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Research on User Participation Willingness of Edible Campus Landscape from Multiple Perspectives: A Case Study of Chinese Universities

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Abstract

Against the backdrop of global food security and environmental sustainability challenges, the concept of "edible landscapes" has gained attention as an innovative strategy that integrates food production with urban green spaces. This study examines factors influencing user participation intention in edible campus landscapes, using Chinese universities as a case study. The COVID-19 pandemic has exacerbated food supply chain instability and increased public awareness of sustainability, prompting universities to explore innovative uses of green spaces to alleviate psychological stress, improve food security, and enhance social interactions. This study applies the integrated C-TAM-TPB model (a combination of the Technology Acceptance Model and the Theory of Planned Behavior) and employs Structural Equation Modeling (SEM) to analyze the impact of perceived benefits, perceived costs, subjective norms, perceived behavioral control, and attitude on user participation intention. The findings indicate that users' awareness, external support, and perceived benefits

positively influence their willingness to participate, whereas perceived costs have a negative effect. Moreover, demographic factors such as gender, age, occupation, education level, and academic background contribute to differences in participation intention. For instance, faculty members and graduate students demonstrate higher awareness and willingness to engage in edible landscapes compared to undergraduates and administrative staff. The study highlights the need for targeted strategies in promoting edible campus landscapes, considering users' educational and professional characteristics, optimizing resource allocation, lowering participation barriers, and enhancing external support to improve overall sustainability. The findings provide theoretical insights for university planners and practical implications for future policy-making and implementation.
Keywords: Edible Landscapes, User Participation, Campus Environment, Sustainability, Behavioral Intention

Introduction

Agriculture faces both natural and human-induced challenges, such as soil degradation and unsustainable farming practices (Fanelli & Romagnoli, 2019). In China, the lack of systematic planning prioritizes staple food production over urban green spaces, limiting landscape diversity (Tian & Qian, 2021). Additionally, weak legal frameworks and management strategies contribute to land-use conflicts, highlighting the need to understand public participation for effective policymaking (Xiao et al., 2023).

The COVID-19 pandemic exposed vulnerabilities in the global food system, disrupting labor, supply chains, and exports, exacerbating food insecurity (Hobbs, 2020). Edible landscapes have gained attention as a sustainable solution that integrates food production with urban greenery, enhancing food security and environmental resilience (Sevik et al., 2020). University campuses, heavily impacted by lockdowns, faced food shortages and increased psychological stress among students (Soda et al., 2023). Research indicates that horticultural activities alleviate stress and improve well-being (Jin et al., 2022; Theodorou et al., 2021). Edible landscapes provide stable food sources while enriching social and cultural experiences (Elands et al., 2019).

With China's rapid shift to a knowledge-based economy, universities play a vital role in sustainability. However, challenges such as high food demand, imbalanced diets, and food waste persist (Ding et al., 2024). Edible landscapes not only support ecological conservation but also promote education, well-being, and social interaction (Zhao, 2022). Unlike urban public spaces, university campuses offer a controlled environment ideal for edible landscape integration (Liu & Zhou, 2021). However, homogeneous campus designs limit their development (Lin et al., 2022). Strategic planning and implementation can enhance sustainability, optimize campus spaces, and foster environmental awareness among students and faculty.

Literature Review

Edible Landscapes in Campus Environments

Post-pandemic urban environments require enhanced resilience and sustainability. The shift to remote work has increased social isolation, affecting mental health (Theodorou et al., 2021). Universities, characterized by high-density student housing and frequent community interactions, are particularly affected (Soda et al., 2023). Campus lockdowns have restricted student activities, contributing to emotional distress and social detachment, making the quality of campus landscapes increasingly important (Yang et al., 2022; Vaughn et al., 2023). Research indicates that while the pandemic heightened student awareness of sustainability, it also negatively impacted their health and safety (Yip et al., 2022). Restricted access to shopping forced students to rely on university food provisions, increasing stress and food insecurity. Incorporating edible plants into campus design presents an opportunity for crisis mitigation and resilience building (Sardeshpande et al., 2020). Horticultural activities have been shown to alleviate pandemic-induced stress and enhance mental well-being (Jin et al., 2022; Theodorou et al., 2021). Edible landscapes not only support robust food systems but also provide cultural, artistic, and recreational experiences (Elands et al., 2019).

With China's rapid transition to a knowledge-based economy, the rise of "university towns" has strengthened regional competitiveness and higher education development (Zhu & Tang, 2013). However, many Chinese universities face challenges such as high food demand, unbalanced diets, excessive food waste, and suboptimal environmental quality. Edible campus landscapes offer environmental education, well-being benefits, social interaction, and economic advantages, enriching campus experiences and public services (Ding et al., 2024; Zhao, 2022).

Potential and Challenges of Edible Campus Landscapes
Existing research on edible landscapes mainly focuses on urban residential areas and public spaces such as parks and streets, where management is complex due to high human mobility. In contrast, universities provide a controlled environment conducive to ecological initiatives, offering valuable opportunities for edible landscape implementation (Liu & Zhou, 2021). Further exploration of influencing factors and educational integration could enhance student engagement and optimize campus space utilization.

Despite its potential, edible campus landscapes in China face multiple challenges, including limited agricultural adaptability, lack of long-term planning, spatial constraints, unclear land-use rights, insufficient maintenance support, inadequate technical knowledge, and difficulties in balancing aesthetic and functional needs (Cui-Hua, 2011). The adoption of informal community gardening models often leads to inefficient management and neglects infrastructure and user needs (He & Zhu, 2018). Unsustainable practices and inadequate government attention further hinder their contribution to biodiversity and social well-being. Edible landscapes are common in urban communities and small spaces but remain underutilized in university settings. The tendency toward uniform campus landscape design has restricted diversity and customization in edible landscape development (Lin et al., 2022). Addressing these challenges through systematic planning and strategic integration can maximize the benefits of edible landscapes, fostering environmental sustainability and improved campus experiences.

Research Methodology
Research Design
A well-structured research design provides a systematic framework for data collection and analysis, ensuring coherence and validity in investigating research questions (Wisenthige, 2023). It integrates existing knowledge with new data, guiding researchers toward reliable outcomes and enhancing the quality of social science research (Li, 2003; Gupta, 2023). By

mitigating potential challenges, a clear research design improves overall study quality and identifies possible limitations (Suyitno, 2020; Ganeshpurkar et al., 2018). Establishing explicit objectives and a methodological framework enhances research validity, particularly in experimental studies involving independent and dependent variables (Damasceno, 2020). It further ensures methodological appropriateness, allowing researchers to select suitable techniques for data collection and analysis (Abutabenjeh & Jaradat, 2018).

Quantitative Research

Quantitative research is ideal for studies requiring statistical analysis, causal reasoning, and variable measurement. Methods such as surveys, experiments, and observational studies facilitate numerical data collection, enabling hypothesis testing and generalization (Labuschagne, 2015; Wu & Little, 2011; Zyphur & Pierides, 2017). Structural equation modeling (PLS-SEM) effectively tests relationships and hypotheses within this framework (Plugge & Nikou, 2024). This approach is particularly valuable for quantifying attitudes, perceptions, and behaviors, allowing insights to be drawn from large sample populations (Mohajan, 2020; De Sordi, 2024).

For perception analysis, quantitative research provides objective measurement and comparison, offering structured insights into audience preferences and influencing factors (Rademaker & Polush, 2022; Barnham, 2015). It facilitates broad characterization of target populations, ensuring generalizability and predictive validity (Fonseca et al., 2013). By quantifying subjective experiences into statistically analyzable data, researchers can systematically assess and interpret perceptions, supporting data-driven decision-making in landscape planning tailored to university communities (Tudorie et al., 2020).

Study Site

The selection of a study site is crucial for environmental assessments, directly influencing research objectives and findings. Inadequate site selection can lead to irrelevant comparisons and diminished research quality, underscoring the need for careful selection (Walford, 2001). A well-chosen site enhances the relevance and accuracy of results while optimizing resource utilization, particularly in regions impacted by climate change. Key considerations include geological, topographical, and soil conditions (Gumbo et al., 2022; Siegel, 2018). A strategically selected location facilitates participant recruitment, data retention, and research efficiency (Warden et al., 2011).

Priority should be given to sites with established expertise in the field, ensuring both accuracy and real-world applicability of research outcomes (Sharma et al., 2024). Industry-leading or resource-rich sites often provide essential infrastructure, optimal resource distribution, and supportive policies, reducing risk and enhancing research feasibility (ResearchFDI, 2023). Locations with robust research capabilities and experienced personnel further ensure high-quality data collection and execution (Applied Clinical Trials, 2020; TNF Pharmaceuticals, 2020).

This study selects South China Agricultural University (SCAU) in Guangzhou, China, due to several factors:

1. Favorable Natural Conditions: Located in Guangdong province, SCAU benefits from a warm, humid climate with distinct seasons, fertile soil, and ample precipitation—ideal for

edible landscape development.

2. Agricultural Expertise and Land Resources: The university offers extensive agricultural research support, technical expertise, and abundant land, providing a strong foundation for edible landscape design and implementation.
3. Existing Initiatives and High Acceptance: Since 2016, an edible landscape research group has been active on campus, with strong faculty and student interest facilitating study implementation.

Despite these advantages, challenges remain. While acceptance of edible landscapes is high, actual participation is limited, making long-term maintenance and management difficult, which in turn affects ecological and educational efficiency.

Sampling Method

Although purposive and snowball sampling are primarily associated with qualitative research, they can also be effective in quantitative studies, particularly when probability sampling is impractical (Shafie, 2010). While these methods do not offer the same statistical generalizability as probability sampling, they enable researchers to strategically select participants and expand the sample through social networks, thereby enhancing data quality and depth. Social media further amplifies survey reach and response rates (Dusek et al., 2015).

Purposive sampling allows researchers to identify individuals who meet specific criteria, ensuring that the sample aligns with research objectives and enhances data relevance (Dragan & Isaic-Maniu, 2022). By selecting participants with relevant backgrounds or experiences, researchers obtain directly applicable insights (Vincent & Thompson, 2020).

Snowball sampling, wherein participants recruit others from their social circles, is particularly useful for accessing hard-to-reach populations. In quantitative research, this method helps expand the sample through referrals, making it highly effective when the target population is not fully defined or difficult to access (Dusek et al., 2015). By leveraging existing connections, snowball sampling significantly increases sample size, which is crucial for improving statistical power (Hossan et al., 2023).

Combining these methods addresses the limitations of traditional sampling techniques. In resource-constrained scenarios, purposive and snowball sampling offer an efficient means of collecting diverse and representative data within a short timeframe (Kennedy-Shaffer et al., 2021). These approaches enhance both the breadth and depth of data collection, ensuring a more comprehensive research sample. For instance, Da Silva et al. (2023) used purposive sampling to select physicians familiar with thyroid microcarcinoma (PTMC) and then applied snowball sampling through WhatsApp networks to expand participation. Similarly, Perez et al. (2011) examined how these sampling techniques influenced survey response rates in multiethnic communities.

In this study, a combined purposive and snowball sampling approach will be employed. Initially, purposive sampling will be used to select participants from the university's edible landscape research group, comprising students, faculty, and staff with relevant expertise. This ensures high sample relevance and targeted data collection.

After completing the initial surveys, snowball sampling will be utilized to expand the sample. Participants will be encouraged to share the survey link via social media platforms such as WeChat and QQ, allowing for organic expansion. This method is particularly beneficial for reaching dispersed populations and increasing sample diversity. By integrating these sampling techniques, this study ensures both relevance and scalability, facilitating a comprehensive dataset for subsequent analysis.

Components of Research Design

Variables

This study examines the factors influencing campus users' behavioral intentions to participate in edible campus landscape projects, based on the integrated C-TAM-TPB model. The model incorporates variables from the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB), with attitude as a mediating variable.

The dependent variable, behavioral intention (BI), reflects users' willingness to engage in the project. Independent variables fall into two categories: TAM-based and TPB-based factors.
From the TAM perspective, perceived benefits (PB) and perceived costs (PC) are key predictors. Perceived benefits, such as environmental and educational advantages, positively influence attitude (H4) and indirectly affect BI (H6). Perceived costs, including time, financial, and effort constraints, negatively impact attitude (H5) and, consequently, BI (H7).

From the TPB perspective, subjective norms (SN) and perceived behavioral control (PBC) directly impact BI. Subjective norms (H2) capture social pressure from peers or family, while perceived behavioral control (H3) measures users' confidence in their ability to participate.
Attitude (ATT) serves as a mediating variable, directly affecting BI (H1) and being influenced by PB (H4) and PC (H5). A positive attitude strengthens users' intention to participate.

Hypothesis Overview

H1: ATT positively influences BI.
H2: SN positively influences BI.
H3: PBC positively influences BI.
H4: PB positively influences ATT.
H5: PC negatively influences ATT.
H6: PB positively influences BI.
H7: PC negatively influences BI.

By integrating these relationships, the C-TAM-TPB model provides a comprehensive framework for analyzing participation determinants. This theoretical approach enhances the understanding of user behavior and informs strategies for project implementation and promotion (Figure 1).

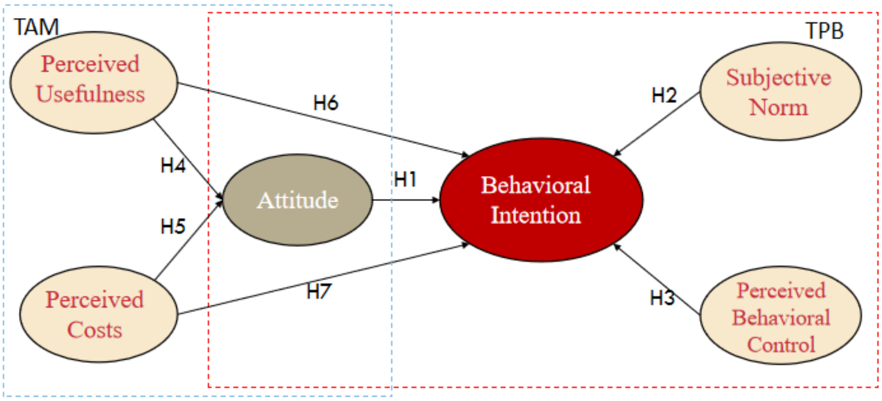

Figure 1. Theoretical Framework

Population and Sample Size

Determining the appropriate sample size is crucial for ensuring research validity and precision. Insufficient or excessive sampling can compromise study quality (Ahmad & Halim, 2017). A well-calculated sample ensures representativeness, facilitating accurate generalization (Bujang & Adnan, 2016; Gupta, 2011).

Krejcie and Morgan's (1970) method is widely used for estimating sample sizes when full population data is unavailable. This approach provides a statistical formula to ensure adequate representation and reliable findings (Chuan, 2006; Bukhari, 2021).

South China Agricultural University (SCAU), a multidisciplinary institution in China, serves as the study site. The university comprises 25 faculties, with a total student and faculty population of approximately 50,000, including 3,000 faculty members. This diverse academic community offers a robust foundation for sampling and data collection.

Instrument Development

This study employs a structured questionnaire, a widely used and efficient tool for collecting large-scale data in a short time (Patten, 2016). Questionnaires are frequently applied in edible campus landscape research (Hazzard et al., 2012; Sottile et al., 2016) to assess user attitudes, perceptions, and behavioral intentions.

Two widely recognized attitude measurement tools, the Semantic Differential Scale and the Likert Scale, were integrated. While both quantify subjective perceptions, they differ in approach. The Semantic Differential Scale, which uses bipolar adjectives (e.g., good-bad), captures nuanced emotional responses and enhances clarity in expressing attitudes (Reyes et al., 2015; Siegler et al., 2020). This method mitigates response bias and reduces completion time (McLeod et al., 2011). Conversely, the Likert Scale presents a range of agreement statements (e.g., strongly agree-strongly disagree) and is commonly used in social sciences for its simplicity and reliability (Emerson, 2017; Krosnick, 1991).

The Questionnaire Consists of 7 Sections

1. Demographics – Collects data on gender, age, education, and professional background.
2. Subjective Awareness – Assesses awareness, support, and satisfaction with edible landscapes.
3. External Support – Evaluates social and institutional encouragement for participation.
4. Resource Availability – Examines accessibility, facilities, skills, funding, and campus planning.
5. Perceived Costs – Addresses time investment, financial burden, and safety concerns.
6. Perceived Benefits – Measures the positive impact on health, education, and environmental sustainability.
7. Participation Intentions – Evaluates willingness to engage in edible landscape activities.

To ensure validity and reliability, a pilot test with 80 participants was conducted, yielding a Cronbach's Alpha above 0.7. In the formal study, 381 valid responses were collected, with reliability coefficients exceeding 0.8, confirming the questionnaire's robustness.

The questionnaire was initially developed in Chinese to ensure participant comprehension, followed by a back-translation process for accuracy verification. Data collection was conducted online via the Wen juanxing platform, distributed through social media (WeChat, QQ). Online surveys are cost-effective, time-efficient, and provide flexibility in administration (Regmi et al., 2017; Nayak et al., 2019). Research indicates comparable validity between online and paper-based surveys, with online formats demonstrating higher completion rates and data integrity (Kongsved et al., 2007; Bowen, 2012).

To enhance response rates, participants were incentivized with small rewards (e.g., campus souvenirs, study materials). Reminders were sent mid-study to encourage completion, ensuring a robust sample size for analysis. This strategic approach optimized data quality and representativeness.

Pilot Study

A pilot study, also known as a feasibility study, is a crucial step in refining research instruments before formal data collection (Van Teijlingen & Hundley, 2002). It enhances study success by identifying potential logistical challenges and optimizing research design (Thabane et al., 2010). Pilot results help adjust sample size to ensure adequate statistical power (Hundley & Van Teijlingen, 2002; O'Neill, 2022).

This study conducted a pilot with the university's edible landscape research group, leveraging interdisciplinary expertise to refine survey design. Team collaboration provided valuable feedback, improving questionnaire clarity and applicability. While there is no universal guideline for pilot sample size, scholars recommend around 10-20% of the main study (Hertzog, 2008; Coffey & Muller, 1999). Following this, 80 participants were selected for the pilot to ensure adequate assessment.

Data Analysis

Data analysis began with descriptive statistics to summarize demographic characteristics such as gender, age, and position. This helped in understanding sample distribution and provided preliminary insights.

Next, reliability and validity analyses were conducted to ensure measurement consistency and accuracy. Exploratory Factor Analysis (EFA) identified latent structures within the dataset, confirming construct validity (Mahfud et al., 2023). Internal consistency was assessed using Cronbach's alpha, with values above 0.80 indicating strong reliability (Yang & Zhou, 2024; Başer et al., 2024).

The final scale, validated through expert review, comprised 42 items across six dimensions. Factor analysis confirmed structural soundness (Düzgün & Kırkıç, 2023), reinforcing its applicability across research contexts. EFA facilitated refinement by removing low-loading items, ensuring a robust measurement tool (Chen & Mustapha, 2024).

For further validation, Confirmatory Factor Analysis (CFA) was employed to test hypothesized relationships between observed and latent variables. Unlike EFA, CFA requires a predefined model, allowing verification of measurement accuracy (Fox, 2010; Kevin, 2015). Model fit was evaluated using statistical indices, including Chi-square ($\chi^2/df < 3\text{-}5$), RMSEA (< 0.08), and CFI (> 0.90), ensuring model adequacy (Hu & Bentler, 1999; Kline, 2016).

Lastly, measurement invariance was tested to confirm consistency across different participant groups, enhancing result comparability (Levine, 2015). Using AMOS, CFA further validated the factor structure, supporting the study's theoretical framework (Erkan et al., 2023).

Results and Analysis

Introduction

This study's analysis is based on both the pilot and formal studies, utilizing SPSS 27 and AMOS 27 to assess the validity and reliability of the research framework. During the pilot phase, SPSS 27 was used for reliability and validity testing, along with descriptive statistics to ensure the accuracy and structure of the questionnaire. In the formal study, all collected data underwent descriptive statistical analysis, followed by confirmatory factor analysis (CFA) and structural equation modeling (SEM) using AMOS 27.

Questionnaire Reliability and Validity Testing

Reliability analysis

The reliability of the questionnaire was assessed using Cronbach's Alpha in SPSS to evaluate internal consistency across dimensions. Results showed that all Cronbach's Alpha values exceeded 0.8, indicating high reliability. Specifically, Subjective Awareness scored 0.865, External Support 0.946, Resource Availability 0.912, Perceived Costs 0.924, Perceived Benefits 0.927, and Participation Willingness 0.957. According to standard reliability criteria (Alpha > 0.9 as "excellent" and 0.8-0.9 as "good"), all dimensions demonstrated strong measurement consistency.

Further analysis revealed reasonable mean and standard deviation distributions. Subjective Awareness had a mean of 3.71–3.97 and a standard deviation of 0.743–0.915, indicating moderate agreement among respondents. External Support had the highest Alpha (0.946) and a mean of 3.93–4.12, with a standard deviation of 0.872–0.996, reflecting strong consensus. Resource Availability exhibited a mean of 3.79–3.97 with slightly higher variability (SD = 0.899–1.155). Perceived Costs ranged from 3.38 to 3.87, with a standard deviation of 0.943–1.171, suggesting neutral perceptions with moderate dispersion. Perceived Benefits had the highest mean (4.20–4.39) and a standard deviation of 0.708–0.784, indicating a strong perceived advantage of edible landscapes. Participation Willingness, with the highest Alpha (0.957), had a mean of 4.11–4.29 and a standard deviation of 0.776–0.903, confirming high measurement stability.

Table 1
Reliability analysis

Construct	Item	M±S.D.	Cronbach's Alpha
Subjective Awareness	SA1	3.83±0.915	0.865
	SA2	3.96±0.886	
	SA3	3.97±0.879	
	SA4	3.71±0.861	
	SA5	3.72±0.759	
	SA6	3.83±0.773	
	SA7	3.86±0.743	
External Support	ES1	4.12±0.879	0.946
	ES2	4.01±0.945	
	ES3	4.03±0.996	
	ES4	4.01±0.872	
	ES5	4.04±0.901	
	ES6	4.00±0.909	
	ES7	3.93±0.943	
Resource Availability	RA1	3.70±1.155	0.912
	RA2	3.91±1.085	
	RA3	3.67±1.193	
	RA4	3.79±1.099	
	RA5	3.93±0.899	
	RA6	3.97±1.032	
	RA7	3.80±1.020	
Perceived Costs	PC1	3.87±0.943	0.924
	PC2	3.80±1.020	
	PC3	3.39±1.167	
	PC4	3.46±1.171	
	PC5	3.51±0.986	
	PC6	3.42±1.146	
	PC7	3.38±1.107	
Perceived Benefits	PB1	4.20±0.766	0.927
	PB2	4.26±0.755	
	PB3	4.37±0.727	
	PB4	4.29±0.708	
	PB5	4.33±0.719	
	PB6	4.39±0.784	
	PB7	4.37±0.780	
Participate Willingness	PW1	4.29±0.892	0.957
	PW2	4.16±0.865	
	PW3	4.11±0.903	
	PW4	4.17±0.855	
	PW5	4.22±0.776	
	PW6	4.22±0.810	
	PW7	4.26±0.789	

Note: M ± S.D. represents Mean ± Standard Deviation.
Given that standard deviations in a 5-point Likert scale typically range from 0.5 to 1.5 (Yaska & Nuhu, 2024), these results indicate a well-structured instrument with reliable data. The pilot study findings confirm the questionnaire's robustness, supporting its use in formal data collection.

To assess the validity of the questionnaire, the study conducted the KMO and Bartlett's sphericity test, total variance explained, and rotated component matrix analysis. The Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity are key measures for evaluating the suitability of data for Exploratory Factor Analysis (EFA). KMO values range from 0 to 1, with 0.6–0.7 being acceptable and values above 0.7 indicating good adequacy (Nkansah, 2018; Ashino, 2023). Bartlett's test assesses whether the correlation matrix is an identity matrix, with a significant result ($p < 0.05$) supporting factor analysis (Tobias & Carlson, 1969).

Table 2
Validity Testing

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.810
Bartlett`s Test of Sphericity	Approx. Chi-Square	3425.766
	df	861
	Sig.	.000

Note: *p < 0.05, **p < 0.01, ***p < 0.001.

The pilot study results showed a KMO value of 0.810, exceeding the recommended threshold of 0.7, confirming the data's suitability for factor analysis. Bartlett's test yielded a highly significant result ($\chi^2 = 3425.766$, df = 861, $p < 0.001$), further supporting the feasibility of factor extraction. These findings confirm sufficient inter-variable correlations, validating the appropriateness of EFA.

The numerical range of the cumulative percentage of the rotation component matrix in SPSS analysis is crucial for understanding the variance explained by principal components. The rotated component matrix displays factor loadings, typically ranging from -1 to 1. Loadings above 0.4 are considered significant, indicating strong relationships between variables and factors (Ambo, 2022). The cumulative variance percentage represents the proportion of the selected component in the total variance. The common threshold for retaining components is about 65% to 70% cumulative variance, as this range has been proven to provide a reasonable number of clusters in various applications (Shaharudin&Ahmad, 2017). In practice, researchers often use SPSS to calculate the rotation component matrix and its cumulative percentage, making it easier to analyze complex datasets (Magdamo, 2017).

In the rotated component matrix, the loadings of each variable on the corresponding factors are relatively high, clearly presenting a six potential factor structure. These factors correspond to theoretical dimensions such as "cognition," "external support," "resource availability," "perceived cost," "perceived benefit," and "willingness to participate. The loadings of variables on their respective factors exceeded 0.6, indicating a strong correlation with their respective factors. The results indicate that the questionnaire questions can effectively reflect various dimensions, verifying the structural validity of the questionnaire.

Table 3
Rotated Component Matrix

	Component					
	1	2	3	4	5	6
SA1						.524
SA2						.814
SA3						.814
SA4						.502
SA5						.631
SA6						.737
SA7						.687
ES1			.646			
ES2			.878			
ES3			.891			
ES4			.826			
ES5			.751			
ES6			.823			
ES7			.748			
RA1	.720					
RA2	.864					
RA3	.825					
RA4	.858					
RA5	.777					
RA6	.845					
RA7	.802					
PC1		.702				
PC2		.846				
PC3		.883				
PC4		.880				
PC5		.819				
PC6		.839				
PC7		.816				
PB1					.651	
PB2					.768	
PB3					.671	
PB4					.789	
PB5					.641	
PB6					.750	
PB7					.762	
PW1				.659		
PW2				.747		
PW3				.824		
PW4				.800		
PW5				.781		
PW6				.785		
PW7				.720		

Extraction Method：Principal Components Analysis.
Rotation Method：Caesar normalization maximum variance method.
a. The rotation has converged after 7 iterations.

The Total Variance Explained results indicate that further exploratory factor analysis can be conducted. Using SPSS software and principal component analysis, exploratory factor analysis was conducted on 42 questions, and common factor extraction was performed on the items (Figure 2). The research results extracted 6 common factors, and the total variance explained by the extracted six principal components showed a cumulative explained variance of 74.426%>60%, indicating that these principal components can well reflect the main information of the original data. Among them, the first principal component explained 38.810% of the variance, while the variance contributions of the remaining five components were 11.393%, 8.155%, 6.784%, 5.474%, and 3.811%, respectively. The variance percentage of extracting the sum of squares of the load is consistent with the variance percentage of the sum of squares of the rotating load. These values indicate that the extracted factors have high explanatory power and a reasonable structure.

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative%	Total	% of Variance	Cumulative%	Total	% of Variance	Cumulative%
1	16.300	38.810	38.810	16.300	38.810	38.810	5.715	13.608	13.608
2	4.785	11.393	50.203	4.785	11.393	50.203	5.632	13.409	27.016
3	3.425	8.155	58.358	3.425	8.155	58.358	5.401	12.858	39.875
4	2.849	6.784	65.141	2.849	6.784	65.141	5.252	12.504	52.379
5	2.299	5.474	70.616	2.299	5.474	70.616	4.999	11.904	64.283
6	1.600	3.811	74.426	1.600	3.811	74.426	4.260	10.143	74.426
7	1.267	3.018	77.444						
8	.971	2.312	79.756						
9	.901	2.145	81.901						
10	.698	1.662	83.562						
11	.650	1.549	85.111						
12	.568	1.353	86.464						
13	.541	1.289	87.753						
14	.485	1.155	88.908						
15	.457	1.088	89.996						
16	.439	1.045	91.041						
17	.399	.949	91.990						
18	.362	.862	92.852						
19	.350	.834	93.686						
20	.285	.679	94.366						
21	.272	.647	95.013						
22	.260	.620	95.633						

Figure 2. Total Variance Explained

Respondent Demographics

This study surveyed campus users across various genders, ages, education levels, positions, and academic fields (Table 4).

Gender Distribution: The sample included 195 males (51.2%) and 186 females (48.8%), maintaining a balanced ratio.

Age Distribution: The majority (80.8%) were aged 18-24, followed by 25-34 (12.6%). Respondents aged 35-44 and 45+ accounted for 3.7% and 2.9%, respectively.

Education Level: Undergraduate students formed the largest group (90.6%), followed by graduate students (7.1%), while respondents with a bachelor's degree or lower accounted for only 2.4%.

Job Roles: Students comprised 90.6%, teachers 5.8%, and staff 3.7%.

Academic Fields: Agriculture and life sciences had the highest representation (35.7%), followed by art and design (30.7%) and humanities/social sciences (15.2%). Other fields, including environmental sciences (5.5%), engineering/IT (7.1%), and economics/management (4.2%), had lower participation.

Participation in Edible Campus Landscape Activities: Only 66 respondents (17.3%) had participated, while 82.7% had not. Participation frequency varied: 27.3% engaged weekly, 12.1% monthly, 22.7% once per semester, while annual and irregular participation stood at 4.5% and 33.3%, respectively.

Table 4
Sample profile

Characteristics	Items	Frequency	Percentage
Gender	Male	195	51.2%
	Female	186	48.8%
Age	18-24	308	80.8%
	25-34	48	12.6%
	35-45	14	3.7%
	<45	11	2.9%
Educational level	High school	9	2.4%
	Bacelar	345	90.6%
	Postgraduate	27	7.1%
Current position	Student	345	90.6%
	Academician	22	5.8%
	Non-Academician	14	3.7%
Field of study/work	Agriculture and Life Sciences	138	35.7%
	Environmental and Resource Science	21	5.5%
	Engineering and Information Technology	27	7.1%
	Economics and Management	16	4.2%
	Humanities and Social Sciences	58	15.2%
	Art and Design	117	30.7%
	Other	6	1.6%
Have you participated in edible landscape activity on campus？	Yes	66	17.3%
	No	315	82.7%
If yes, how often do you participate	Once a week or more	18	27.3%
	Once a month	8	12.1%
	Once per semester	15	22.7%
	Once a year	3	4.5%
	Irregular	22	33.3%

The table indicates that the majority of respondents are undergraduate students aged 18-24, aligning with typical university demographics and ensuring high representativeness for student preferences and behaviors. Students dominate in both educational background and job distribution, while teachers and staff have lower participation, reflecting their limited engagement in daily campus activities.

Regarding disciplinary distribution, respondents from agriculture, life sciences, and art and design fields are more prevalent, whereas participation from environmental sciences and economic management is lower, likely due to varying academic interests and activity preferences.

Although most respondents have not engaged in edible landscape activities, a subset participates regularly, suggesting latent interest and potential for broader involvement. These findings provide a basis for enhancing campus edible landscape initiatives while highlighting opportunities and challenges in increasing user engagement.

Analysis of Differences in Interviewee Groups

Independent Sample T-Test Based on Gender Comparison (Male to Female)

Table 5

Results of multi-group analysis for the moderating effects of gender

Construct	Gender	M±S.D.	t	P value
Subjective awareness	Male	3.72±0.86	1.479	0.140
	Female	3.60±0.67		
External support	Male	3.78±0.90	0.465	0.642
	Female	3.74±0.77		
Resource availability	Male	3.68±0.97	0.765	0.445
	Female	3.61±0.79		
Perceived costs	Male	3.34±0.93	0.829	0.407
	Female	3.27±0.76		
Perceived benefits	Male	3.83±0.88	0.296	0.768
	Female	3.81±0.76		
Participate willingness	Male	3.84±0.89	0.364	0.716
	Female	3.80±0.76		

Independent sample t-test results show that gender does not significantly impact study variables, though minor variations exist (Table 5).

In the subjective awareness dimension, males scored 3.72 (SD=0.86) and females 3.60 (SD=0.67), with t=1.479, p=0.140 (p>0.05), indicating no significant difference. This suggests similar awareness of edible landscapes across genders, likely due to consistent information exposure. For external support, males scored 3.78 (SD=0.90) and females 3.74 (SD=0.77), with t=0.465, p=0.642 (p>0.05), showing no significant gender-based variation in perceived policies, resources, or social encouragement. In resource availability, males scored 3.68 (SD=0.97) and females 3.61 (SD=0.79), with t=0.765, p=0.445 (p>0.05), indicating that gender does not influence perceptions of campus resource distribution and accessibility. For perceived cost, males scored 3.34 (SD=0.93) and females 3.27 (SD=0.76), with t=-0.829, p=0.407 (p>0.05), suggesting both genders assess costs like time, money, and effort similarly. In perceived benefits, males scored 3.83 (SD=0.88) and females 3.81 (SD=0.76), with t=0.296, p=0.768 (p>0.05), showing equal recognition of edible landscapes' advantages, such as environmental and educational benefits. Regarding willingness to participate, males scored 3.84 (SD=0.89) and females 3.80 (SD=0.76), with t=0.364, p=0.716 (p>0.05), indicating similar motivation for participation.

Overall, gender differences do not significantly affect any dimension, suggesting consistent attitudes across cognition, external support, resource availability, perceived costs, benefits, and participation willingness. These findings indicate that campus edible landscape initiatives can be designed inclusively without gender-specific strategies. Future promotional efforts should focus on other influential factors, such as educational program design, resource allocation, and motivation enhancement.

Differences between Participants and Non-Participants

Table 6

Results Of Multi-Group Analysis for the Moderating Effects of Past Behavior

Construct	Have you participated	M±S.D.	t	P value
Subjective awareness	Yes	4.07±0.84	4.870	<0.001
	No	3.58±0.73		
External support	Yes	4.10±0.82	3.724	<0.001
	No	3.69±0.82		
Resource availability	Yes	3.75±1.04	1.085	0.278
	No	3.62±0.85		
Perceived costs	Yes	3.49±1.02	1.978	0.049
	No	3.27±0.81		
Perceived benefits	Yes	4.01±0.84	2.018	0.044
	No	3.78±0.81		
Participate willingness	Yes	4.03±0.77	2.268	0.024
	No	3.78±0.84		

Independent sample t-test results reveal significant differences between users who have participated in campus edible landscape activities and those who have not (Table 6).

In the subjective awareness dimension, participants scored significantly higher than non-participants ($t=4.870$, $p<0.001$), indicating greater awareness of edible landscapes. Similarly, external support was perceived as significantly higher among participants ($t=3.724$, $p<0.001$). For perceived cost, participants scored lower than non-participants ($t=1.978$, $p=0.049$), suggesting that those who engaged in activities viewed the costs as more manageable. Additionally, willingness to participate was significantly higher among participants ($t=2.268$, $p=0.024$), indicating a greater likelihood of future involvement. However, no significant differences ($p>0.05$) were observed in resource availability and perceived benefits, suggesting that perceptions in these areas remain consistent regardless of participation.

Overall, participants demonstrate higher cognition, external support, lower perceived costs, and greater willingness to engage in edible landscape activities, while resource availability and perceived benefits remain unaffected by experience. These insights can inform strategies to enhance campus edible landscape initiatives.

Occupational Based Comparison

Table 7

Results of Multi-Group Analysis for the Moderating Effects of Occupation

Construct	Current Position	M±S.D.	F	P value
Subjective awareness	Student	3.62±0.77	7.211	<0.001
	Academician	4.07±0.56		
	Non-Academician	4.19±0.72		
External support	Student	3.73±0.83	4.294	0.014
	Academician	3.91±0.84		
	Non-Academician	4.36±0.71		
Resource availability	Student	3.64±0.87	1.312	0.271
	Academician	3.91±0.91		
	Non-Academician	3.46±1.08		
Perceived costs	Student	3.32±0.82	2.458	0.087
	Academician	3.38±0.99		

	Non-Academician	2.82±1.21		
Perceived benefits	Student	3.77±0.81	8.125	<0.001
	Academician	4.43±0.67		
	Non-Academician	4.15±1.02		
Participate willingness	Student	3.78±0.82	4.490	0.012
	Academician	4.26±0.66		
	Non-Academician	4.12±1.06		

Analysis of variance (ANOVA) results indicate significant differences among students, teachers, and staff in cognition, external support, perceived benefits, and willingness to participate, while resource availability and perceived cost showed no significant variation (p>0.05).

For subjective awareness (F=7.211, p<0.001), teachers (M=4.07 ± 0.56) and staff (M=4.19 ± 0.72) scored significantly higher than students (M=3.62 ± 0.77), suggesting that greater professional knowledge or project exposure enhances awareness. In external support (F=4.294, p=0.014), employees (M=4.36 ± 0.71) and teachers (M=3.91 ± 0.84) perceived more support than students (M=3.73 ± 0.83), likely due to better access to institutional resources and policies. Resource availability (F=1.312, p=0.271) showed no significant differences, indicating similar perceptions across all groups. This suggests the need for improved resource allocation and accessibility in future initiatives. Perceived cost (F=2.458, p=0.087) was nearly significant, with students (M=3.32 ± 0.82) and teachers (M=3.38 ± 0.99) reporting higher costs than staff (M=2.82 ± 1.21), possibly due to workload constraints. For perceived benefits (F=8.125, p<0.001), teachers (M=4.43 ± 0.67) rated benefits higher than students (M=3.77 ± 0.81) and staff (M=4.15 ± 1.02), highlighting the project's educational and environmental advantages. Willingness to participate (F=4.490, p=0.012) was significantly higher among teachers (M=4.26 ± 0.66) and staff (M=4.12 ± 1.06) than students (M=3.78 ± 0.82), likely influenced by their greater awareness and perceived benefits.

Teachers and staff generally score higher in subjective awareness, external support, perceived benefits, and participation willingness, suggesting advantages in knowledge acquisition and resource access. Resource availability and perceived cost show no significant differences, indicating shared perceptions across all groups. Future project strategies should focus on optimizing resources and reducing participation barriers to enhance overall engagement (Table 7).

Age Based Comparison

Table 8

Results of Multi-Group Analysis for the Moderating Effects of Age

Construct	Age	M±S.D.	F	P value
Subjective awareness	18-24	3.59±0.77	6.986	<0.001
	25-34	3.95±0.74		
	35-45	4.33±0.61		
	<45	3.52±0.69		
External support	18-24	3.70±0.83	3.975	0.008
	25-34	4.04±0.82		
	35-45	4.20±0.81		
	<45	3.53±0.63		
Resource availability	18-24	3.64±0.85	4.283	0.005

	25-34	3.83±0.89		
	35-45	3.85±1.16		
	<45	2.82±0.87		
Perceived costs	18-24	3.31±0.83	0.146	0.932
	25-34	3.29±0.90		
	35-45	3.16±1.26		
	<45	3.32±0.75		
Perceived benefits	18-24	3.75±0.80	6.243	<0.001
	25-34	4.11±0.84		
	35-45	4.49±0.69		
	<45	3.65±0.82		
Participate willingness	18-24	3.77±0.82	4.741	0.003
	25-34	4.02±0.87		
	35-45	4.47±0.60		
	<45	3.54±0.79		

Analysis results show significant differences among age groups in cognition, external support, perceived benefits, and willingness to participate, while resource availability and perceived cost show no significant variation (Table 8).

For subjective awareness (p<0.001), the 25-34 (M=3.95 ± 0.74) and 35-45 (M=4.33 ± 0.61) age groups scored higher than the 18-24 group (M=3.59 ± 0.77) and >45 group (M=3.52 ± 0.69), suggesting greater awareness and engagement with edible landscape concepts among older participants. In external support (p=0.036), the 25-34 group (M=4.09 ± 0.84) reported the highest perceived support, indicating a stronger demand for external resources and institutional backing. For perceived benefits (p<0.001), the 35-45 group (M=4.48 ± 0.57) scored highest, followed by 25-34 (M=4.24 ± 0.83), reflecting a stronger emphasis on ecological and educational advantages. Willingness to participate (p=0.006) was also highest in the 35-45 group (M=4.36 ± 0.66), suggesting a greater likelihood of engagement in edible landscape initiatives.

Findings indicate that older age groups have higher awareness, external support perception, and participation willingness. These insights suggest that future promotional strategies should be tailored to different age demographics to maximize engagement.

Comparison Based on Educational Level

Table 9
Results of Multi-Group Analysis for the Moderating Effects of Educational Level

Construct	Type of study	M±S.D.	F	P value
Subjective awareness	High school	3.68±0.86	4.506	0.012
	Bachelor	3.63±0.78		
	Postgraduate	4.09±0.53		
External support	High school	3.83±0.78	0.695	0.500
	Bachelor	3.74±0.84		
	Postgraduate	3.94±0.74		
Resource availability	High school	3.37±1.24	1.512	0.222
	Bachelor	3.63±0.87		
	Postgraduate	3.89±0.84		
Perceived costs	High school	3.59±0.88	0.712	0.491
	Bachelor	3.31±0.85		

	Postgraduate	3.20±0.95		
Perceived benefits	High school	3.78±0.80	8.527	<0.001
	Bachelor	3.77±0.82		
	Postgraduate	4.44±0.57		
Participate willingness	High school	3.67±0.85	6.650	0.001
	Bachelor	3.78±0.83		
	Postgraduate	4.37±0.62		

Educational background and study field significantly influence campus users' willingness to participate in edible landscapes (Table 9).

Subjective awareness differs significantly by education level (F=4.506, p=0.012), with graduate students scoring highest (M=4.09 ± 0.53), indicating that higher education levels enhance knowledge acquisition and understanding, likely due to greater research exposure. External support perception shows no significant difference across education levels (F=0.695, p=0.500), though graduate students scored slightly higher. This suggests that external support is universally valued, regardless of educational background. Resource availability and perceived costs also show no significant differences (p>0.05), indicating a shared perception of accessibility and financial feasibility across all education levels. However, perceived benefits and willingness to participate vary significantly (p<0.01). Graduate students reported the highest perceived benefits (M=4.44 ± 0.57) and participation willingness (M=4.37 ± 0.62), likely due to a deeper understanding of ecological, social, and educational advantages.

Higher education levels are associated with greater cognitive awareness, perceived benefits, and participation willingness. These insights highlight the importance of targeting highly educated groups in promoting edible landscape initiatives.

Comparison Based on Work Fields

Table 10

Results of Multi-Group Analysis for the Moderating Effects of Field

Construct	Field of Study or Work	M±S.D.	F	P value
Subjective awareness	Agriculture and Life Sciences	3.55±0.75	2.974	0.008
	Environmental and Resource Science	3.51±0.69		
	Engineering and Information Technology	4.14±0.69		
	Economics and Management	3.67±0.62		
	Humanities and Social Sciences	3.70±0.87		
	Art and Design	3.72±0.75		
	Other	3.90±0.92		
External support	Agriculture and Life Sciences	3.60±0.80	3.603	0.002
	Environmental and Resource Science	3.77±0.76		
	Engineering and Information Technology	4.24±0.74		
	Economics and Management	3.30±0.71		
	Humanities and Social Sciences	3.79±0.94		
	Art and Design	3.88±0.81		
	Other	3.79±0.83		
Resource availability	Agriculture and Life Sciences	3.50±0.85	2.221	0.041
	Environmental and Resource Science	3.69±0.85		
	Engineering and Information Technology	4.01±0.94		
	Economics and Management	3.42±0.61		
	Humanities and Social Sciences	3.84±0.88		

	Art and Design	3.68±0.89		
	Other	3.33±1.39		
Perceived costs	Agriculture and Life Sciences	3.28±0.75	1.868	0.085
	Environmental and Resource Science	3.33±0.74		
	Engineering and Information Technology	3.12±1.19		
	Economics and Management	2.99±0.52		
	Humanities and Social Sciences	3.61±0.92		
	Art and Design	3.25±0.88		
	Other	3.40±1.00		
Perceived benefits	Agriculture and Life Sciences	3.61±0.81	3.613	0.002
	Environmental and Resource Science	3.82±0.74		
	Engineering and Information Technology	4.30±0.66		
	Economics and Management	3.71±0.75		
	Humanities and Social Sciences	3.92±0.91		
	Art and Design	3.92±0.79		
	Other	3.93±0.90		
Participate willingness	Agriculture and Life Sciences	3.63±0.81	3.718	0.001
	Environmental and Resource Science	3.71±0.75		
	Engineering and Information Technology	4.33±0.70		
	Economics and Management	3.58±0.60		
	Humanities and Social Sciences	3.89±0.88		
	Art and Design	3.94±0.83		
	Other	3.86±0.96		

This study used one-way ANOVA to examine differences in campus users' willingness to participate in edible landscapes across disciplines. Results indicate significant variations in multiple aspects (Table 10).

Subjective awareness (p=0.008) differs significantly among disciplines, suggesting that academic background influences users' understanding and acceptance of edible landscapes. External support (p=0.002) also shows significant variation, likely due to differences in reliance on resource acquisition channels and institutional support systems across disciplines. Resource availability (p=0.041) varies significantly, reflecting distinct priorities or constraints in resource needs among academic fields. Perceived costs (p=0.085) do not show significant differences, indicating that cost perception is not a key factor affecting engagement across disciplines. Perceived benefits (p=0.002) differ significantly, potentially due to variations in professional knowledge, disciplinary characteristics, and personal interests. Willingness to participate (p=0.001) is significantly different, suggesting that motivation varies based on the perceived value and relevance of edible landscapes in different fields.

Findings highlight significant disciplinary differences in perceptions and attitudes toward edible landscapes. Future promotional strategies should be tailored to discipline-specific needs to enhance participation and engagement effectively.

Conclusion

This study provides comprehensive insights into the factors influencing campus users' willingness to participate in edible landscape initiatives. The findings indicate that gender differences do not significantly impact cognition, external support, resource availability, perceived costs, benefits, or participation willingness, suggesting that such initiatives can be designed inclusively without gender-specific strategies. Instead, future promotional efforts should focus on factors like educational program design, resource allocation, and motivation enhancement to increase participation.

Participation experience plays a critical role, as individuals who have previously engaged in edible landscape activities exhibit higher cognition, greater external support perception, lower perceived costs, and stronger willingness to participate. However, their perception of resource availability and benefits remains consistent with non-participants, indicating that participation strategies should emphasize accessibility and engagement rather than merely increasing awareness.

Significant occupational differences were observed, with teachers and staff demonstrating higher cognition, external support, perceived benefits, and participation willingness compared to students. This suggests that knowledge acquisition and resource access advantages enhance engagement. However, perceived costs and resource availability showed no significant differences, indicating shared perceptions across groups. Future project strategies should focus on optimizing resources and reducing participation barriers to ensure broader involvement.

Age differences also influenced participation, with older groups displaying higher cognition, external support perception, and willingness to engage. This highlights the need for age-specific promotional strategies to maximize engagement across different demographics.

Similarly, higher education levels correlate with increased cognitive awareness, perceived benefits, and participation willingness, underscoring the importance of targeting highly educated individuals in promotional campaigns. Moreover, disciplinary background significantly affects perceptions and attitudes toward edible landscapes, suggesting that tailored engagement strategies based on academic fields can effectively enhance participation.

In summary, while demographic factors such as gender do not significantly influence participation, education level, age, occupation, experience, and disciplinary background play crucial roles. Future edible landscape initiatives should adopt targeted, inclusive strategies that address these key factors, ensuring broader participation and long-term sustainability.

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