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UNVEILING SUSTAINABLE SERVICE INNOVATIONS: EXPLORING SEGMENTATION PATTERNS IN ECUADORIAN RESTAURANT SECTOR

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Abstract:

Purpose: This paper analyses the relationship between sustainability practices and the degree of innovation in the service provided by restaurants. The study identifies relevant restaurant segments in relation to sustainable practice-based service innovation so that effective actions to raise awareness and train managers and staff may be developed. Segmentation has been identified as a key tool when designing strategies and proposing actions. Yet, the use of segmentation techniques is still scarce regarding service innovation and sustainability in restaurants.

Design/methodology/approach: A segmentation analysis was carried out applying the CHAID algorithm from 300 valid questionnaires completed by restaurant owners or managers from coastal Ecuador, where tourism and gastronomy may be drivers of service innovation.

Findings: A typology of restaurants based on the sustainability-service innovation interrelation suggests three final segments: sustainable innovators focused on the value chain, moderate innovators focused on saving resources, and restaurants with a low innovative profile.

Practical implications: The three segments derived from the analysis present differences in terms of the degree of implementation of sustainability practices, as well as in terms of the demographic profile of the restaurant manager. These segments are measurable, substantial, accessible and actionable, so that tailored initiatives to raise awareness and boost sustainability-oriented innovativeness among restaurant owners/managers may be targeted to each group of establishments.

Originality: The present research provides evidence of the positive relationship between sustainability practices and service innovation in foodservices. The segments of restaurants

identified enable the design and implementation of actions that facilitate the transition of less sustainability-oriented restaurants towards more innovative and sustainable business models.

Key words: service innovation, sustainability practices, restaurants, segmentation, Latin America, Ecuador

1. Introduction

There is substantial empirical evidence indicating that society is currently progressing in an unsustainable manner, depleting natural and finite resources and giving rise to global environmental and social crises (George et al., 2016; Baldassarre et al., 2020). This trend is particularly pronounced in the service sector (van Riel et al., 2021). Ongoing environmental worldwide issues are compelling communities to adopt and promote sustainable practices in both production and consumption (Siraj et al., 2022). In the realm of food systems, a transformation is required to effectively tackle the challenges of sustainable development and contribute to resolving global issues of food inequality and malnutrition (Caron, 2021). From the consumer perspective, there is an unprecedented demand for healthy and eco-friendly products, making sustainability a crucial consideration for any business operating in the food industry (Namkung and Cheong, 2013). The tertiary sector consumes a large share of resources (Raab et al., 2017; Baloglu et al., 2020) and significantly contributes to environmental degradation and climate change (Salzberg et al., 2020). Consequently, service innovation holds promise for achieving emerging sustainability objectives within this sector (van Riel et al., 2021; Yoon et al., 2020).

The foodservice industry is considered a resource-intensive activity, requiring a conversion towards circular economic systems focused on resource savings and recovering (Bux et al., 2022). In this sense, restaurants have implemented significant initiatives to introduce eco-friendly practices (Schubert et al., 2010) and encourage diners' participation in these practices. This is particularly the case in waste reduction, which helps mitigate the carbon footprint of food consumption (Martin-Rios et al., 2023). However, despite increasing awareness in restaurants (Schubert et al., 2010), limited research exists on the extent and

approach to sustainability challenges from a management perspective (Raab et al., 2017; Baloglu et al., 2020). Moreover, most of research has focused on food waste, water and energy consumption from 2011 to 2021 (Bux and Amicarelli, 2022), whereas sustainable innovation in foodservice has rather been neglected (Bux et al., 2022).

To progress in their sustainability journey while ensuring customer satisfaction, restaurants must acknowledge the evolving needs and habits of their clientele (Trafialek et al., 2019). Gastronomy plays a significant role in motivating consumers (Seyitoğlu and Ivanov, 2020), who are increasingly interested in exploring local produce, experiencing culinary innovations, and embracing sustainable practices (Daries et al., 2021). Continuous improvement in restaurant operations is essential for customer satisfaction, the sustainability of the food system, and cost-saving for businesses (Chung et al., 2022). Consequently, researchers, industry professionals, and policymakers have demonstrated a growing interest in service innovation as a business approach to address sustainability challenges (Calabrese et al., 2018). However, research on restaurant management has primarily focused on culinary innovations, with limited emphasis on creativity and innovation in other service delivery processes (Lee et al., 2019). Moreover, the restaurant industry has traditionally been hesitant to adopt sustainability-oriented innovations in strategic and operational practices (Pougnet et al., 2022). Therefore, this paper aims to uncover the relationship between service innovation and sustainability practices in the food service sector.

This study adopts an organizational perspective to evaluate the link between the adoption of sustainability practices and service innovation. Some studies suggest that service innovations with a sustainability orientation can provide businesses with a potential

competitive advantage (Chou et al., 2016). However, despite significant interest in service innovation over the past decade, not all dimensions of its relationship with sustainability have been comprehensively addressed from a theoretical standpoint (Calabrese et al., 2018; Gustafsson et al., 2020).

As far as the implementation of the sustainable development is envisioned as one of the main challenges of national and international action plans (Bux et al., 2022), some institutions, such as the European Commission, have launched several initiatives, e.g. the 'Farm to Fork Strategy' within the European Green Deal (Amicarelli et al., 2022) to raise awareness of the challenges that the foodservice industry should address and encourage sustainability-oriented innovation. Since most research on service innovation and sustainable practices primarily focuses on Western countries, the findings obtained from a less developed economy can provide valuable insights into the state of this topic in broader geographical areas. Consequently, data for this study was collected from restaurants in coastal Ecuador, where tourism and gastronomy are likely to act as drivers of service innovation. Segmentation is recognized as a fundamental tool for designing strategies and proposing actions (Kotler, 1988). Existing literature emphasizes the need for further research to evaluate the appropriateness of targeted approaches versus 'one size fits all' approaches (Tkaczynski et al., 2018). However, empirical evidence in the field of restaurant segmentation is scarce, with most studies primarily focused on identifying consumer segments (e.g., Kelley et al., 2020). Therefore, an additional objective of this study is to identify different restaurant segments based on their sustainable practices and service innovation, utilizing primary data provided by restaurant managers in Ecuador.

2. Literature review

2.1. Sustainability in restaurants

The environmental impact of restaurants has garnered increasing attention among professionals and researchers in recent decades (Madanaguli et al., 2022). Sustainability in the restaurant industry encompasses not only environmental practices but also actions that address social and economic aspects (Elkington, 2018). The complex nature of sustainability poses challenges that necessitate continuous innovation, including the adoption of sustainable practices (Calabrese et al., 2018) to optimize the use of natural resources, particularly in food service businesses (da Costa et al., 2018), while also positively impacting competitiveness and customer satisfaction (Cantele and Cassia, 2020).

Despite the economic and social pressures driving the implementation of sustainable measures in restaurants, research indicates that sustainability is not a priority for all restaurant managers (Adina et al., 2022). Several factors act as barriers to the adoption of sustainable practices, limiting restaurants' capacity to respond to internal and external factors. These factors include cost-benefit analysis, legislation (Kasin and Ismail, 2011; Cantele and Cassia, 2020; de la Hoz et al., 2022), management practices, employee engagement, commercial pressure, and stakeholder demands (Kasin and Ismail, 2011). Furthermore, Salzberg et al. (2020) argue that authorities, legislators, and regulators have not held restaurants accountable for their negative environmental impact.

Various studies suggest that food services adopt different sustainable initiatives once these barriers are overcome. According to Karagiannis and Andrinos (2021), restaurants

should implement four types of sustainable initiatives: environmentally sustainable practices, sustainability awareness, environmental stewardship, and the use of local and seasonal products. Alternatively, Yoon et al. (2020) categorize sustainability-oriented actions based on value chain areas: sourcing (purchasing organic, seasonal, and fresh products, and collaborating with sustainable suppliers), production (reducing portion sizes, employing healthy cooking methods, and limiting the use of unhealthy ingredients), marketing (offering healthy menu options, using signs or symbols to highlight healthy choices, providing a healthy children's menu, and allowing customers to customize menus according to their preferences), and service (providing nutrition-related services, offering health-related information, participating in healthy eating programs or certifications, and promoting food policies and reports).

Commonly mentioned sustainability practices in the restaurant literature include efficient use of energy and water, recycling (waste, water, oil, paper, aluminum), sustainable sourcing (local and organic products) (Namkung and Cheong, 2013; Scozzafava et al., 2017; da Costa et al., 2018; Adina et al., 2022), pollution prevention (Namkung and Cheong, 2013), differentiated waste management, menu planning or modifications (da Costa et al., 2018; Adina et al., 2022), food waste reduction (Martin-Rios et al., 2018), efficient use of detergents and consumables, introduction of intelligent supply systems, and staff well-being (Adina et al., 2022).

It is worth noting that these sustainable practices in restaurants contribute to advancing food sustainability and waste reduction, leading to increased consumer satisfaction and loyalty (Kim and Hall, 2020). By ensuring quality and health, customer confidence is

enhanced, resulting in continued patronage of these establishments (Karagiannis and Andrinos, 2021). The literature provides evidence of consumer segmentation in relation to eco-friendly food choices (e.g., Jung et al., 2011; Funk et al., 2020) and differences in pro-environmental behaviour between high- and low-dining expenditure consumers (Kim and Hall, 2019). However, there is a need to identify restaurant segments from the establishment perspective, as there is limited specialized literature on how food services perceive and implement sustainable practices in less economically developed economies.

2.2. Service innovation in restaurants

Crises faced by the foodservice industry, particularly in the service sector, have significantly influenced the perspectives of modern managers regarding service innovation (Breier et al., 2021; Galanakis et al., 2021), with a specific focus on the implementation of sustainable practices (Elkhwesky, 2022). According to Ruiz et al. (2020), innovation in services is achieved through the generation and integration of new technologies and knowledge, which requires substantial efforts to improve competitive positioning within the business sector. In the service industry, innovation plays a vital role in revitalizing the environment and driving economic growth (Snyder et al., 2016), as it allows companies to place greater emphasis on intangible factors such as value creation (Feng et al., 2021). This evolution of innovation in services has experienced exponential growth throughout the twentieth century, parallel to the expansion of service offerings. However, it is in the past two decades that research interest in this context has significantly increased, leading to an expansion of knowledge in various fields such as economics, marketing, organizational science, and administration (Randhawa and Scerri, 2015).

Service innovation is understood as a new value creation process, focused on results and not on development (Gustafsson et al., 2020). Its impact is reflected in the performance of the organisation, allowing it to understand what the changing user needs, assertively launching products and services to the market, rationally selecting the path towards growth and allocating resources, as well as reducing risks and costs (Feng et al., 2021).

Chou et al. (2016) specify that sustainable service innovation is a fundamental attribute in restaurant management, widely recognised by restaurant professionals and experts, since it allows them to promote their supply chains in a more ecological way, reducing costs and generating benefits that meet consumer expectations and improve purchase intention. According to Li et al. (2020), service innovation and sustainability are two concepts that complement each other and constitute the future of the restaurant industry, working mainly on reducing food waste to improve sustainability and on the use of digital technology to provide the service.

On the other hand, Fang et al. (2018) note that, considering that each restaurant presents different operational and environmental needs, it is important to understand that for successful results, the focus should not remain solely on sustainable service, but also on sharing the benefits with all members on a personal and business level, and the surrounding environment impacted by these sustainable services.

Following Chou et al. (2016), the dimensions with the greatest incidence in service innovation are: (1) sustainable service innovation; (2) restaurant technologies; (3)

organisational learning; (4) adoption of innovations; and (5) organisational environment. In contrast, Li et al. (2020) categorise them from the following perspectives: fruit and vegetable conditions, pre-service processes and tools, in-service activities, post-service activities, food waste management, support system, and technology. On the other hand, Wei et al. (2022) point out that service innovation encompasses dimensions related to the intrinsic elements that define the service, customer interfaces, and technological options. In previous research (e.g., Chou et al., 2016; Li et al., 2020; Wei et al., 2022) restaurant service innovation is related to the incorporation of technology to obtain successful results, as well as aspects of sustainability, and elements of the service offered to the client.

Several works have attempted to analyse innovation as a variable to segment restaurants. On the one hand, Gagić (2016) maintains that a significant number of restaurants presents a low or very low degree of innovation, and therefore considers that greater business interest is needed for its implementation. Furthermore, Ivkov et al. (2016) conclude that the type of innovation applied by restaurants is related to the age, educational level, and experience of restaurant managers. It is also relevant that, due to current health trends, the area paid the greatest attention is that of food and beverages, while services are somewhat overlooked, which could be attributed to limitations in the level of education and experience of managers.

More recently, Cho et al. (2020) conducted a study examining innovation strategies in both startup and established restaurants, with a particular focus on the use of exploitation (i.e., proximity to existing technologies, products, and services) and/or exploration (i.e., proximity to existing consumer segments). The authors concluded that exploitative innovation holds greater significance for startup restaurants, whereas established restaurants

tend to excel in exploratory innovation. Nevertheless, they found that a balance between both strategies (known as innovation ambidexterity) is positively correlated with restaurant performance, especially in the segment of startup restaurants. In a different perspective, Erkux and Terhorst (2020) argue that high-end urban establishments are at the forefront of innovation within the restaurant industry.

However, in the limited literature related to the segmentation of restaurants based on their degree of innovation, it is highlighted that sustainable service innovation depends to a large extent on the uncertainty about the indicators, costs, and results of sustainable practices, which on many occasions discourages organisations from their decision to implement these measures despite their indubitable benefits to society (Krozer, 2008; Chou et al., 2012). From this is inferred the need to understand to what extent sustainable practices can explain the degree of innovation in restaurant service, and to identify which specific practices differentiate, to a greater extent, the most innovative restaurants from the less innovative ones.

Based on the above, we propose the following research questions:

RQ1: Are sustainable restaurant practices useful in differentiating restaurant groups based on their service innovation?

RQ2: What are the sustainable restaurant practices that permit differentiation between restaurant groups based on their service innovation?

3. Methodology

With the aim of achieving the objective set forth in this work and respond to the two proposed research questions, a quantitative approach was adopted, using a structured questionnaire as a data collection instrument to measure the relevant variables for this research: service innovation and sustainable practices in restaurants related to several stages in the foodservice (i.e. purchasing and planning, cooking method, packaging, kitchen environment, dining area environment, recycling, staff training, customer information, water and energy saving) as well as social responsibility.

3.1. Description of the study area

Competition has increased in the last years in the hospitality industry in the coastal areas of Ecuador. Three coastal cities, i.e. Guayaquil, Manta, and Portoviejo have been selected for the field work since they are among the 8 most populated cities in Ecuador (being Guayaquil the biggest city in Ecuador in terms of number of inhabitants) and there is a high number of restaurants in these areas. Indeed, according to the 2022 census of companies provided by INEC (2023), there were 84,455 restaurants in Ecuador, being 10,248 in Guayaquil, 1,686 in Manta and 1,438 in Portoviejo, thus representing 15.8% of Ecuadorian restaurants. In this way, the restaurants located in these areas can be a referent for other establishments in Ecuador as well as in other wide regions in the world coping with similar challenges.

3.2. Questionnaire development and data collection

The questionnaire contains ten dimensions for the independent variable (sustainable practices), of which nine are taken from Wang et al., (2013), and one from Kim et al. (2010). Regarding the dependent variable (service innovation), the items were adapted from Chou et al. (2016). The dimensions of sustainable practices, their indicators, and the source from which they were adapted are shown in Table I. These scales were selected since they were applied to restaurants, which is the context of our study, and had been previously validated. All the items are measured using a 5-point Likert scale (1 "nothing implemented" and 5 "fully implemented"). Last, the questionnaire includes several classification variables for the respondent (gender, age, educational level, and position) and the restaurant (menu average price, menu type and restaurant category).

INSERT TABLE I ABOUT HERE

As far as the data collection is concerned, information about independent restaurants in Guayaquil, Manta, and Portoviejo was extracted from the database of the Internal Revenue Service of Ecuador (SRI) and TripAdvisor. Restaurants were contacted by phone to invite them to participate in this survey. To collect data from the restaurants that agreed to participate in the survey, face-to-face interviews were conducted with the managers, directors, owners and/or supervisors of those restaurants, obtaining a final sample of 300 valid questionnaires, representing 2.24% of the restaurants in the three cities where the fieldwork was developed. This convenience sampling procedure has been widely used in tourism research (Tomić et al., 2019) since probability samples are often cost-prohibitive and require an extensive period of time to collect data (Winton and Sabol, 2022). As a drawback of convenience samples, it has been argued that their generalizability is lower than that of

probability samples; however, there is no conclusive evidence supporting that convenience samples do not allow to draw conclusions on organizational behavior (Highhouse and Gillespie, 2010).

3.3. Data analysis

For the classification of restaurant segments, the CHAID (Chi-square Automatic Interaction Detection) method was used, establishing service innovation as a dependent variable based on the sustainable practices. According to Althuwaynee et al. (2014), this method has the ability to automatically classify and analyse a large number of factors, resulting in two or more nodes for each independent variable. The tree structure characterises this method; segments are defined by independent variables to which it assigns a response probability, and in this way it classifies them and selects the independent variables that explain to a greater extent the behaviour of the dependent variable (van Diepen and Franses, 2006).

In contrast to other procedures of multivariate analysis widely used, such as cluster analysis, multiple correspondence analysis and discriminant analysis, the CHAID algorithm operates in a sequential manner so that it identified the most significant determinants in the formation of segments (Díaz-Pérez and Bethencourt-Cejas, 2016), thus enabling a better understanding of the hierarchy of variables related to the dependent variable (Pintassilgo et al., 2023). In addition to this, the CHAID analysis does not require the use of parametric tests for predictive variables, it allows introducing interval and nominal variables independent variables (predictors) in the model, and continuous variables can be considered as criterion variables. In comparison to non-criterion methods, such as cluster analysis, the use of the

CHAID algorithm increases the model's efficiency, since relying on a set of variables and not a criterion variable may not result in significant descriptors of segments (Díaz-Pérez et al., 2020). Moreover, it is considered the most suitable segmentation technique when dealing with large samples (Chung et al., 2004).

4. Analysis and discussion of results

The results of the application of the CHAID algorithm demonstrate the existence of several restaurant segments through a decision tree that takes sustainable service innovation as a dependent variable, and the dimensions of sustainable practices as independent variables (i.e. purchasing and planning, cooking methods, packaging, kitchen environment, dining area environment, recycling, staff training, customer information, water and energy saving, and social sustainability). Figure I shows the identification of three final segments of independent restaurants in Ecuador, for which significant differences were observed both in the degree of implementation of sustainable practices and in the classification variables.

INSERT FIGURE I ABOUT HERE

INSERT TABLE II ABOUT HERE

As a result of the application of the CHAID algorithm considering sustainable innovation in the service of independent restaurants as a dependent variable, three final nodes are obtained. Segment 1 presents the highest average value in sustainable service innovation (3.99, with 5 as the maximum value on the scale) compared to the other two segments, which

makes it the most innovative segment, representing 64.7% of the total sample of restaurants (Table II). This segment presents significantly higher values than those of the other two segments in relation to the implementation of practices related to Purchasing and planning, Cooking methods, Packaging management, and Recycling. Therefore, these practices are the ones that contribute the most when defining a restaurant as innovative due to its sustainability-based service. This could be attributed to the fact that these establishments focus on sustainable practices inherent to the value chain, such as service planning, sourcing, preparation of dishes, and waste management (Cantele and Cassia, 2020).

However, segment 1 presents significantly lower values in Water and energy saving, and Social sustainability, which are identified by the CHAID algorithm as the practices that most discriminate between segments in terms of service innovation. No significant differences are observed between segments with regard to the kitchen environment, the dining area environment, and customer information. Segment 2 it is the one with the lowest values in the dependent variable. It shows lowest level in terms of the implementation of measures to save resources as well as the lowest degree of innovation in the service.

Regarding segments 2 and 3, they differ significantly in terms of their degree of innovation, moderate in the case of segment 3 (2.90) and low for segment 2 (2.36); the latter does not reach the scale midpoint. Representing 18.7% of the total sample, segment 3 prioritises sustainability in terms of saving resources (water and energy), showing significantly higher values than segments 1 and 2 in terms of the implementation of these practices.

Regarding the demographic variables, the gender and age of the respondents are significantly associated with the identified segments, as for these a chi-square value of less

than 0.05 is obtained (see Table III). Specifically, the female weighting is relatively higher in Segment 1, which conceives sustainable innovation linked to sustainable practices in the value chain; in fact, 76.6% of the women surveyed are integrated into node 1 (innovative), compared to 58.0% of the men who participated in the study; the rest is distributed practically equally between the other two segments. However, male representatives are relatively higher in Segments 2 and 3, where staff training and resources management (reflected in the more efficient use of water and energy) show significantly higher scores, thus reflecting higher levels of professionalization in contrast to restaurants in Segment 1, where higher scores in service innovation may be related to informal management practices.

Regarding age, Segment 1, the most innovative, presents a higher proportion of restaurant managers under 36 years of age (56.7% of the observations in Segment 1) compared to segments 2 and 3. Older restaurant owners in Segment 2 and 3 may be more risk adverse and reluctant to introduce service innovations. This evidence is aligned with previous empirical research concluding that older CEOs are more reluctant to assume risks than younger ones (Serfling, 2014; Andreou *et al*., 2017).

INSERT TABLE III ABOUT HERE

Regarding the level of education, the position in the company, the average price of the menu, the type of menu, and the category of the restaurant, no statistically significant associations were observed.

5. Discussion

Sustainability in restaurants has emerged as both an environmental and financial imperative, leading to the adoption of service innovation and sustainable practices as effective means to achieve this goal, as highlighted in the literature (Schubert et al., 2010; Chou et al., 2016; Yoon et al., 2020; van Riel et al., 2021; Chung et al., 2022). However, it is observed that different restaurant profiles exist in terms of their approaches to sustainable service, and this study aims to identify these profiles in the decision-making of restaurant owners and/or managers regarding sustainable practices associated with each profile. Using the CHAID algorithm, this paper demonstrates that innovative restaurants can be classified into three distinct segments: sustainable innovators focused on the value chain (Segment 1), moderate innovators focused on resource conservation (Segment 3), and low-innovators representing restaurants with an overall low innovative profile (Segment 2).

For the most innovative segment, sustainability encompasses both environmentally friendly practices and social sustainability practices. There is potential for improvement in areas such as staff training, resource management (particularly water and energy), and overall operational efficiency. On the other hand, less innovative restaurants have room for enhancing the implementation of green practices in areas such as purchasing and planning, cooking methods, use of environmentally friendly packaging, and recycling.

It is crucial to emphasize that consumer satisfaction remains a primary objective for restaurants (Trafialek et al., 2019), especially in today's context where consumption patterns are increasingly shifting towards sustainable innovation and environmentally friendly practices. Addressing our first research question, sustainable restaurant practices indeed contribute to differentiation among restaurant groups based on their service innovation.

Regarding our second research question on social responsibility practices, the implementation of specific foodservice tasks (such as purchasing and planning, cooking methods, packaging, and recycling), as well as water and energy conservation measures and staff training, emerge as key sustainable restaurant practices that differentiate across restaurant groups based on their service innovation.

5.1. Theoretical implications

The aim of this research is to extend existing theory on service innovation and sustainability in the context of restaurants. Research on food services has primarily focused on product innovation and creativity. This study addresses the need for further research on service innovations in managerial areas and processes in service delivery (Lee et al., 2019). Specifically, this study focuses on analysing the sustainable practices that contribute most to service innovation and identifying the characteristics of both the restaurants and their managers. Therefore, it adopts a broader perspective to consider service innovation as a sustainability attribute that is widely recognized by experts in the field and by restaurant owners as a source of competitive advantage (Calabrese et al., 2018; Gustafsson et al., 2020). Despite significant interest in service innovation over the past decade, not all aspects of its relationship with sustainability have been theoretically addressed in a coherent manner, according to these authors. Furthermore, in the context of the restaurant industry, the literature affirms that it has traditionally been reluctant to introduce sustainability innovations (Pougnet et al., 2022).

Based on the results obtained in this research, there is evidence of the ability of sustainable practices to identify distinct segments of restaurants based on their level of service innovation. This contributes to the field of research on service innovation and builds upon the work of Chou et al. (2012), who suggest that the adoption of sustainable practices by restaurants is largely influenced by their perception of the characteristics of the innovation. The identified segments are measurable, substantial, accessible, and actionable, in line with the criteria outlined by Kotler (1988). This study contributes to theory by demonstrating that management in the food services sector establishes clear strategies for service innovation and sustainability. It provides evidence of the existence of restaurant segments that differ in their level of service innovation, which appears to be closely linked to various sustainable practices, as well as the demographic profile of the restaurant owner/manager.

From a methodological standpoint, the present research contributes to provide evidence of the usefulness of the CHAID algorithm to identify the most significant determinants in the formation of segments (Díaz-Pérez and Bethencourt-Cejas, 2016) and to characterized the resulting groups of restaurants. In this way, this study contributes to the extent literature on tourism management, where the CHAID algorithm has been rarely used (Díaz-Pérez et al., 2020).

5.2 Managerial implications

From a managerial perspective, focusing on targeted segments is more effective than a 'one size fits all' approach (Kotler, 1988). However, in the context of less economically developed economies, particularly in Latin America, there is a lack of public sector initiatives addressing the environmental and social impact of restaurants. These initiatives are mostly limited to promoting good practices within the sector. Nonetheless, certain studies suggest that businesses, including hotels and restaurants, have been driving ecological awareness and sustainability efforts within the tourism sector (Velázquez et al., 2020). Apart from environmental concerns, an increasing number of restaurants have shown interest in public health by creating healthy environments and participating voluntarily in initiatives addressing social problems. However, there is still much work to be done. It is crucial for restaurants in emerging economies to receive public support in implementing work practices that promote healthy and sustainable food service, ensuring their efforts towards a sustainable future are not hindered (Higgins-Desbiolles et al., 2017).

The relatively higher levels of staff training observed in restaurants with low and medium levels of service innovation, compared to highly innovative ones, can be explained in two ways. Firstly, certain forms of training may not be effective in creating an innovative ecosystem that accelerates the transition towards a low-carbon economy. Secondly, highly innovative restaurants may have higher demands in terms of training, which may result in their assessment of lower implementation levels of staff training, even though they are similar or even higher than those in less innovative restaurants. Overall, public policies aimed at training restaurant professionals should focus on areas such as purchasing and planning, cooking methods, packaging, and recycling, which are practices intensively implemented by restaurants with high service innovation. Yet, the most innovative restaurants seem to pay

insufficient attention to efficient resource management and staff training, which are crucial practices for generating sustainable competitive advantages, in line with Cantele and Cassia (2020).

In addition to the importance of human capital, investing in technological solutions may enable restaurant managers and/or owners to introduce sustainable innovations aiming to monitor and manage the most impacted natural resources by the restaurant activity, i.e. food, water, and energy, following the conclusions of Bux et al. (2022). In this sense, for instance, implementing specific software to estimate the "number of guests–food required" in restaurants may contribute to improving their sustainability through addressing more efficiently some crucial tasks such as predicting and checking guests' attendance, and purchasing frequency and perishable food provisioning, thus facilitating the smooth performance of processes at administrative, kitchen and service level, as suggested by Amicarelli et al. (2022).

Lastly, the findings on service innovation in a less developed economy, such as Ecuador, can provide insights into the state of this topic in broader regions of the world that have been underexplored. While scarce research on service innovation related to sustainability is conducted in highly developed countries, the present findings can offer valuable information for restaurant managers and policymakers, allowing them to understand the most relevant sustainability practices for differentiating restaurants based on their level of service innovation.

5.3. Limitations and future research

This research is not without limitations. Firstly, data were collected in three of the coastal cities with the greatest tourist influx in Ecuador, where there is the greatest amount of waste generated by restaurants and where is a greater need for sustainable practices. In this sense, the study could be replicated in other geographical areas.

Secondly, the establishments analysed do not show reports of social and environmental sustainability, so the results obtained cannot be compared, and are validated only against the criteria of the owner and managers; therefore, a study should also be applied to the personnel working across the entire value chain, from sourcing, production, marketing, and service, as suggested by Yoon *et al.* (2020). Moreover, in line with Marine-Roig *et al*. (2019), future research may analyse the interrelations between restaurants and destination image, and how local destinations can progress to ensure gastronomic cultural sustainability.

Finally, the exploratory nature of the segmentation analysis technique does not provide conclusive results. In future research, the contrasting of causal models and other confirmatory methods should be considered in order to explore the determinants and consequences of service innovation based on sustainable practices.

6. Conclusions

In conclusion, this study contributes to the understanding of sustainability and service innovation in the restaurant industry. The research identifies distinct restaurant profiles based on their sustainable service approaches, offering valuable insights for decision-making by

owners and managers. The findings reveal three segments of innovative restaurants: sustainable innovators focused on the value chain, moderate innovators emphasizing resource conservation, and low-innovators representing less innovative establishments.

Theoretical implications extend existing knowledge on service innovation and sustainability, addressing the need for research in managerial areas and processes within the restaurant industry. It emphasizes the recognition of service innovation as a sustainability attribute for competitive advantage. From a managerial perspective, targeted segment-focused strategies are recommended. However, in less economically developed economies like Latin America, there is a lack of public sector initiatives in addressing environmental and social impacts. Greater support is needed to enable emerging economy restaurants to implement sustainable practices.

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Table I. Variables, indicators, and sources

PURCHASING AND PLANNING (Wang et al., 2013)
All food purchases made by the restaurant are local products.
All food purchases made by the restaurant are seasonal products.
The expiration date of the food in the pantry is checked regularly.
All food purchases made by the restaurant are organic products.
All dishes offered by the restaurant are healthy (low in fat, salt, sugar)
Vegetables and fruits extensively used in cooking; no meat dishes or prepared meats on offer.
COOKING METHODS (Wang et al., 2013)
Energy-efficient cooking methods are used, such as blanching, steaming, boiling, or cold salad.
Energy and food are conserved when cooking (e.g. by turning off the extractor hood when not needed or avoiding food waste).
PACKAGING (Wang et al., 2013)
Biodegradable packaging or containers or those made from recyclable materials are used.
Packaging or containers made from recycled materials are used.
KITCHEN ENVIRONMENT (Wang et al., 2013)
A grease trap has been installed or grease and food residues are removed to avoid contamination.
Energy-efficient equipment is used (e.g. Category A, A+, A++, A+++) or equipment that saves energy and/or water, such as a refrigerator or freezer, dishwasher, air conditioning unit, etc.
A kitchen fan or activated carbon treatment system has been installed to prevent the emission of pollutants.
Kitchen equipment and electrical appliances are cleaned and maintenance operations are carried out regularly.
DINING AREA ENVIRONMENT (Wang et al., 2013)
All light bulbs are energy efficient.
Air quality of the air is controlled so that it remains fresh, without the smell of smoke or other unpleasant odours in the dining area of the restaurant.
All taps in the dining area and in the toilets are water saving.
All toilets are equipped with a double push-button cistern (to empty half or all of the cistern's capacity).
Sunlight is used as natural light.
RECYCLING (Wang et al., 2013)
A collection point for recycling materials has been put in place to correctly segregate waste and rubbish.
Organic waste is recycled to make compost.
Grease, oil, and other waste is collected and delivered to a specialised company for recycling or reuse.
All dish detergents are eco-friendly and dilutable for use.
Hazardous waste (such as batteries, electronic products, etc.) is recycled.
STAFF TRAINING (Wang et al., 2013)
Environmental management policies or practices are published or otherwise made known to the employee.
Training programmes are carried out annually to improve the employee's environmental management skills.
CUSTOMER INFORMATION (Wang et al., 2013)
There are posters about saving electricity and water in the kitchen, toilets, and office.
Environmental concepts are integrated into marketing programmes.
There is a rewards policy to encourage customers to behave in an environmentally sustainable manner.
Customers are encouraged to take home unconsumed food/drinks to avoid food waste (except buffets).
Slogan is used on the restaurant menu or poster to persuade customers to behave responsibly and in an environmentally sustainable manner.
WATER AND ENERGY SAVING (Wang et al., 2013)
There is a water audit system to detect water leaks and repair them quickly.
There is an energy audit system to control energy consumption.
SOCIAL RESPONSIBILITY (Kim et al., 2010)
The company donates a part of its profits to not-for-profit organisations (NGOs).
The company invests part of its profits in the communities where the business is located.
The company integrates charitable contributions into its business activities.
SUSTAINABLE SERVICE INNOVATION (Chou et al. 2016)
Organic food and materials/sustainable sourcing policy.
Energy-efficient cooking method.
Environmentally sustainable business management (“green” business processes).
“Green” equipment and environment (e.g. natural light, sustainable building, etc.).
The restaurant recommends low-carbon activities (e.g. the customer orders via Smartphone or mobile phone).

Source: Authors’ compilation

Table II. CHAID variables: average values and significant differences across segments

CHAID variables	1 N=194 64.7%	2 N=50 16.7%	3 N=56 18.7%	*F*	Differences between segments*
Dependent variable: *Service innovation*	3.99	2.36	2.90	63.92	1-2, 1-3, 2-3
Independent variables: *sustainable practices*					
Purchasing and planning	3.82	3.35	3.29	36.67	1-2, 1-3
Cooking method	4.52	3.47	3.61	66.09	1-2, 1-3
Packaging	2.49	1.73	1.82	16.06	1-2, 1-3
Kitchen environment	4.65	4.53	4.56	1.14	-
Dining area environment	3.85	3.82	3.98	0.96	-
Recycling	3.85	3.34	3.60	15.10	1-2, 1-3
Staff training	1.99	2.98	3.37	30.50	1-2, 1-3
Customer information	2.05	1.80	2.17	2.02	-
Water and energy saving	2.06	2.39	4.43	420.90	1-2, 1-3, 2-3
Social responsibility	1.00	3.06	3.06	486.09	1-2, 1-3

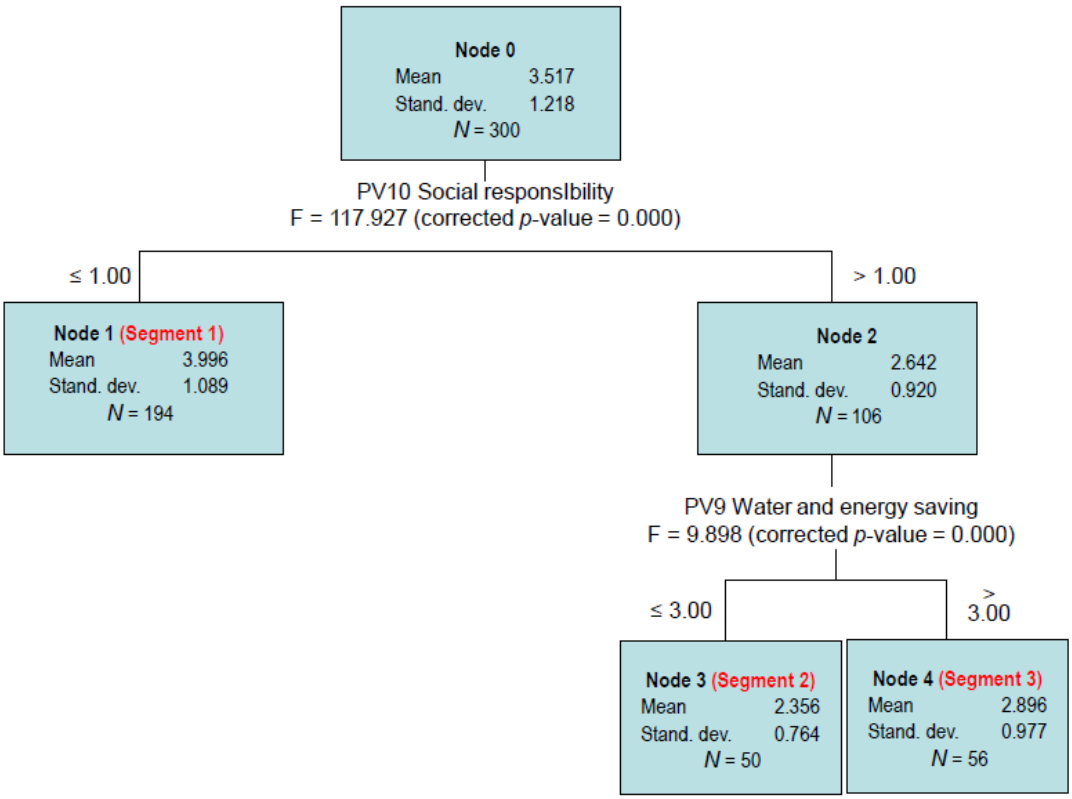
[*] * In order to test the significance of the differences between the segments of retail customers, the Tukey post hoc multiple comparison test is used. Only the statistically significant differences between segments at $p < 0.05$ are shown.

Table III. Classification variables: percentages and contingency tests

Classification variables (%)	**1**	**2**	**3**	**Chi²**	**p-value**
Gender					
- Male	57.7	78.0	75.0	10.531[a]	0.005
- Female	42.3	22.0	25.0		
Age					
- 18-25 years old	9.8	4.0	7.1		
- 26-35 years old	46.9	48.0	33.9		
- 36-45 years old	30.9	32.0	26.8	15.695[b]	0.047
- 46-55 years old	7.7	14.0	23.2		
- more than 56	4.6	2.0	8.9		
Educational level					
- Primary studies	3.1	2.0	3.6		
- Secondary studies	47.9	56.0	44.6	1.562	0.816
- Higher education studies	49.0	42.0	51.8		
Position					
Hotel manager	2.1	2.0	0		
Hotel owner	9.3	8.0	14.3		
Restaurant manager	22.7	22.0	30.4	11.611	0.169
Restaurant owner	8.2	20.0	5.4		
Others	57.7	48.0	50.0		
Menu average price					
Less than $5	10.3	8.0	1.8		
$6-$10	33.5	40.0	44.6		
$11-$15	22.2	28.0	19.6	8.993	0.343
$16-$20	14.9	6.0	16.1		
Higher than $20	19.1	18.0	17.9		
Menu type					
À la carte – single size	62.9	64.0	57.1		
À la carte – several dish sizes	32.0	30.0	39.3	1.478	0.830
Buffet	5.2	6.0	3.6		
Restaurant category					
One fork	7.2	2.0	1.8		
Two forks	46.4	54.0	32.1		
Three forks	26.8	20.0	39.3	11.884	0.156
Four forks	17.5	22.0	23.2		
Five forks	2.1	2.0	3.6		

[a,b,c] Statistically significant at 1, 5 and 10%, respectively.

Figure 1. Classification tree generated by CHAID algorithm



Note(s): Risk estimate: 1.033. Standard error: 0.063
Source(s): Authors' compilation