosity (Ajina et al., 2024; Hui et al., 2025). Since people are constantly exposed to faith-made teachings, and shared customs and traditions, their environmental values cannot be considered a purely internal creation (Asyari et al., 2024; Elhoushy & Jang, 2021). Thus, the classical VBN framework fails to acknowledge the role of socially embedded forces in influencing pro-environmental orientations by ignoring such external antecedents.

Second, the classical VBN approach assumes that PEPN strongly and consistently translates into behavior. It means that when individuals feel a moral obligation, they will act accordingly. But Quoquab et al. (2020) and Werff & Steg (2016) found a norm behavior gap which suggests that individuals may recognize their responsibility but fail to act due to competing goals, habits or convenience. So this limitation highlights the need for external factors that can strengthen the relationship between personal norms and behavior.

To overcome these limitations, the VBN framework is broadened and deepened in this

study. Theoretical broadening refers to the introduction of new or external antecedents to enhance the scope of existing model to a new context (Perugini & Bagozzi, 2001). Religiosity is a significantly strong external antecedent in Pakistan, where Muslims tend to be defined more by their religious identity rather than by national and cultural identity (Ali et al., 2019). The teachings of the religions emphasize on stewardship, thankfulness, and non-wasting, which inevitably leads to environmental awareness and ecological consumption. The current study recognizes that environmental values are formed by moral orientations by using intrapersonal and interpersonal religiosity as antecedents. This shows that the environmental values of individuals are not made in isolation but are made through religious and cultural traditions.

The framework is further deepened by introducing GCC as a moderator of the personal norm behavior relationship. GCC refers to students' perception of their university's commitment to sustainability through visible policies, practices, and cultural cues, such as food waste awareness campaigns, portion control initiatives, recycling facilities, and peer-led green activities (Zafar et al., 2023). In higher education settings, where daily food consumption occurs in cafeterias, hostels, and campus events, such institutional reinforcement can strengthen students' sense of responsibility and make it easier to act upon their moral norms. By embedding sustainability within the campus environment, universities provide both normative and practical support that encourages students to align their behavior with their values. Highlighting GCC thus addresses the norm–behavior gap, showing that personal norms are more likely to translate into concrete food waste reduction behavior when reinforced by a supportive institutional climate.

Conceptual Framework

The current study extends the VBN model through psychological and institutional factors to explain FWRB more effectively in the HEIs context. Specifically, the model builds on the fundamental VBN sequence and religiosity as external antecedent of EV. Religiosity is based on religious values and offers moral guidance and adherence to moderation, thankfulness, and conservation of natural resources. Enhancing religiosity will enhance EV, and thus, induce downstream beliefs in the VBN chain, that is, NEP, AC and AR. Specially, In cultural society like Pakistan, where Islamic teachings do not support wastefulness, religiosity can be a powerful cultural enabler of sustainability.

The framework is further enhanced through moderation of GCC between PEPN and FWRB. While the VBN model suggests that activated PEPN should naturally develop pro-environmental action, but researchers suggested that these outcomes are shaped by contextual conditions. A strong GCC reflected in sustainability policies, awareness efforts, and green practices can enhance the likelihood that students' moral norms translate into FWRB. GCC reflects students' perceptions of their university's commitment to sustainability, expressed through campus policies, awareness campaigns, and green initiatives. When students perceive their institution as environmentally committed, they are more likely to act on their moral obligations by reducing food waste. Conversely, in the absence of such reinforcement, even strong personal norms may not consistently translate into action.

These two extensions enhances VBN framework by combining religiosity as an

internal moral-spiritual factor and GCC as an institutionally based factor that strengthens behavior based on norms. This two-fold model identified that student FWRB is not only determined by in-cognitive process, but also by cultural perspectives and institutional contexts. Religiosity triggers the pathway as shown in Figure 1 by impacting EV (broadening the model) and GCC moderates the PN-FWRB association (deepening the model).

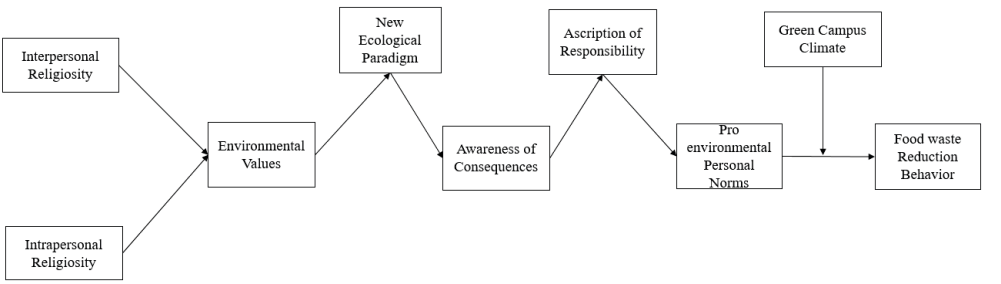

FIGURE 1: Conceptual Framework

Hypotheses development

Religiosity

Religiosity can be defined as "the extent to which an individual is committed to his religion and to which that religion is reflected in the individual's attitudes and behavior" (Johnson et al., 2001). Religiosity is measured in two forms: intrapersonal religiosity, "that originates from the beliefs and attitudes of an individual", and interpersonal religiosity, which develops through engagement with religious communities and organizations (Osanlou & Rezaei, 2025).

In recent times, Religiosity has also become a well-known antecedent of pro-environmental orientations since it offers the moral and ethical backgrounds that determine value systems (Elhoushy & Jang, 2021; Minton et al., 2020). Religion always teaches about moderation, thankfulness, and conservation of natural resources and also discourages excess and wastefulness. An example is the Quran which asks believers to eat and drink but not to waste (7:31) and in which waste avoidance is described as an ethical and religious obligation. This kind of teaching would develop a sense of responsibility towards environmental protection and value the equilibrium of creation, which may be embedded in EV value orientations that place value on ecological sustainability and sustainable living.

Prior research demonstrates that religiosity activates altruistic and biospheric values, reinforcing concern for nature and motivating sustainable consumption practices (Ghazali et al., 2018; Hassan, 2014). Empirical evidence from Egypt (Rice, 2006) and China (Wang et al., 2020) confirms that religiosity plays crucial role in pro-environmental behavior, highlighting its role in shaping ecological orientations (Wani et al., 2025). Hence,

H1a. Intrapersonal religiosity positively affects EV.

H1b. Interpersonal religiosity positively affects EV.

Environmental Value

EV represents a long-term ethical practice of preserving the natural ecosystem,

biodiversity and ecological balance independent to utilitarian or self-serving interests (Stern et al., 1999). EV is regarded as one of the central value dimensions of the VBN framework, which supports ecological beliefs and attitudes (Stern, 2000). The recent research on sustainability adopts EV as standalone construct that best represents the value orientation which are closely associated with environmental concern (Han, 2015, 2020). The people with strong EV have higher chances of embracing ecological worldviews.

Prior studies have confirmed that EV predicts ecological worldviews and fosters harmony-based relationships with nature rather than human-centered dominance (Choi et al., 2015). In the context of higher education, EV is especially relevant to food waste, as students who attach moral importance to environmental protection recognize that wasting food contributes to ecological degradation alongside social and economic costs. Accordingly, students with strong EV are expected to develop ecological worldviews that reinforce sustainable consumption practices.

H2: EV positively affects NEP.

New Ecological Paradigm

The NEP is the personal ecological perception of the world, where the weakness of the ecosystems, the boundaries of natural resources and the dependency of the human and the environment are their priorities (Dunlap et al., 2000). In the VBN model, NEP acts as a belief system which links value orientations with the more detailed environmental issues and moral responsibilities (Stern, 2000). People who have a strong ecological worldview are unlikely to accept any anthropocentric assumptions and consider protecting the environment as a personal and social responsibility.

In the context of food consumption, individuals with stronger NEP are more aware of the environmental impact of food wastage. They recognize that discarded food contributes not only to economic inefficiencies but also to ecological harm, including greenhouse gas emissions, resource depletion, and broader sustainability challenges (Choi et al., 2015). Prior research confirms that ecological worldviews are strong predictors of awareness of consequences, particularly in sustainable consumption contexts (Ghazali et al., 2019; Karimi, 2019).

H3: NEP positively affects AC.

Awareness of consequences

AC means that a person knows the harmful environmental behaviors are the causes of undesirable results to the ecosystem, society and the next generation (Stern et al., 1999). AC has a central role in the VBN model because it triggers the process of moral thinking because people start to understand that their daily behavior may cause more environmental and moral damages (Schwartz, 1992). Climate change, pollution, biodiversity loss, and the scarcity of available natural resources are part of such consequences (Ghazali et al., 2019).

In the context of food waste, awareness becomes particularly salient for university students. Recognizing that discarded edible food contributes to greenhouse gas emissions, growing landfills, and global hunger elevates the issue from a financial loss to a moral concern. Students with higher AC are therefore more likely to internalize food waste as a sustainability challenge and to acknowledge the need for corrective action. Empirical

research consistently shows that greater awareness strengthens individuals' readiness to accept responsibility in green contexts such as recycling and sustainable consumption (Kiatkawsin & Han, 2017; Trautwein et al., 2023).

H4: AC positively affects AR.

Ascription of Responsibility

AR explains the extent to which individuals feel that they are personally responsible for the environmental impacts of their actions (Stern et al., 1999). Under the VBN model, AR is an essential intermediate that transforms the awareness of consequence into moral responsibility by changing the focus of attention to the external causes of environmental damage and the individual contribution to it (Megeirhi et al., 2020).

In the food waste context, AR can be explained as students' beliefs that their actions, such as disposing of edible food, filling their plates with large amounts of food, and leaving leftovers, lead to the destruction of the environment and nature. This sense of responsibility forms an in-built sense of believing that food waste is not a societal or an institutional problem, but a personal problem that must be solved. The above study confirms that less responsible people are more likely to develop stronger personal norms and moral obligations towards such sustainable activities as recycling, green purchases, and waste minimization (Jaini et al., 2019; Quoquab et al., 2020).

H5: AR positively affects PEPN.

Food waste reduction behavior

Personal norms is a manifestation of individuals believed to possess a moral duty to behave in an ecologically responsible way (Stern et al., 1999). Such norms emerge after individuals are aware of and take responsibility for their actions. In the context of FWRB, PEPN is the feeling of guilt or moral discomposure regarding the wastage of edible food and an ethical motivation to minimize waste. The previous researches have always established that greater PN has a significant relationship with FWRB, including organizing food, regulate portions, and the reuse of leftovers (Ajina et al., 2024). PEPN is particularly applicable to student groups since young adults are developing permanent patterns of consumption, and their moral obligation is essential in influencing the long-term sustainability practices (Hui et al., 2025). Thus, it is expected that:

H6: PEPN positively affects FWRB.

Green Campus Climate

Green Organizational Climate refers to employees' shared perceptions that their organization is committed to pro-environmental policies, practices, and procedures (Dumont et al., 2017). It reflects the extent to which environmental sustainability is embedded in organizational priorities and communicated through formal policies and informal norms, thereby shaping employees' own attitudes and sense of responsibility (Iqbal & Piwowar-Sulej, 2023). Studies indicate that when people recognize a supportive ecological climate, they tend to adopt pro-environmental values and willingly participate in sustainable actions.

In HEIs, GCC reflects university students' perceptions regarding university

sustainability commitment in terms of the environmental commitment, university leadership, and campus practices (Zafar et al., 2023). A strong GCC signals students about food waste awareness, portion-size control in the cafeteria, recycling centers, and peer-to-peer green actions. A powerful GCC sends signals to students that the sustainable food practices are not only important to the institution but also social, and thus, supports students to continue with their ethical responsibilities of reducing waste.

Thus, GCC functions as a contextual boundary condition that can strengthen the translation of personal norms into behavior (Xiao et al., 2020). It is found that in the educational institute climate, students internalize values similar to those of employees in an organization, which ultimately impacts their beliefs, attitude, and behavior (Cohen et al., 2009). So, when students perceive a supportive campus climate, they are more likely to act on their personal environmental norms by avoiding wasteful practices, monitoring portions, or encouraging peers to consume responsibly. In contrast, when the campus climate is weak, students may find it difficult to enact their norms due to a lack of institutional cues and reinforcement.

H7: GCC moderates the relationship between PN and FWRB.

RESEARCH METHOD

The survey was a cross-sectional, quantitative survey to examine the drivers of FWRB of Muslim university students in Pakistan. The survey technique was chosen because it is the most appropriate technique for gathering attitudes, values, and behaviors of a large and diverse population, thereby enabling theory testing within the extended VBN framework. The study was conducted in four major cities i.e, Lahore, Islamabad, Multan and Faisalabad due to the diversity of the academic atmosphere, high number of students, and the availability of vibrant campus food services i.e. cafeteria, hostel messes, and student food outlets. These institutional settings are important food consumption and waste production sites and hence are especially relevant in exploring the psychological, social and religious motivations behind waste reduction behaviour.

A purposive non-probability sampling strategy was employed, consistent with (Calder et al., 1981), emphasizing theoretical alignment over population-wide generalization. The primary objective was not to extrapolate findings to all Pakistani students but to test the hypothesized relationships within a conceptually relevant group that actively engages with university dining services. To ensure data relevance, participants were screened using the filter question: "Have you eaten a complete meal from a university cafeteria, hostel mess, or on-campus food outlet in the past seven days?" Only students responding "Yes" were included, as this ensured immediate recall of food-related decisions and minimized memory bias. The seven-day timeframe was considered appropriate because food consumption behaviors are frequent and routine, and responses outside this window may have been less reliable in reflecting current waste-related practices.

The data was collected in May and June 2025 via online questionnaires that were administered to the university societies, mailing lists, and university representatives. All the protocols related to ethical procedures were followed strictly, i.e., informed consent, voluntary participation, confidentiality and the guarantee that no identifying information was gathered at any point among the participants. A total of 750 questionnaires were sent,

and 560 respondents returned the questionnaires, which is an initial response rate of 74.7%. After exclusion of 72 incomplete and invalid submissions, 488 valid questionnaires were left to be analyzed. This produced a good response rate of 65.07%, which is generally considered as good enough to conduct surveys in terms of social sciences (Nulty, 2008).

The demographic profile of the students suggested that 40% of the students were females while 60% males. The age analysis revealed that 32 % of the respondents were below 20 years, 47 % were between the ages of 20-30, 16 % were in the 31-40 with 5% in the 41-50 group. This is an indication that most of the people interviewed were young adults and especially the twenties. In terms of educational level, 36 % were undergraduates, 58 % were graduate level students and 6 % were postgraduates. The high number of graduate-level students offers valuable insights that can be useful to the objectives of the study.

The survey instrument was a series of already existing scales that were developed based on previous research, and questionnaire items are given in the appendix. There was also a rating on a seven-point Likert scale, with an agreement, strongly disagree (1) to strongly agree (7), but items were adapted to the cultural context.

RESULTS AND DISCISSION

The structural equation modeling (SEM) is a popular method in social and behavioral science studies that is used to explore the relationship between latent constructs (Hair et al., 2014). SEM has two major methods: the covariance-based SEM (CB-SEM) and the partial least squares SEM (PLS-SEM). CB-SEM is mainly used to confirm the theory and is often focused on the model fit, requiring large samples, multivariate normality, and comparatively simple model (Danish et al., 2019). Meanwhile, PLS-SEM is a variance-related approach, which aims at maximizing the predictive validity of the endogenous constructs and, therefore, it is especially appropriate in exploratory research and theory development (Hair et al., 2011). Another benefit of PLS-SEM is when the data are not distributed normally, and a high number of constructs, indicators, and moderating relations (Richter et al., 2016). Since the current research is an expansion of the classic VBN model with supplementary antecedents and a moderation influence, and aims to explain a goal of food waste reduction behavior and not to validate an existing model, PLS-SEM is a more suitable tool of analysis. Furthermore, the 488 respondents are sufficient in size and matched the strengths of PLS-SEM to analyze datasets with complicated path models. Based on this, both measurement and structural models were assessed by means of SmartPLS 4.0 (Ringle et al., 2015).

The analysis was carried out in two phases: first, the measurement model was evaluated to confirm the reliability and validity of the constructs; second, the structural model was assessed to test the hypothesized relationships and extract both theoretical and applied implications (Anderson & Gerbing, 1988).

Measurement Model Evaluation

Measurement model Factor loading and composite reliability (CR) were used to determine the measurement model reliability (Hair et al., 2011). All CR values were considerably above the suggested value of 0.70, with Interpersonal Religiosity (0.804) to GCC (0.894),

TABLE 1: Measurement Model Analysis

Constructs	Scales Adaptation	Items	Loading	CR	AVE
Interpersonal Religiosity	(Worthington et al., 2003)	InterR1	0.679	0.840	0.569
		InterR2	0.687		
		InterR3	0.824		
		InterR4	0.816		
Interpersonal Religiosity	(Worthington et al., 2003)	IntraR1	0.627	0.804	0.857
		IntraR2	0.754		
		IntraR3	0.554		
		IntraR4	0.769		
		IntraR5	0.771		
		IntraR6	0.748		
Environmental Value	(Han, 2020) and (Hui et al., 2025)	EV1	0.790	0.835	0.628
		EV2	0.843		
		EV3	0.741		
New Ecological Paradigm	(Dunlap et al., 2000) and (Han, 2020)	NEP1	0.837	0.820	0.611
		NEP2	0.901		
		NEP3	0.566		
Awareness of Consequences	(Hui et al., 2025)	AC1	0.819	0.844	0.644
		AC2	0.812		
		AC3	0.777		
Ascription of Responsibility	(Hui et al., 2025)	AR1	0.582	0.820	0.609
		AR2	0.852		
		AR3	0.874		
Pro-Environmental Personal Norm	Wang et al. (2022).	PEPN1	0.748	0.833	0.557
		PEPN2	0.650		
		PEPN3	0.831		
		PEPN4	0.746		
Food Wastage Reduction Behavior	(Attiq et al., 2021)	FWRB1	0.799	0.852	0.592
		FWRB2	0.696		
		FWRB3	0.756		
		FWRB4	0.819		
Green Campus Climate	(Dumont et al., 2017)	GCC1	0.817	0.894	0.628
		GCC2	0.698		
		GCC3	0.827		
		GCC4	0.847		
		GCC5	0.765		

and it is possible to say that construct reliability is satisfactory. On the same note, the item loadings were all above the benchmark of 0.50, hence indicating indicator reliability.

The Average Variance Extracted (AVE) was used to test convergent validity. The AVE values of all constructs were above the 0.50 threshold (Hair et al., 2016) and the range of AVE values of 0.557 (PEPN) to 0.857 (Intrapersonal Religiosity) indicates that the constructs obtained enough variance in its indicators.

To evaluate potential common method bias, Harman's single-factor test was employed. The results showed that the first factor explained less than 50% of the total variance i.e., 28.10%, indicating that common method bias was not a serious concern (Podsakoff et al., 2003). Moreover, All VIF values are less than 3.3, indicating there is no issue of multicollinearity (Kock & Lynn, 2012).

Discriminant validity was evaluated using the Heterotrait–Monotrait (HTMT) criterion (Henseler et al., 2015). The results indicated that all HTMT values were comfortably below the 0.9 threshold (Table 2), demonstrating clear conceptual distinctiveness among the constructs

TABLE 2: Discriminant Validity- HTMT

Constructs	AR	AC	GCC	EV	FWRB	InterR	IntraR	NEP	PEPN
AR									
AC	0.613								
GCC	0.439	0.395							
EV	0.775	0.552	0.483						
FWRB	0.559	0.513	0.760	0.638					
InterR	0.333	0.289	0.525	0.511	0.484				
IntraR	0.697	0.477	0.557	0.583	0.578	0.380			
NEP	0.383	0.535	0.632	0.427	0.472	0.400	0.457		
PEPN	0.460	0.478	0.853	0.590	0.793	0.568	0.557	0.673	

Structural Model Analysis

The second stage involved the evaluation of the structural model using path coefficients (β), t-values, effect sizes (f^2), predictive relevance (Q^2), and explained variance (R^2). Bootstrapping with 5000 resamples was applied to assess the significance of relationships.

The results in Table 3 show that all hypothesized relationships were supported. Interpersonal religiosity ($\beta = 0.272$, $t = 6.937 > 1.64$) and intrapersonal religiosity ($\beta = 0.361$, $t = 8.624 > 1.64$) positively influenced environmental values. EV in turn positively predicted the NEP ($\beta = 0.319$, $t = 8.481 > 1.64$). The NEP was strongly associated with AC ($\beta = 0.386$, $t = 9.891 > 1.64$), which positively influenced AR ($\beta = 0.436$, $t = 11.736 > 1.64$). AR significantly impacted PEPN ($\beta = 0.356$, $t = 10.328 > 1.64$), which further predicted FWRB ($\beta = 0.371$, $t = 8.695 > 1.64$). Additionally, GCC significantly moderated the relationship between PEPN and FWRB ($\beta = 0.097$, $t = 4.018 > 1.64$).

The model demonstrated substantial explanatory power with an R^2 value of 0.520 for food waste reduction behavior. Predictive relevance (Q^2) was also above zero, indicating strong predictive accuracy (Hair et al., 2016). Effect sizes (f^2) ranged from small to large, in line with Cohen (1988) guidelines.

TABLE 3: Structural Model Results

Hypotheses	Relationship	Path Coefficient	Std. Error	*t* value	*p*-Value	Result	R^2	Q^2	F^2
H1a	InterR→ EV	0.272	0.039	6.937	0.000	Supported			0.091
H1b	IntraR → EV	0.361	0.042	8.624	0.000	Supported			0.160
H2	EV → NEP	0.319	0.038	8.481	0.000	Supported			0.114
H3	NEP → AC	0.386	0.039	9.891	0.000	Supported			0.175
H4	AC → AR	0.436	0.037	11.736	0.000	Supported			0.235
H5	AR → PEPN	0.356	0.034	10.328	0.000	Supported			0.145
H6	PEPN → FWRB	0.371	0.043	8.695	0.000	Supported	0.520	0.376	0.145
H7	Moderating role of GCC PEPN→FWRB	0.097	0.024	4.018	0.000	Supported			0.029

The current study results provide empirical evidence of the extended VBN framework through psychological and institutional factors on the FWRB in HEIs. The results confirm that religiosity has a big impact on the environmental values of students (H1a, H1b) and this indicates that faith-based orientations play a critical role in influencing sustainability issues. Students who internalized religious beliefs or applied them within the societal setting were more inclined to focus on the environmental protection. The finding aligns with the findings of the previous literature (Khorakian et al., 2024; Minton et al., 2020), which emphasize the importance of religious values in promoting environmental responsibility. Religiosity is a powerful motivational factor in developing the environmental value orientations in Pakistani higher educational context in which Islam has clearly outlawed wastefulness.

The empirical findings implied that EV has a positive effect on NEP (H2). Students having a high degree of pro-environmental values tended to understand food waste as an ecological issue, instead of an economic one. The above result is consistent with previous studies, such as Han (2015) and Klöckner (2013), who highlighted the importance of biospheric values as the basis of ecological worldviews. These NEP, in their turn, improved the AC of students (H3), proving that people with high ecological orientation are more concerned about the environmental damage of wasteful activities. The cognitive foundation of understanding the connection between everyday practices and existential issues of sustainability is achievable with the help of AC (Wang et al., 2022). The plate waste and over-ordering seen in the case of the university dining may make students more sensitive to these effects.

The path from AC to AR (H4) was also supported. Students who understood the environmental implications of wasteful behavior were more likely to assume personal accountability for reducing waste. This finding is consistent with prior studies (Han, 2015; Trautwein et al., 2023), which highlight that awareness is a prerequisite for responsibility

attribution. As hypothesized, ascription of responsibility significantly predicted PEPN (H5). This indicates that once students felt accountable, they developed stronger moral obligations to act sustainably, confirming the central VBN proposition that moral norms are activated when responsibility is internalized (Ajina et al., 2024; Stern et al., 1999).

Furthermore, the outcomes showed that PEPN had a significant impact on FWRB (H6), which is that the students who participated in stronger moral commitments had a higher likelihood of converting sustainability into practical actions which comprised the avoidance of over-ordering, completion of meals and the encouragement of peers to minimize waste. This could be explained by previous research by Jaini et al. (2019) and Wang et al. (2022) who have shown that the moral obligation of people has a role to play in the development of pro environmental behavior. Nevertheless, researchers like Werff & Steg, (2016) warn that norms do not necessarily correlate directly onto behavior owing to the conflicting situational demands. Although a strong direct effect was discovered in the present study, the existence of modulating effects gives this association some depth.

In line with this, the relationship among PEPN, FWRB and GCC was observed to be moderated positively (H7). When students perceived a high green climate on their campuses, they were more willing to act on their moral norms and translate their duty into a practical behavior of waste reduction. This implies that overt institutional reinforcements like food waste awareness and sustainable eating policies and peer-led initiatives reinforce moral commitments of students and enable them to act. These findings are consistent with the existing research on green organizational climate (Iqbal & Piwowar-Sulej, 2023; Xiao et al., 2020), which shows that the positive climates in the environment enhance the transfer of ecological concern into action. In the context of higher education, GCC appears to play a decisive role in bridging the norm–behavior gap by embedding sustainability into campus culture, thereby legitimizing and normalizing students' food waste reduction practices.

CONCLUSION

This study validated an extended VBN framework to explain FWRB among university students in Pakistan, incorporating religiosity as an antecedent and GCC as a moderator. The findings confirmed that religiosity plays a vital role in shaping environmental values, which sequentially activate NEP, AC, AR, and PEPN. Moreover, GCC enhanced the translation of personal norms into sustainable behaviors, which showed that positive institutional settings were critical in eliminating the norm-behavior gap. By placing the VBN framework in a cultural context within a religious and collectivist society, this research broadens and deepens the theoretical base of VBN and provides empirical evidence that can be used by universities and policymakers to integrate sustainability into a campus culture. Finally, the study demonstrates that food waste reduction cannot be performed only through solid moral investment but also institutional support that would transform the practices that can be sustained and implemented into a norm.

Theoretical Contributions

The current study has many theoretical contributions to literature. First, it extends the VBN model by introducing religiosity as antecedent of environmental values. Although the

conventional VBN applications start with either value orientation, the present study illustrates that intrapersonal and interpersonal religiosity play significant roles in influencing the concern that students have towards the environment in Muslim environments. The study places VBN in a faith-based cultural environment, which shows that religion is an effective source of environmental motivation that has been largely ignored in previous research.

Second, the study deepens the VBN model by incorporating GCC as a moderating factor in the link between PEPN and FWRB. Previous studies have pointed to the existence of a norm-behavior gap in which, despite having strong moral norms, individuals are not always ready to engage in pro-environmental behavior. The results indicate that GCC reinforces this relationship, which highlights the importance of institutional factors to strengthening the moral commitments of students and helping to enforce sustainable practices. This extension contributes to the theoretical knowledge by introducing organizational and contextual factors within a framework, which had previously employed the idea of individual cognition, thus emphasizing how conducive climates on campuses facilitate the transfer of moral responsibility into the pro-environmental behavior.

Third, the paper puts the VBN framework into perspective by empirically validating the model in institutions of higher learning in Pakistan. Majorities of studies utilized VBN framework in Western or household settings yet this study proves the strength of the model among university students in a collectivist and religious society. The study addresses the problem of food waste reduction in campus dining areas, thus increasing the theoretical understanding of the interplay between values, norms, and social factors in a formative stage of life when sustainable patterns are established. Collectively, these contributions extend, enrich and contextualize the framework of VBN, giving a more thorough picture of how psychological, religious and institutional factors all interact to influence food waste minimization behavior.

Practical Contribution

The current study has multiple practical implications for the Universities seeking to reduce food waste and promote sustainable consumption. From a management perspective, the results show that students' moral intentions are more likely to translate into actual behavior when supported by a strong GCC. It means university managers must internalize the principle of sustainability through clear policies such as the restriction of portion size, non-tray dining, sorting areas of waste, donation programs, as well as, compost programs. The regular food waste audits and the exposure of the information (ex., displaying the amount of waste in the cafeterias every day) can contribute to the enforcement of the sense of responsibility and simplify the sustainable decisions of students.

Food waste has direct financial impacts on university dining services in terms of business and operations. Better planning of portions, predictive procurement planning on the basis of consumption patterns, menu optimization and staff training can help in reducing unnecessary costs and also in optimizing the resources. Through strategic alliances with food banks, recycling companies, or composting companies, universities can use waste to create value, which will help them in the long run financially and environmentally.

From a perspective of Marketing/communication, the research focuses on the use of messaging, based on morals and faith, especially in a setting with a majority of Muslims. Universities can partner with religious scholars, student imams, influencers, or honorable alumni to convey the Islamic values discouraging israf (wastefulness) and encouraging the need to be grateful, moderate, and stewardly. They can be incorporated into the awareness campaigns, social media posts, cafeteria branding, and student involvement activities. Besides making students better, this kind of moral marketing makes the institution more sustainable, in terms of image and brand image.

From a sustainability perspective, the integration of religiosity and campus climate demonstrates that effective food waste reduction requires both cultural alignment and structural support. Encouraging sustainable consumption habits among students contributes to SDG 12 (Responsible Consumption and Production) and strengthens the university's role as a model for environmentally responsible behavior. By embedding sustainability into campus operations, communication strategies, and student culture, HEIs can cultivate a long-term shift toward mindful food practices.

Limitations and future direction

Although this study provides valuable theoretical and practical insights, it has a few limitations. To begin with, the cross-sectional survey is not applicable when establishing causal inferences. Longitudinal or experimental designs, and even mixed-method designs, could be used in future experiments to understand better how religiosity, as well as GCC, influences students to change their food waste reduction behaviors over time. Second, this study has only considered the university contexts in Pakistan, and this may restrict the generalizability of the results to other cultural or institutional environments. External validity could be enhanced by replicating the model and testing it in different contexts, e.g., household and hospitality settings or community-based food systems. Third, since GCC was studied as a moderating factor between the pro-environmental personal norms and the behavioral results, there are additionally other contextual or social processes that may also influence. Peer influence, social pressure, or institutional culture of sustainability may also be more specific variables that explain how individual norms can be translated into tangible food-saving behaviors. The investigation into such dynamics using multi-level or comparative analysis would help to gain a better understanding of the structural and cultural conditions that either promote or inhibit food waste reduction.

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