

THE FACTORS INFLUENCING THE LEVEL OF 3RS PRACTICES IN THE F&B INDUSTRY. A CASE STUDY OF HUE CITY, VIETNAM

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Abstract

In this study, the authors examine the factors influencing the level of 3Rs practices in the F&B industry in Hue city, Vietnam. The paper extends the TPB (ETPB) by including new factors such as environmental commitment, green economic incentives, and economic benefits. The research employs a questionnaire survey method to collect data from F&B companies' owners or representatives. Out of the 250 distributed questionnaires, 220 valid responses were collected. The empirical results of the ETPB model are based on structural equation modeling (SEM). The results reveal that among the factors included in the principal component analysis, economic benefits have the strongest influence, followed by attitude and perceived behavioral control. Environmental commitment, green economic incentives, and subjective norms weakly impact the level of 3Rs practices of surveyed companies. The research findings will provide a strong platform to understand the relevance of 3Rs practices of F&B companies and design strategic plans to encourage 3Rs implementation.

Keywords: F&B industry, 3Rs practices, Theory of Planned Behavior, Structural Equation Model

1. INTRODUCTION

Vietnam's food and beverage (F&B) sector has become one of the country's fastest-growing industries, reflecting rising household consumption, rapid digitalization, and shifting dietary preferences (DTM Consulting, 2024). Forecasts suggest that the national economy will continue expanding more quickly than many neighboring markets in the coming years, creating favorable conditions for the sector's growth. In 2024, the market is projected to surpass 655 trillion VND, with growth close to 11%. By 2027, small and medium-sized independent firms are expected to account for nearly all of the industry, demonstrating the strength of local entrepreneurship (Capital, 2024). Dining-out services alone already contribute hundreds of trillions of VND annually, while online ordering and delivery channels have also surged (IPOS.VN, 2025).. Alongside these opportunities, however, the expansion of F&B businesses has brought mounting waste management challenges, reinforcing the importance of adopting sustainable strategies such as the 3Rs framework.

In addition, Vietnamese consumers are shifting towards healthier and more sustainable eating habits. Trends such as organic food consumption, plant-based diets, and eco-friendly packaging are gaining traction. Over 71% of surveyed consumers support a ban on single-use plastics, and 38% are willing to pay a premium for biodegradable packaging (DTM Consulting, 2024). However, the rapid expansion of the sector has also led to increased waste generation, raising concerns about the industry's environmental impact and resource efficiency. To address these issues, the 3Rs (Reduce, Reuse, Recycle) approach has gained attention as a sustainable waste management strategy, aiming to minimize waste while optimizing resource use. The implementation of the 3Rs principles can be achieved efficiently, as the approach is straightforward and user-friendly (Inc, 2008). Enhancing awareness among food service personnel and customers is essential, as it fosters a deeper understanding of waste management and promotes self-awareness in minimizing and preventing food waste (Gustavsson et al., 2011). Despite growing awareness of sustainability practices in Vietnam's F&B sector, the adoption of 3Rs measures remains inconsistent. Factors such as economic incentives, regulatory frameworks, infrastructure availability, and consumer behavior significantly influence the level of 3Rs implementation in businesses(Capital, 2024). Additionally, consumer preferences are shifting towards eco-friendly packaging, waste reduction initiatives, and circular economy models, reflecting a broader trend toward sustainable consumption(DTM Consulting, 2024).

Amid the growing global attention to environmental and social issues, an increasing number of F&B businesses in Hue have begun to explore sustainable development solutions. New trends such as using organic ingredients, reducing plastics and packaging, as well as recycling and reusing by-products in the production process, are being implemented (Hue,

2022). The 3R model is seen as a strategic solution because it helps optimize product life cycles, reduce costs, enhance corporate image, and promote social responsibility. Moreover, practicing 3R is not only about applying technology but also about the “regeneration” of resources, culture, and living environments. In the context of Hue implementing circular economy programs—one of the key focuses in the national policy direction for environmental protection—the 3R model has become more accessible and easier to apply, especially in the food service sector. Raising awareness among staff and customers in Hue’s F&B establishments will help foster sustainable consumption behaviors and prevent food waste (FAO, 2011).

Furthermore, the growing emphasis on Corporate Social Responsibility (CSR) has positioned sustainable practices, such as 3Rs implementation, as a core ethical value in modern global business. By incorporating 3Rs principles into their business operation, F&B service establishments can contribute to broader corporate social responsibility efforts (Immanuel et al., 2013). The growing importance of sustainability in the F&B sector has motivated further research into 3Rs applications. This study examines the key determinants influencing the level of 3Rs practices in F&B industry, drawing insights from recent market reports and behavioral theories. By identifying barriers and drivers of 3Rs adoption, this research aims to provide practical recommendations for businesses, policymakers, and stakeholders to enhance sustainability efforts in the sector. Hue city is chosen as case study because Hue is well known as a tourist destination in Vietnam. Therefore, a sustainable F&B sector supports eco-tourism, boosting the local economy while attracting environmentally conscious travelers. It also helps protect Hue’s fragile environment, including the Perfume River and surrounding ecosystems, from pollution and overuse.

The Theory of Planned Behavior (TPB) is considered a valuable theoretical framework for explaining and predicting pro-environmental behavior, particularly in the context of 3R practices and circular economy (CE) readiness. TPB has been widely applied in international research to analyze recycling behaviors in households (Susanto et al., 2019), food waste reduction among consumers (Schrack et al., 2023), and plastic usage behavior in Malaysia (Chun et al., 2020). Furthermore, the extended TPB model has been utilized to examine CE readiness among micro, small, and medium enterprises (MSMEs) in India by incorporating additional factors such as environmental commitment and green economic incentives (Singh et al., 2018). However, in Vietnam, particularly in the food and beverage (F&B) sector, the application of TPB in studying 3R behaviors and circular economy approaches remains limited. A few recent studies have begun applying TPB in agriculture and among small-scale producers (Ngoc et al., 2024). Meanwhile, the F&B sector generates a significant amount of food and plastic packaging waste, posing major environmental challenges, yet it has not received adequate attention in behavior-focused research. This gap indicates an urgent need for further studies to expand the TPB framework by integrating additional factors such as environmental awareness, economic motivation, and social norms—tailored to the consumer culture and operational characteristics of the F&B industry in Vietnam. This is the scientific gap that motivates us to conduct this study to bridge.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 Theory of Planned Behavior Model

The Theory of Planned Behavior (TPB), which originates from the Theory of Reasoned Action (TRA), provides a framework for understanding how personal determinants influence a firm's practices of 3Rs (Ajzen, 1991). TPB was used to examine the CE readiness of MSMEs in India (Singh et al., 2018), to explore the level of CE in agriculture in Vietnam (Nguyen et al., 2024), to investigate the 3Rs behavior in plastic usage in Malaysia (Chun et al., 2020), to assess university students’ efforts in reducing plastic consumption (Hasan et al., 2015), and to explain household recycling behaviour (Strydom, 2018). As such, TPB provides a valuable framework for examining the determinants of reduction and recycling behaviours. According to TPB, behavioral intention is shaped by three primary factors: attitude, subjective norms, and perceived behavioral control. The Theory of Planned Behavior proposes that people’s intentions are influenced by their attitudes, perceived social expectations, and their sense of control over the behavior. To adapt this framework to the sustainability practices of F&B firms, the present study expands the model by integrating three additional dimensions: commitment to environmental values, access to economic incentives, and perceived financial benefits. This extension provides a more comprehensive lens for understanding the motivations behind the adoption of 3Rs practices.

2.2 3Rs practices

This study examines the level of practicing 3Rs concepts – reduce, reuse, recycle, which is the basic practice of the circular economy. In the F&B industry, food waste and other organic waste disposed of in landfills significantly contribute to greenhouse gas emissions, particularly methane, which is considerably more potent and environmentally hazardous than carbon dioxide (CO₂) (Immanuel et al., 2013). Reduction involves minimizing unnecessary consumption and choosing alternatives to disposable products, such as durable packaging (Ahmadi, 2017). Reuse refers to extending the useful life of items, whether through repurposing containers, donating excess food, or repairing equipment. For example,

instead of purchasing new bottled water, individuals can refill existing beverage bottles; similarly, reusable cups can be adopted in place of single-use disposable cups, and plastic bags can be repurposed for trash collection (Chun et al., 2020). Moreover, in F&B sector, the most common reuse opportunities involve redeploying overproduced foods and also donating them to a food recovery program and other charities (Immanuel et al., 2013). Recycling covers the recovery and transformation of discarded materials into new resources, ranging from paper and plastics to food waste that can be processed into compost or bioenergy. Together, these practices are designed to optimize resource efficiency and limit environmental damage. In F&B sector, when food waste is no longer suitable for consumption, it can be sold or donated to commercial composting companies, which process these organic materials—often in combination with other biodegradable waste—into nutrient-rich soil amendments (Macy, 2008). This practice not only diverts waste from landfills but also contributes to circular resource utilization in agricultural and landscaping applications. In addition, specialized recycling services are available for handling specific food-related waste streams, such as grease, used cooking oil, and butcher scraps, ensuring that these by-products are managed in an environmentally responsible and economically beneficial manner (Immanuel et al., 2013) (Ahmadi, 2017; Chun et al., 2020).

2.3 The components of an extended theory of planned behavior model

2.3.1 Attitude

Attitude, as a central component of the Theory of Planned Behavior (TPB) (Ajzen, 1991), plays a critical role in shaping individuals' and organizations' intentions to engage in environmentally responsible behaviors, including the application of 3Rs practices and the broader adoption of circular economy (CE) models. Attitudes are defined as psychological tendencies expressed by evaluating a particular entity with favor or disfavor (Harris, 2011). In environmental behavior models, a positive attitude generally reflects a person's or firm's belief that the benefits of sustainable practices outweigh the costs. Empirical evidence shows that attitude has a significant and positive influence on pro-environmental behavioral intentions. For instance, in a study on plastic waste reduction among Malaysians, attitude was found to significantly affect individuals' intention to engage in 3Rs behaviors, although the strength of the relationship was modest (Chun et al., 2020). (Chang & Chou, 2018) further reinforced this finding in the context of Taiwan, where positive consumer attitudes strongly predicted the intention to bring reusable bags when shopping. At the organizational level, the attitude has also been recognized as a determinant of the owner's readiness for something new. According to (Singh et al., 2018), owner's positive evaluation of CE practices—especially when these practices are perceived to offer cost savings, efficiency, and competitive advantage—leads to a higher likelihood of adoption. Conversely, if CE adoption is associated with high capital investment, technological complexity, or the need for highly trained personnel, firms are less likely to embrace it. Awareness, salient beliefs, and organizational culture have been shown to foster more favorable attitudes toward sustainable waste management (Singh et al., 2018).

A similar pattern emerged in the Vietnamese context, (Susanto et al., 2019) found that among various behavioral prediction factors, attitude had the strongest and most significant influence on household-level 3Rs behavior. The study highlighted that campaigns targeting awareness and values transformation could positively shift attitudes, thereby increasing participation in 3Rs activities. Moreover, positive environmental attitudes among managers are linked to firms' environmental commitment and implementation of green practices. It emphasized that environmentally conscious managers are more likely to develop organizational policies that support sustainable waste management (Roxas & Coetzer, 2012). This aligns with a previous study's assertion that the mental and emotional disposition of decision-makers influences whether circular practices are integrated into firm operations (Montalvo Corral, 2003).

2.3.2 Subjective norms

The subjective norm refers to the perceived social pressure from important referents (e.g., family, peers, community, or institutions) to perform or refrain from performing a particular behavior (Ajzen, 1991). Within the scope of 3Rs practices, subjective norms are a pivotal component in shaping individuals' and firms' intentions to adopt pro-environmental behaviors.

Empirical research confirms that subjective norm exerts a significant influence on behavioral intention in waste management contexts. For example, it's found that support from family, friends, and community members significantly enhances an individual's intention to engage in 3Rs practices in Malaysia. Their study revealed that subjective norm positively influences 3Rs behavioral intention, suggesting that when individuals perceive that others expect them to act sustainably, they are more likely to do so (Chun et al., 2020).

In organizational contexts, circular economy readiness among Indian manufacturing SMEs is investigated by using an extended TPB model. Their findings highlighted that social pressure (a proxy for subjective norm), which includes expectations from government regulators, market forces, and community stakeholders, has a positive and significant effect on the adoption of circular economy practices. The authors emphasized that external referents, such as regulatory

bodies and consumer expectations, motivate firms to comply with sustainable waste management practices and green innovation(Singh et al., 2018).

Similarly, in a Vietnamese context, (Nguyen et al., 2024) analyzed the adoption of circular economy in agriculture. While their study did not isolate subjective norm explicitly, they emphasized the role of community awareness and social influence in encouraging farmers to adopt sustainable practices. The findings suggest that collective cultural values and peer behavior significantly contribute to behavioral shifts in sustainability-focused initiatives.

However, the influence of subjective norms may vary depending on demographic, cultural, and institutional contexts. For instance, (Susanto et al., 2019) found that in the case of household 3Rs behavior in Semarang, Indonesia, subjective norm had an insignificant effect on intention compared to attitude. The authors concluded that without a strong community-level campaign or reinforcement from influential figures, the impact of subjective norms remains limited.

Despite these differences, many studies acknowledge that subjective norms become more impactful when supported by policy measures, education, and visible role models within a society or organization. When regulatory institutions, financial institutions, and community stakeholders convey strong expectations regarding environmental responsibility, both individuals and businesses are more likely to adopt 3Rs and circular economy behaviors(Montalvo Corral, 2003; Singh et al., 2018).

2.3.3 Perceived behavioral control

Perceived Behavioral Control (PBC) constitutes a fundamental element of the TPB, representing individuals' or organizations' perception of the ease or difficulty associated with performing a particular behavior (Ajzen, 1991). It reflects not only internal confidence and capacity but also the anticipated presence of facilitating or constraining conditions in a given context. According to (Han et al., 2010), PBC assesses the availability of resources and situational enablers or barriers that may influence the likelihood of engaging in a specific behavioral action.

In the context of CE practices, numerous studies have emphasized that PBC is significantly shaped by technological capabilities, supply chain integration, green innovation, and access to technical or cooperative partnerships (Zhang et al., 2013). These elements collectively determine an enterprise's level of competence in exploiting environmental opportunities and, in turn, influence their behavioral intentions and commitments toward sustainable waste management.

For micro, small, and medium-sized enterprises (MSMEs) in particular, the implementation of CE initiatives is often hindered by structural limitations, such as inadequate technological infrastructure, financial constraints, managerial capacity, and a narrow customer base in localized markets (Schrang et al., 2023; Singh et al., 2018; Susanto et al., 2019). Consequently, in examining the PBC of MSMEs, key dimensions such as technological capabilities (TC), financial capabilities (FC), human resource capabilities (HRC), and infrastructural capacity (IC) are essential constructs to capture the firm's perceived control over CE implementation.

2.3.4 Environment Commitment

Environmental commitment is defined as the ethical obligation and proactive engagement of individuals or firms to protect the environment through green practices. Environmental commitment plays a pivotal role in shaping organizational strategies and operational decisions (Singh et al., 2018).

It is demonstrated that firms with higher environmental commitment are more likely to engage in resource-efficient, low-waste processes and adopt cleaner production technologies (Singh et al., 2018).

A firm's commitment to the environment has been shown to enhance organizational sustainability, improve operational efficiency, and support green innovation (Stone, 2006). However, small and medium enterprises (SMEs), especially in developing countries, often perceive waste management practices as non-essential to productivity, thereby limiting their environmental initiatives (Bhupendra & Sangle, 2016).

In the broader behavioral context, research on 3Rs practices shows that environmentally committed individuals are more likely to demonstrate consistent pro-environmental behavior, such as plastic reduction and recycling efforts (Chun et al., 2020). Public campaigns and educational interventions have been found to strengthen environmental commitment, translating awareness into action and increasing participation in 3Rs programs (Roxas & Coetzer, 2012; Susanto et al., 2019).

Environmental commitment thus serves as a bridge between individual values and organizational action, aligning internal motivations with external sustainability goals. Its influence on both behavioral intention and actual behavior makes it a powerful enabler for the successful implementation of circular economy initiatives in diverse sectors.

2.3.5 Green Economics Incentives

Green economic incentives (GEIs) refer to financial inducements or supplementary rewards designed to encourage environmentally responsible behaviors. These incentives support critical activities such as waste minimization, recycling, and advanced waste treatment—key components for fostering a resource-efficient circular economy (Gunsilius, 2015). Recent literature has increasingly highlighted the importance of green economic incentives as a driving force in promoting CE adoption across sectors. In the manufacturing context, (Singh et al., 2018) emphasize that green economic incentives, such as subsidies, tax benefits, and access to cheaper recycled materials, play a crucial role in influencing small firms' readiness to implement CE practices. These incentives help mitigate the perceived high costs of transitioning to greener technologies and practices, strengthening firms' internal capabilities, and encouraging sustainable waste management. Their study, based on the Extended Theory of Planned Behavior, found green incentives to have a significant and positive impact on CE readiness, even more so than perceived behavioral control. In the agricultural domain, (Nguyen et al., 2024) similarly found that financial incentives are the strongest determinant of CE adoption among Vietnamese farming households. Their research shows that investments in sustainable agriculture—supported by government subsidies and favorable lending policies—are essential for overcoming barriers related to technology, scale, and awareness. Without adequate financial support, small agricultural producers often lack the motivation and resources to shift toward CE practices. Together, these studies affirm that green economic incentives are not only enablers but also strategic levers for driving environmental transformation, particularly in resource-constrained settings.

2.3.6 Economic benefits

This is a newly introduced variable in the model. To date, there are limited studies that have examined the impact of economic benefits on businesses' attitudes toward practicing the 3Rs principle, except for the study by (Ngoc et al., 2024) that demonstrated a positive effect of economic benefits on the willingness of coffee-producing households in Đắk Lắk province, Vietnam, to participate in the circular economy. Based on key informant interviews with the experts in CE and economics, we decided to include this new variable in the proposed research model in the context of Vietnam.

3. METHODOLOGY

3.1 Research design

The study followed a quantitative approach using a structured questionnaire to ensure consistency across respondents. Before the official survey, the draft instrument was reviewed by several subject experts, and adjustments were made to improve clarity and relevance. A self-administered survey was then conducted among owners and managers of F&B businesses in Hue City. Respondents answered using a five-point Likert scale, which is widely recognized for capturing behavioral and attitudinal variations.

3.2 Sampling

In this study, the sample size was determined using a non-probability sampling method, based on the formula proposed by (Yamane, 1967):

$$n = \frac{N}{1 + Ne^2}$$

Where:

- n represents the required sample size,
- $N=375$ is the total population (number of enterprises within the research scope),
- $e=0.05$ is the allowable margin of error (corresponding to a confidence level of approximately 95%).

The target population consisted of 375 F&B enterprises in Hue. Using established guidelines for determining sample size with a 5% margin of error, the minimum requirement was around 200 valid responses. In addition, according to (Joseph F Hair et al., 1998), when conducting Exploratory Factor Analysis (EFA), the ideal sample size should follow a 5:1 ratio of observations to measurement items, meaning that each measurement item should be supported by at least five observations. Prior methodological recommendations also suggest a ratio of at least five respondents per survey item for factor analysis, and a minimum of 200 for structural equation modeling. To meet these thresholds and allow for possible non-responses, 230 questionnaires were distributed. After excluding incomplete submissions, 220 valid cases remained, which were sufficient for the planned analyses. (Joseph F Hair et al., 1998).

To ensure the reliability of the data and mitigate the effect of invalid responses, the research team distributed 230 questionnaires to enterprises. Among these, 10 responses were deemed invalid due to incompleteness or inconsistency.

Therefore, the final valid sample used for quantitative analysis consisted of 220 enterprises, which satisfies the minimum required sample size for statistical testing.

The study focuses on enterprises in the food and beverage sector in Hue city that had engaged in 3Rs-related practices within the past year. This approach was chosen because a complete sampling frame of all eligible enterprises was unavailable, and purposive sampling allowed access to respondents with relevant experience. While this limits the generalizability of findings, it is consistent with prior sustainability studies in emerging economies and ensures data quality from knowledgeable participants.

3.3 Data collection

Data were collected between January and April 2025. To ensure the reliability of responses, only enterprises with at least three years of operation and valid business registration were included. In each case, the survey was completed by the owner or a designated representative with decision-making authority. This approach provided access to respondents with relevant knowledge and experience regarding sustainability practices.

3.4 Data processing and analysis

The analysis was conducted in several stages. First, descriptive statistics were used to profile the sample. Reliability was assessed with Cronbach's Alpha, followed by exploratory factor analysis (EFA) to explore the factor structure. Confirmatory factor analysis (CFA) was then performed to validate the measurement model, using indicators such as chi-square/degrees of freedom ratio, goodness-of-fit index, comparative fit index, Tucker–Lewis index, and root mean square error of approximation. Finally, structural equation modeling (SEM) was applied to test the hypotheses and examine the relationships between constructs. Mediation effects were further evaluated using bootstrapping with 1,000 resamples.

4. RESULTS AND DISCUSSION

4.1 Descriptive sample

Table 1: Investigated pattern structure

	Frequency	Percentage
Drinks Shop	76	35
Full-service restaurant	43	20
Fast-service restaurant	101	45
Total	220	100

(Source: Author's analysis, 2025)

Based on the data, the F&B industry in Hue City displays a strong dominance of fast-service restaurants, which account for 45% of all F&B establishments. This highlights a growing preference for quick and convenient dining experiences, likely driven by changing consumer lifestyles, tourism dynamics, and urban development. Drinks shops, which include cafes, tea houses, and beverage stalls, form the second-largest segment with 35%, indicating a vibrant café culture and the popularity of social hangout spots, especially among younger demographics. Full-service restaurants constitute the smallest portion at 20%, suggesting either a higher operational barrier or a more niche market segment focused on formal dining experiences. Overall, the F&B landscape in Hue is characterized by a youthful, fast-paced trend favoring efficiency and affordability, while still maintaining a presence of traditional dining formats. The dominance of fast-service restaurants suggests a trend toward quick-turnover, convenience-oriented consumption, which inherently poses both opportunities and challenges for sustainable waste management practices. Fast-service restaurants typically operate on high-volume, low-margin models and rely heavily on single-use packaging(e.g., disposable containers, plastic utensils, and drink cups). As a result, this segment contributes significantly to solid waste generation, particularly plastic and food waste, which underscores an urgent need for tailored 3R interventions.

Table 2: Online sale

Yes	194	88
No	26	12
Total	220	100

(Source: Author's analysis, 2025)

The data reveals a strong digital adoption trend in the local market. Specifically, 88% of the businesses (194 out of 220) have embraced online sales channels, showing a high level of digital integration and responsiveness to changing consumer behaviors—especially in the post-pandemic era, where online food ordering and delivery have surged. This reflects both the demand from customers for convenience and the willingness of local businesses to adapt to technological trends to remain competitive. Meanwhile, only 12% of establishments do not engage in online sales, possibly due to resource limitations, the nature of their services, or targeting specific customer segments that prefer traditional dining experiences. The data shows that full-service restaurants account for most non-online sales. Overall, the widespread adoption of online sales channels positions Hue’s F&B industry as increasingly tech-savvy and aligned with modern consumer expectations.

4.2 Cronbach’s Alpha Analysis Results Cronbach’s

Table 3: Descriptive Statistics and Reliability Measures

Constructs	Items	Factor Loadings	Cronbach’s Alpha	AVE
Attitude (ATT)	4	0.675-0.727	0.867	0.653
Subjective norms (SNR)	4	0.829-0.877	0.926	0.724
Perceived Behavioral Control (PBC)	5	0.671-0.790	0.895	0.634
Environmental Commitment (ECM)	6	0.772-0.866	0.940	0.764
Green Economic Incentives (GEI)	4	0.829-0.885	0.923	0.751
Economic Benefits (EBT)	4	0.696-0.816	0.884	0.622
3Rs Practice (TRP)	8	0.476-0.890	0.925	0.623

(Source: Author’s analysis, 2025)

Reliability tests confirmed strong internal consistency across all constructs, with Cronbach’s Alpha values exceeding the standard 0.70 threshold. Factor loadings were generally high, and average variance extracted values indicated sufficient convergent validity.(Cronbach, 1951). Based on the descriptive statistics and reliability measures provided in the table 3, the preliminary analysis for Exploratory Factor Analysis (EFA) indicates a strong foundation for further factor extraction. All constructs demonstrate high internal consistency, as reflected by Cronbach’s Alpha values exceeding the recommended threshold of 0.70, which satisfies the rule of thumb (Joe F Hair et al., 2011). Specifically, One item within the 3Rs construct showed weaker performance but did not significantly undermine the model, so it was retained for further analysis. Exploratory factor analysis revealed a clear seven-factor structure that explained nearly 75% of the total variance, demonstrating strong data suitability..

In terms of convergent and discriminant validity, the factor loadings for each construct generally fall within acceptable ranges, mostly above 0.60. There is no cross-loading appears above .3, indicating excellent discriminant validity. Each factor has a coherent and interpretable structure corresponding to theory-based constructs from the extended Theory of Planned Behavior. However, one concern arises in the 3Rs Practice construct, which includes a loading as low as 0.476, indicating that one item may contribute weakly to the overall factor and may warrant further inspection or removal. The Average Variance Extracted (AVE) values for all constructs exceed 0.5, which confirms that each construct captures a sufficient proportion of variance from its items (Fornell & Larcker, 1981). This reinforces the measurement model’s validity.

Overall, the initial reliability and validity assessments indicate that the scales are robust, justifying continuation to the next steps of EFA, which would involve KMO and Bartlett’s tests to confirm sampling adequacy and factorability, followed by factor extraction and rotation to explore the underlying structure of the dataset.

4.3 Exploratory Factor Analysis (EFA) Results

Based on the reliability analysis of the measurement scale, all seven groups of factors, including six independent variables and one dependent variable, satisfy the requirements for inclusion in the EFA.

Table 4: KMO và Bartlett’s Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.940
Bartlett's Test of Sphericity	Approx. Chi-Square	6409.478

	df	595
	Sig.	.000
Total Variance Extracted		74.84

(Source: Author's analysis, 2025)

As the next step in the Exploratory Factor Analysis (EFA), the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity were employed to evaluate the suitability of the data for factor analysis. The KMO value obtained was 0.940, well above the recommended threshold of 0.80. This indicates that the sampling is highly adequate and that the partial correlations among variables are sufficiently low to justify factor analysis. Furthermore, Bartlett's Test of Sphericity yielded a Chi-Square value of 6409.478 with 595 degrees of freedom and a significance level of $p < 0.001$. This result confirms that the correlation matrix is not an identity matrix and that the variables are significantly correlated, fulfilling another key assumption for EFA. Together, these results strongly support the appropriateness of applying factor analysis to the dataset, paving the way for factor extraction and rotation in subsequent steps.

The EFA results indicate seven factors with 35 observed variables have Eigenvalues greater than 1, and the total variance explained by the main factors is 74.848% (greater than 50%). This reveals that the factors explain 74.848% of the data variation, confirming the suitability of the data for the factor analysis.

4.4 Confirmatory Factor Analysis (CFA) Results

From the results of EFA, the authors conduct a CFA model to analyze and confirm the relationship between independent and dependent variables. Following the CFA analysis, the results are presented in Table 5:

Table 5 : Confirmatory Factor Analysis (CFA)

Index	Standard	Result	Evaluation
CMIN/df (Chi-square/degrees of freedom)	≤ 3	1.284	Good
GFI (Goodness of Fit Index)	>0.85	0.888	Good
CFI (Comparative Fit Index)	≥ 0.9	0.981	Good
TLI (Tucker-Lewis Index)	≥ 0.9	0.978	Good
RMSEA (Root mean square error of approximation)	≤ 0.08	0.036	Good

(Source: Author's analysis, 2025)

The confirmatory factor analysis (CFA) results indicated that the measurement model fit the data well. Key indicators, including CFI and TLI, were above 0.95, while the error approximation value (RMSEA) was well below 0.05. Although the goodness-of-fit index (GFI) was slightly lower than the conventional threshold, the overall combination of indices supported the adequacy of the model. These results confirm that the constructs were measured consistently and provide a robust foundation for subsequent structural modeling.(Chen, 2016; Zhang et al., 2013). We acknowledge that it falls slightly below the conventional 0.85 threshold but according to Hair et al. (2010) models can still be acceptable if other indices (CFI, TLI, RMSEA) are strong, which they are here.

Table 6: Results of SEM analysis of factors influencing the 3Rs practice

Hypothesis		Unstandardized beta coefficient	Standardized beta coefficient	S.E.	C.R.	P-Value	Conslusion	Model explanation
H1	TRP <--- ATT	0.236	0.226	0.096	2.469	0.014	Supported	
H2	TRP <--- ECM	0.128	0.150	0.051	2.511	0.012	Supported	73.3%

H3	TRP <--- SNR	0.090	0.109	0.042	2.157	0.031	Supported
H4	TRP <--- PBC	0.187	0.224	0.060	3.107	0.002	Supported
H5	TRP <--- GEI	0.126	0.134	0.050	2.517	0.012	Supported
H6	TRP <--- EBT	0.290	0.243	0.087	3.327	***	Supported

(Source: Author's analysis, 2025)

The SEM explained more than 70% of the variance in 3Rs practices, confirming strong explanatory power. All six hypothesized predictors were statistically significant. Perceived economic benefits had the greatest influence, underscoring the importance of cost savings and profitability in shaping sustainable practices among small and medium-sized enterprises. Specifically, Economic Benefits (EBT) had the strongest standardized effect ($\beta = 0.243$, $p < 0.001$), underscoring the importance of tangible economic outcomes in motivating sustainable practices. In the second position, Attitude and perceived behavioral control followed closely, reflecting the critical role of managerial belief and confidence in implementing new practices. Environmental commitment and green incentives also showed meaningful effects, while subjective norms exerted the weakest but still significant influence. This suggests that while social expectations are not ignored, they remain less decisive than financial and internal motivations in this context (Ajzen, 1991): individuals who believe in the value and benefit of an action are more likely to engage in it. This finding is consistent with (Zhang et al., 2013), who showed that positive environmental attitudes significantly predicted green behavior in manufacturing workers in China. The study confirms that shaping a pro-environmental mindset is a key managerial task.

Additionally, Perceived Behavioral Control (PBC) exerted a significant influence ($\beta = 0.224$, $p = 0.002$), indicating that when the F&B owners feel confident in their ability to perform 3Rs behaviors, they are more likely to engage in them. This finding is in line with studies of (Chun et al., 2020; Schrank et al., 2023; Singh et al., 2018; Susanto et al., 2019), who demonstrated that low perceived behavioral control is considered a major barrier to adaptation the circular economy in MSMEs.

Environmental Commitment (ECM) ($\beta = 0.150$, $p = 0.012$), also showed a significant impact, highlighting the role of emotional identification with environmental values. This confirms the insights of Afridi et al. (202, who demonstrated that employees with strong green commitment are more likely to engage in sustainability practices.

Green Economic Incentives (GEI) ($\beta = 0.134$, $p = 0.012$), These results reveal that external financial inducements, such as tax reductions and subsidies, help overcome inertia and motivate organizations toward sustainability. The findings support the arguments of previous studies, which confirm that GEI is a positive and predictive component influencing a firm's circular readiness (Agnello et al., 2015; Singh et al., 2018)

Subjective Norms (SNR) ($\beta = 0.109$, $p = 0.031$) was the smallest among all factors; it remained statistically significant. This result is in line with previous studies of (Agnello et al., 2015; Chun et al., 2020; Schrank et al., 2023; Singh et al., 2018; Susanto et al., 2019), but this component has a stronger impact than in our study. This suggests that social pressure and normative influence—from peers, managers, or corporate culture—can still encourage green behaviors, albeit modestly. However, in our case, social pressure seems to have less influence on the owner's action because it's possible that the limited awareness of 3Rs among the people around him/her.

The finding that economic benefits exert the strongest influence on 3Rs adoption aligns with the practical orientation of Vietnamese food and beverage enterprises, most of which are small- and medium-sized firms facing resource constraints. For these firms, cost savings and efficiency gains are critical determinants of strategic decisions, which explains why economic feasibility dominates over normative or ethical drivers. This result resonates with findings from other developing contexts, such as India and Indonesia, where economic imperatives similarly outweighed social norms in shaping pro-environmental practices. In contrast, the relatively weak role of subjective norms may reflect the limited public awareness of 3Rs in Hue, as well as weak enforcement of environmental regulations. Unlike in Malaysia or China, where consumer expectations and peer influence strongly encourage green practices, the Vietnamese context appears to be more individually and resource-driven. This divergence highlights the importance of contextualizing behavioral models to national and sectoral realities.

5. CONCLUSION

This study applied an extended Theory of Planned Behavior framework to examine the adoption of 3Rs practices among food and beverage businesses in Hue City. By including environmental commitment, green economic incentives, and perceived financial benefits in the model, the research provides a more complete understanding of sustainability drivers in the sector. The analysis shows that economic outcomes are the most decisive factor shaping adoption, followed by managerial attitudes and perceived behavioral control. Although social pressure and external incentives also matter, their influence is comparatively modest. This aligns with findings of (Nguyen et al., 2024)(Ngoc et al., 2024) in the agricultural sector, which found that economic viability is the primary driver of circular economy practices among Vietnamese farming households. Similarly, (Singh et al., 2018) emphasized that cost efficiency and savings are essential motivators for small manufacturers transitioning to circular systems. These comparisons underscore the cross-sectoral importance of financial feasibility as a green behavior.

The research findings have some implications to enhance the 3Rs practices of F&B companies in Hue city:

Firstly, given the strong impact of economic benefits, policymakers should prioritize the design and promotion of financial incentive schemes, such as tax reductions, subsidies, and low-interest green loans for companies that adopt 3Rs technologies and practices. These measures can directly reduce the perceived financial burden and motivate investment in sustainable packaging, waste management systems, and process redesign. The economic benefits of 3Rs practices are not always counted in the short term. The government can educate the F&B companies on how to calculate the economic benefits in the long term, which takes into account the sustainable criteria. According to F&B business owners, they are very eager to adopt the 3Rs practices, but they are unsure how to calculate the long-term costs and benefits of implementing these activities, as many associated expenses and revenues cannot be accounted for in monetary terms. Therefore, short-term training courses that provide knowledge and skills in building business models centered around 3Rs practices are essential for enhancing the capacity of F&B entrepreneurs. Through this, businesses will gain a clearer understanding of the long-term economic benefits of applying the 3Rs principles and will be able to manage their accounting in a more proactive and scientific manner.

Secondly, the level 3Rs practices of the F&B companies depends on his/her attitude about environmental responsibility. Hence, the government plays a crucial role in fostering a sense of environmental responsibility among F&B companies that can shape attitudes toward the 3Rs practices. This can be achieved by leveraging digital platforms such as Facebook, TikTok, or Instagram to disseminate targeted educational content and promote sustainable behavior. In addition, broader awareness can be enhanced through conferences, seminars, in which sufficient information and knowledge related to 3Rs practices can be intensively provided for the owners of F&B companies. These may include technical training on waste sorting, resource efficiency, and innovations in food waste valorization.

Thirdly, to address environmental commitment, national sustainability agendas should incorporate recognition schemes, green labeling, or public procurement advantages for companies that demonstrate high levels of commitment to environmental goals. Furthermore, the role of green economic incentives and subjective norms underlines the importance of shaping a favorable social and regulatory environment.

Finally, the previous studies have proved that social pressure is a critical component within the TPB, highlighting its role in shaping perceived attitudes, strengthening green commitment, and fostering sustainable behavior (Montalvo Corral, 2003; Roxas & Coetzer, 2012). External influences, particularly those originating from the community and market dynamics, are found to substantially impact the environmental and social responsibilities of individuals and firms alike (Pratarelli & Mainguy, 2010). Moreover, regulatory pressures exerted by governmental or institutional bodies have been shown to drive organizations toward sustainable practices, including adopting green innovations and efforts to minimize waste (Singh et al., 2018). However, in our study, most F&B companies' owners have been slightly encouraged by family, neighbors, friends, and the surrounding community to practice 3Rs. To effectively embed subjective norms related to 3Rs behavior within the community of Hue city, 3Rs campaigns must be implemented across all societal levels. Government-led initiatives must be equitably distributed throughout the area to ensure consistent exposure and engagement. These campaigns may include the installation of informative signage within residential complexes and the provision of direct training sessions aimed at enhancing community awareness and participation. In addition, local authorities should take an active role in monitoring local F&B companies' waste generation to support the evaluation and refinement of 3Rs initiatives. Such coordinated efforts are essential to cultivate sustainable waste management habits and normalize 3Rs practices among the residents of Hue City.

Based on research's results, fast-service restaurant takes into account of 45% of F&B enterprises in Hue city, therefore we recommend some solutions focusing on this type. By reducing single-use plastics and food waste through optimized inventory and portion control, restaurants can significantly lower their ecological footprint. Initiatives to reuse serving materials, such as implementing returnable container systems, can further diminish dependence on disposables. Lastly, integrating effective recycling programs, including partnerships with waste management firms for

segregated waste collection, ensures responsible disposal and resource recovery. Collectively, these strategies not only mitigate environmental impact but also enhance operational efficiency and corporate social responsibility.

The cross-sectional nature of this study limits the ability to establish causality, and the reliance on self-reported survey data may restrict the depth of insights. Future research should explore moderating effects, such as firm size, digital adoption, or consumer demand, which may shape the relationship between behavioral drivers and 3Rs adoption. Longitudinal studies would also help capture how attitudes and practices evolve as regulatory environments and consumer expectations change. Based on the SEM results indicating that economic benefits, attitudes, perceived behavioral control, environmental commitment, green economic incentives, and subjective norms significantly influence 3Rs practice adoption, several policy implications can be proposed to enhance the implementation of 3Rs in F&B companies. Public-private partnerships, industry benchmarking, and stakeholder dialogues should be strengthened to build collective momentum for 3Rs practices. These policy directions emphasize that the successful adoption of 3Rs in the F&B sector requires a combination of economic motivation, behavioral change, and institutional support, reinforcing the multifaceted nature of sustainable transformation.

A further limitation of this study lies in the absence of analysis on potential mediating and moderating effects. While the model identifies direct relationships between environmental commitment, green economic incentives, economic benefits, and 3Rs adoption, it does not explore whether variables such as digitalization, firm size, or consumer demand might mediate or moderate these effects. For instance, digitalization could enhance the impact of environmental commitment by enabling more efficient waste management practices, while firm size may determine the resources available for green initiatives. Similarly, consumer demand for sustainable products could amplify the role of economic benefits in shaping adoption behavior. The omission of such pathways restricts the explanatory depth of the model, and future research should extend the theoretical framework by incorporating these factors to capture the complexity of 3Rs adoption more comprehensively.

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