Perceived customer journey innovativeness and customer satisfaction: a mixed-method approach

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Abstract
This research aims to understand the link between perceived innovativeness and customer satisfaction in the fine-dining catering segment. By employing a mixed-method approach, this paper proposes a multidimensional framework for measuring the perceived innovativeness of restaurants throughout the entire customer journey. Customer satisfaction was measured by considering online customer-generated data from TripAdvisor. The study not only finds a strong correlation between perceived innovativeness and customer satisfaction but also presents how fine-dining restaurants can employ user-generated data to co-innovate entire customer journeys and restaurant experiences. The results highlight menu-, service-, and customer experience-related innovativeness as the three most important criteria for fine-dining restaurant customers. Additionally, the results of the qualitative study indicate that in the context of fine-dining catering, the quality of the dishes, the service, and the customers’
experience with the service staff and chefs are the main elements of satisfaction that restaurants should consider in promoting innovation.

**Keywords** Perceived innovativeness · Customer journey innovation · Customer satisfaction · Fine-dining restaurants · Customer-generated data · AHP · Fuzzy-TOPSIS

## 1 Introduction

Data-driven innovation (DDI) consists of procuring, analyzing, and making decisions based on customer data (Babu et al., 2021; Bhatti et al., 2022; Rindfleisch et al., 2017). A huge amount of data obtained from using emerging technologies, such as blockchain, cloud computing, artificial intelligence, data analytics, and the Internet-of-things enable firms to create DDI in developing new products or improving existing ones (Akter et al., 2016, 2022; Babu et al., 2021; Ciampi et al., 2021; Duan et al., 2020; Wamba et al., 2017). According to Akter and Wamba (2016), digital giants, such as Amazon, Tencent, Google, Alibaba, Apple, and Facebook are experiencing stronger competitive advantages from DDI. Notably, in the unprecedented context of the COVID-19 outbreak, these digital giants witnessed an extreme increase in their turnover. For example, since the COVID-19 pandemic spread to Europe and the United States in the spring of 2020, Amazon has recruited more than 400,000 employees and posted a record profit for the period July to September for a second consecutive quarter at USD 6.3 billion (Greene, 2020).

From an academic research standpoint, data and analytics are considered the core elements of the innovation and development of services and products (Akter et al., 2016, 2019; Babu et al., 2021; Ciampi et al., 2021; Ho-Dac, 2020; Lee, 2018; Wamba et al., 2017) or business models (Saura et al., 2022; Sorescu, 2017). The literature has also acknowledged that an organization’s innovativeness is critical in maintaining its competitive advantage (Acar et al., 2019; Akter & Wamba, 2016; Hollebeek & Rather, 2019; Kazadi et al., 2016; Kim et al., 2018; Yang et al., 2022; Zhan et al., 2018). Hence, to ensure the success of innovations in the marketplace, a consumer-centric view is crucial, highlighting the notion that the end consumer ultimately determines the success of an innovation (Cukier, 2021; Kunz et al., 2011; Tan & Staats, 2020). Customer satisfaction is recognized as a significant indicator of a product or service innovation (El Ouardighi et al., 2018; Giannakis et al., 2022; Hollebeek & Rather, 2019; Mahmoud et al., 2018). However, many studies on the relationship between innovativeness and customer satisfaction (e.g., Mahmoud et al., 2018) primarily focused on a single product or service (Hoeffler, 2003; Kunz et al., 2011), leaving a gap in terms of understanding the impacts of customer journey innovativeness on customer satisfaction and how firms can integrate customer-generated data into innovating.

Customer journey mapping is an essential strategic management tool widely hailed by practitioners and academics for its usefulness in understanding an organization’s customer satisfaction. This can help an organization’s strategic management team identify which touchpoints are critical to customer satisfaction. It can also reveal key strategic initiatives at each touchpoint, resulting in cross-functional inputs to advance an organization’s service and product innovation (Hamilton et al., 2021; Klein et al., 2020; Rosenbaum et al., 2017). Moreover, Akter et al. (2019) claimed that gaining value from DDI is an integrative process, from idea generation to commercialization. Thus, we propose that customer journey innovativeness must be considered in determining whether a firm is successful in its innovation because
customers review a range of firm activities to form an overall evaluation of its innovativeness (Hamilton et al., 2021; Kunz et al., 2011).

Since 2010, “the gastronomic meal of the French” has been included in UNESCO’s list of intangible heritage. In 2016, the catering sector represented a turnover of 66 billion euros, making it the 5th sector in terms of job creation in France. Given the importance of the catering industry in French culture and economy, this research aims to examine the link between the customer journey innovativeness of French fine-dining restaurants and customer satisfaction, as well as to explore how these restaurants use customer-generated data to innovate. As highlighted by Vo-Thanh et al., (2022a, 2022b), fine-dining restaurants are different from fast-food or classic restaurants, as their customer journeys are much more complex. Fine-dining restaurants are defined based on their tangible and intangible attributes (Harr, 2008; Vo-Thanh et al., 2022a, 2022b). In addition to the excellent food choices, the visual presentation, refined decoration, use of high-quality tableware, interactions with the renowned chef, and faultless and precise services from the frontline employees also help provide customers with memorable and unique dining experiences, which induce customer satisfaction (Vo-Thanh et al., 2022a, 2022b).

Meanwhile, innovativeness is described as the ability of an individual, organization, business, or even an economy to innovate, adopt, and develop a new product or service, or implement a new idea (Crawford & Di Benedetto, 2011; Rubera & Kirca, 2012). Although the importance of innovativeness is recognized in all sectors, studies on innovativeness have rarely dealt with the service industry (Ettlie & Rosenthal, 2011). Furthermore, the few studies on how customers perceive restaurant innovativeness (Kim et al., 2018; Sean Hyun & Han, 2012) have partially dealt with innovativeness and have not considered the entire customer journey. Notably, no study has been carried out on the perceived innovativeness of restaurants in France. Finally, studies that explore the use of DDI in fine-dining restaurants to create added value for customers and enhance competitive advantages are scant.

At the same time, the development of information and communication technologies has radically changed consumer behaviors (Kirova & Vo-Thanh, 2019; Lamberton & Stephen, 2016; Xiang et al., 2015). In particular, the hospitality sector (e.g., hotel, restaurant, or leisure) has been greatly impacted by online review sites, mobile devices, and home food delivery (Clauzel et al., 2019; Kirova & Vo-Thanh, 2019; Vo-Thanh & Kirova, 2018; Vo-Thanh et al., 2021; Zaman et al., 2016a, 2016b, 2021). These review sites not only play a vital role in customers’ decision-making processes but also allow firms to capture and analyze data that can help them innovate their products or services (Vo-Thanh & Kirova, 2018; Zaman et al., 2016a, 2016b).

To address the above research gaps, this study introduces the following research questions:

1. Is there a relationship between perceived customer journey innovativeness and customer satisfaction in the context of fine-dining restaurants in France?
2. How can fine-dining restaurants use customer-generated data to identify the main elements of customer satisfaction, innovate the customer journey, and co-create restaurant experiences?

To answer these questions, this research established an evaluation grid of the perceived customer journey innovativeness of fine-dining restaurants, comprising six criteria and 32 subcriteria. First, the evaluation grid was developed through an extensive literature review and then refined with 37 MBA Hospitality Management (Executive Program) students who had at least three years of experience in the hotel and restaurant industries and held management positions at the time of the study. Second, the relationship between perceived customer journey innovativeness and customer satisfaction, as well as the elements of satisfaction,
were examined. In this regard, the analytic hierarchy process (AHP), fuzzy-technique of order preference by similarity to ideal solution (TOPSIS) methods, and content analysis of customer online reviews were employed. By doing so, we explored the data of customer journey innovativeness of fine-dining restaurants to create DDI that can add more value for ensuring customer satisfaction and competitive advantage.

2 Data-driven innovation

DDI refers to the process, techniques, and technologies that allow firms to analyze big data (Babu et al., 2021; Bhatti et al., 2022) related to customers, business partners, and competitors based on innovation and value creation, thus helping firms generate competitive advantages (Kumar et al., 2016).

In recent years, big data have gained particular attention from researchers in the tourism and hospitality field (Li et al., 2018; Mariani, 2020; Shamim et al., 2021). For example, Amatulli et al. (2019) demonstrated how Italian hotels use customer-generated online reviews to predict the sharing of negative emotional content. Zaman et al. (2022) highlighted the utilization of internal and external data in creating values for all the stakeholders of a destination. In addition, firms may use co-creation to include their customers in DDI (Bresciani et al., 2021). Meanwhile, customers’ experiences also play a vital role in product or service innovation (Bresciani et al., 2021; Vo-Thanh & Kirova, 2018). Kim et al. (2018) emphasized that a product or service could be considered innovative if end users (customers) find it innovative and if their perceptions of it are primordial. Therefore, we argue that fine-dining restaurants should include their customers in the innovation process. They should know their customers’ perception vis-à-vis the firm’s innovativeness and use these customer DDIs to co-innovate customer journeys and their dining experiences.

In addition, customer satisfaction is one of the key performance indicators for firms in which a higher level of customer satisfaction improves a firm’s competitive advantage (Zaman et al., 2016b). Hence, if their innovations generate higher satisfaction rates, the competitive advantages of fine-dining restaurants are strengthened. Thus, based on customer-generated review data, fine-dining restaurants should consider what should be innovated to obtain the highest customer satisfaction levels from DDI sources.

3 Perceived innovativeness of firms

3.1 Measurement of innovativeness

The innovativeness of firms is often measured by their investments in research and development (R&D) activities (Raymond et al., 2013) or through the number of patents they registered for a given period of time (Kleis et al., 2012). However, Deltour and Lethiais (2014) pointed out that in the context of small and medium-sized enterprises (SMEs), the measurement of innovativeness through investments in R&D and patents is not suitable because SMEs do not have enough budget to invest in such activities. Still, they are capable of developing a real capacity to implement other types of innovation (Forsman, 2011). Subramanian (1996) emphasized that the measurement of innovativeness is a multidimensional process that must be done over time. Hurley and Hult (1998) considered the speed of firms’ innovation adoption a criterion for measuring innovativeness and partly agreed with Subramanian’s (1996)
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view. Later, Wang and Ahmed (2009) state that firm innovativeness concerns their ability to innovate both in products and in processes. Therefore, some authors (e.g., Danneels & Klein-schmidt, 2001; Kamins et al., 2007; Kunz et al., 2011) highlighted the necessity of taking a more holistic view of the perceived innovativeness of a firm. These authors recommend that a firm’s perceived innovativeness should be measured through its various activities and not just its new products.

According to Kim et al. (2018), the perceived innovativeness of a firm can be measured from both managers’ (Binder et al., 2016; Sandvik et al., 2014) and customers’ (Jin et al., 2016; Kamins et al., 2007; Kunz et al., 2011) perspectives. In the current research, we focus on consumer-perceived innovativeness because, on the one hand, we adopt the conceptualization of the overall perceived innovativeness of the firm proposed by Kunz et al. (2011). On the other hand, a product or service is considered innovative if its users consider it to be such. Therefore, studying customers’ or users’ perceived innovativeness is crucial for firms (Kim et al., 2018; Kunz et al., 2011).

3.2 Perceived innovativeness of fine-dining restaurants

Restaurants are part of the service industry. Thus, we need to consider its specificities, such as intangibility, perishability, inseparability, and heterogeneity (Kim et al., 2018; Parasuraman et al., 1985). Kim et al. (2018) presented four dimensions of innovativeness for restaurants:

- **Menu-related innovativeness** This is measured by customers’ perceptions of the novelties and unique characteristics of a restaurant’s menu (Hubert et al., 2017; Kim et al., 2018). Kim et al. (2018) proposed measuring this through four subdimensions: quality, current food-related trends, menu uniqueness and variety, and personalization.

- **Technology-based service-related innovativeness** Service is intangible and can only be measured when delivered (Ding & Keh, 2017). The use of technology allows restaurants to better anticipate customer behaviors, gain competitive advantages, strengthen bonds with their customers, and build loyalty among them (Kim et al., 2018). This dimension is not only limited to the front of house (dining area), but also concerns the delivery of meals at home—a service that has proliferated with the development of digital platforms, such as Deliveroo, Uber Eats, Just Eat, Resto In, Frichti, or Nestor (Bordeaux, 2019). Home delivery has increased by about 20% per year for the last three years (e.g., 160 million euros in 2018) (Bordeaux, 2019). Kim et al. (2018) suggested measuring technology-based service-related innovativeness through four subdimensions: differentiation, technologies, utility, and advanced service.

- **Experience-related innovativeness** This refers to the creation of an atmosphere that allows customers to interact with employees and fellow customers (Ding & Keh, 2017; Kim et al., 2018). In an analysis of “The restaurant of the future: Engaging the next-generation customer,” Chick (2021) demonstrated how restaurants can engage their customers throughout the customer journey. To measure experience-related innovativeness, Kim et al. (2018) used three subdimensions: atmosphere, interaction (with employees and customers), and customer satisfaction.

- **Promotional innovativeness** This refers to the ability of a restaurant to introduce creative promotional activities using different channels, be they traditional and/or digital (Shankar et al., 2010). For example, in the summer of 2014, five Parisian hotels launched a highly successful innovative campaign with their “Pay What You Want” program (Zaman et al., 2016b). To measure promotion-related innovativeness, Kim et al. (2018) used five
subdimensions: loyalty program, good deals, advertising, marketing manner, and communication.

Notably, Kim et al. (2018) did not consider innovativeness related to a restaurant’s website, even though it is crucial in the digital era (Daries et al., 2018) due to changes in consumer behaviors (Lamberton & Stephen, 2016; Xiang et al., 2015) and the strong impacts of online review sites and home delivery tools on the restaurant sector (Clauzel et al., 2019; Vo-Thanh & Kirova, 2018; Vo-Thanh et al., 2021). In 2018, eight out of ten French people made purchases online, of whom 12% bought meals online (Laine-Devroede, 2019). In addition, consumers can now view online reviews and/or rate restaurants on review sites. These reviews are vital in shaping the choices of future customers (Zaman et al., 2016a). Moreover, the quality of a website can enhance both an organization’s online visibility and customer satisfaction (Bai et al., 2008). Therefore, in a context in which digital content influences consumption, restaurants should understand the entire customer journey and bring innovations to their websites.

3.3 Measurement of the perceived innovativeness of the entire customer journey

According to Bolden et al. (2017), the restaurant customers’ journey in the digital age consists of five stages. The first stage is about demand generation, where customers seek inspiration. At this stage, a company uses online and/or offline communication tools, such as social networks, online review sites, promotions, online booking platforms, or loyalty programs, to generate demand from potential consumers. Kim et al. (2018) considered this to be the dimension of promotional innovativeness. The next stage is ordering, which includes online menus, e-commerce, and payment. These aspects are also highlighted by Daries et al. (2018). The third stage is preparation, which involves inventory management, process management, and staff training. Kim et al. (2018) considered these aspects in studying menu-related innovativeness and technology-based service-related innovativeness. The fourth stage lies in service and delivery, which falls under experience-related innovativeness (Kim et al., 2018). The last stage refers to engagement (e.g., blogs and social networks), which, in turn, can generate demand (Daries et al., 2018). Considering the entire customer journey, we constructed the evaluation grid of the perceived innovativeness restaurants as follows:

- **Step 1** A total of 37 MBA Hospitality Management (Executive Program) students were recruited. These students already had at least three years of experience in hotel and restaurant management. During the first three-hour session, we explained the restaurant customer journey in the digital age, as described by Bolden et al. (2017), along with the different criteria and subcriteria of restaurant innovativeness developed by Kim et al. (2018). Subsequently, we asked participants to work in groups (11 groups of three members and 1 group of four members) and to propose a restaurant innovativeness measurement framework (RIMF) in the digital age that they considered most relevant.
- **Step 2** The participants were given three weeks to work on and refine the RIMF by interviewing at least three restaurant managers and three consumers of these restaurants based on the innovativeness criteria and subcriteria.
- **Step 3** We organized a brainstorming session during which we discussed the proposed criteria and subcriteria and retained the final RIMF (Table 1).
| Criteria (C) | Subcriteria (SC) | References |
|-------------|-----------------|------------|
| C1: Innovativeness of demand generation | SC1.1: The restaurant has a website on which general information (about the restaurant, its chef, its dishes and prices, opening hours, geographical location, etc.) can be found | Daries et al. (2018), Kim et al. (2018) |
| | SC1.2: The website is available in several languages with adapted expressions | |
| | SC1.3: The website has good-quality photos of the dishes and presents them thematically in an innovative way | |
| | SC1.4: The website gives information about the partners (including local partners, if any), the origin of the products, and the labels (ISO 9000, ISO 14000, and other ecological labels, if any) | |
| | SC1.5: Online reviews are accessible from the website, which displays photos and comments from social networks in an innovative way | |
| | SC1.6: The website offers different promotional offers and good deals | |
| | SC1.7: The website has a responsive design, and the mobile site is also well-designed | |
| | SC1.8: The website offers the possibility to communicate with the restaurant in real time (via Messenger, for example) | |
| | SC1.9: The website offers the possibility of ordering online and offers secure payment channels with several choices | |
| | SC1.10: The restaurant carries out advertising campaigns in an innovative way | |
| | SC1.11: The restaurant offers innovative communication platforms (e.g., virtual communities) to gather ideas from customers | |
| | SC1.12: The restaurant responds to customer feedback in an innovative way | |
| | SC1.13: The restaurant partners with influencers and communicates in innovative ways | |
| Criteria (C)                     | Subcriteria (SC)                                                                                                                                       | References                                      |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| C2: Innovativeness of preparation | SC2.1: The restaurant uses digital tools to manage its inventory, orders, etc. (e.g., staff are equipped with digital tools)  
SC2.2: Waiting time is short thanks to the implementation of process innovation | Bolden et al. (2017), Hurley and Hult (1998), Kim et al. (2018) |
| C3: Innovativeness of menu      | SC3.1: The restaurant offers new flavors according to market trends  
SC3.2: The restaurant has unique menus/dishes compared with its competitors  
SC3.3: The restaurant often innovates its menus and presents them attractively  
SC3.4: The restaurant offers customers the opportunity to create their own menus  
SC3.5: The restaurant gives priority to local products | Kim et al. (2018) |
| C4: Innovativeness of service   | SC4.1: The restaurant provides exceptional service compared with its competitors  
SC4.2: Employees communicate in an innovative manner  
SC4.3: The restaurant uses technology to better serve customers (contactless payment, interactive tables, etc.) | Kim et al. (2018) |
| C5: Innovativeness of customer experience | SC5.1: The restaurant has a unique atmosphere  
SC5.2: The restaurant has unique decorations compared with its competitors  
SC5.3: The restaurant organizes its activities in an innovative way  
SC5.4: The chef is approachable and often comes out to greet customers  
SC5.5: The restaurant uses technology to enhance the customer experience (e.g., the ability to see the chef’s preparation from the table) | Bolden et al. (2017, Kim et al. (2018) |
| C6: Innovativeness of customer engagement | SC6.1: The restaurant is featured on online review sites and solicits customers to leave reviews  
SC6.2: The restaurant has a blog on which it regularly publishes information to maintain ties with its customers  
SC6.3: The restaurant communicates on social networks in an innovative way  
SC6.4: The restaurant has an innovative loyalty program | Bolden et al. (2017) |
Table 2 Excerpt of the questionnaire used for evaluating each restaurant’s innovativeness

| Criterion 1: Innovativeness of demand generation |
|-----------------------------------------------|
| Subcriterion 1.1: Does the restaurant’s website offer general information in an innovative way? |
| Poor (Not at all or very little innovative) | Good (Averagely innovative) | Excellent (Very innovative) |
| Subcriterion 1.2: Is the website available in several foreign languages with adapted expressions? |
| Poor (Not at all or very little innovative) | Good (Averagely innovative) | Excellent (Very innovative) |
| Subcriterion 1.3: Are the photos of the dishes of good quality and presented thematically? |
| Poor (Not at all or very little innovative) | Good (Averagely innovative) | Excellent (Very innovative) |

Table 3 Linguistic terms and their TFN

| Linguistic terms | TFN for each linguistic term |
|------------------|-----------------------------|
| Poor (Not at all or very little innovative) | (0, 25, 50) |
| Good (Averagely innovative) | (25, 50, 75) |
| Excellent (Very innovative) | (50, 75, 100) |

4 Application of AHP and fuzzy-TOPSIS methods

By using the RIMF (Table 1), we evaluated 13 fine-dining restaurants in Paris (Restaurant Aux Lyonnais—R1, Restaurant Spoon—R2, Restaurant Kei—R3, Restaurant Champs—R4, Restaurant Le Pharamond—R5, Restaurant Huguette—R6, Restaurant Cucina—R7, IDA—R8, Anicia—R9, Plume Restaurant—R10, Bistrot Belhara—R11, 32 by Hervé—R12, et Brasserie Baroche—R13). These are voluntary members of a chain of restaurants called Les Collectionneurs under the famous chef Alain Ducasse (3-star Michelin chef). The study by Kim et al. (2018) did not distinguish among restaurant categories, which was identified as a limitation of their study. Our study addresses this limitation by studying fine-dining restaurants only. In addition, according to Gira Conseil (2021), superior, upscale, and luxury restaurants represent 23% of the overall restaurant revenue in France.

Using the fuzzy-TOPSIS method (Chan et al., 2016; Hwang & Yoon, 1981; Lai et al., 1994) allowed us to rank restaurants according to their relative performances in terms of perceived innovativeness. In this regard, a questionnaire was developed according to the RIMF (Table 2).

The questionnaire consisted of linguistic terms (Table 3) based on fuzzy set theory (Zadeh, 1965). Zimmermann (1996) emphasized that natural representations are more efficient in measuring service performance. Li (2013) argues that using a fuzzy scale is more appropriate than a traditional Likert scale. Each linguistic term corresponds to a fuzzy number situated on a scale between 0 and 100. The membership function of each linguistic term has three values known as triangular fuzzy number (TFN; Li, 2013; Tsaur et al., 2002; Zadeh, 1965).

1 https://www.lescollectionneurs.com/restaurants-gourmands
For example, if we consider three linguistic terms, including Poor (Not at all or very little innovative), Good (Averagely innovative), and Excellent (Very innovative), and we assign 25, 50, and 100 for the Poor, Good, and Excellent terms, respectively, we can have the TFN for each linguistic term as follows:

Table 3 only illustrates the TFN for the three linguistic terms. It should be noted that linguistic terms were adapted (from two to five linguistic terms) according to the question (Ma et al., 2007).

As for the consumers’ evaluation, we had to find evaluators who had already eaten in the 13 selected restaurants and were willing to give their evaluations. To that end, we requested the help of Mr. Aldric D., who was, at the time of the study, owner and general director of the ZE Hotel Paris Opéra (a 4-star establishment, www.zehotel.fr) and president of the hotel owners of Alain Ducasse’s voluntary chain, Les Collectionneurs. Thanks to him, we were able to find seven people working in hotels in Paris who met the abovementioned conditions. Indeed, all seven evaluators were invited by the 13 chosen restaurants as part of the partnership, so they already knew those restaurants and their services very well. Notably, the hotels where these seven evaluators have been working are also part of Les Collectionneurs, and each of these evaluators was asked to evaluate the 13 selected restaurants. Table 4 summarizes their profiles.

If we consider \( n \) number of restaurants, \( R = (R_j, j = 1, \ldots, n) \); \( m \) number of criteria, \( C = (C_j, j = 1, \ldots, m) \) and \( t \) number of subcriteria, \( SC = (SC_{j,h}, h = 1, \ldots, t) \); and \( k \) number of evaluators, \( E = (e_p, p = 1, \ldots, k) \), we will obtain the result for restaurant \( i \) on criterion \( j \) from the following equation:

\[
RR_{i,C_j} = \frac{1}{t} \sum_{t=1}^t RR_{i,SC_{j,t}}.
\] (1)

By employing Eq. (1), we obtain the performance matrix–fuzzy as illustrated in Table 5.

| Evaluator | Position | Age range |
|-----------|----------|-----------|
| E1        | General Manager (Hotel 4*) | 40–49 years |
| E2        | Deputy Director (Hotel 4*)  | 50–59 years |
| E3        | Front Office Manager (Hotel 4*) | 40–49 years |
| E4        | Receptionist (Hotel 4*)     | 40–49 years |
| E5        | Receptionist (Hotel 4*)     | 40–49 years |
| E6        | Marketing Director (Hotel 4*) | 40–49 years |
| E7        | Receptionist (Hotel 4*)     | 40–49 years |

| Table 5 Performance matrix–fuzzy |
|-------------------------------|---|---|---|
| \( R_{C_1} \) | \( R_{C_2} \) | \ldots | \( R_{C_m} \) |
| \( R_{C_1} \) | \( R_{C_1}C_1 \) | \ldots | \ldots |
| \( R_{C_2} \) | \( R_{C_2} \) | \ldots | \ldots |
| \( \ldots \) | \( \ldots \) | \ldots | \ldots |
| \( R_{C_m} \) | \( R_{C_m} \) | \ldots | \ldots |
Table 6 Performance matrix–non-fuzzy

|   | C₁         | C₂         | ...      | Cₘ         |
|---|------------|------------|----------|------------|
| R₁| BNP R₁C₁   | BNP R₁C₂   | ...      | BNP R₁Cₘ   |
| R₂| BNP R₂C₁   | BNP R₂C₂   | ...      | BNP R₂Cₘ   |
| ...| ...        | ...        | ...      | ...        |
| Rₙ| BNP RₙC₁   | BNP RₙC₂   | ...      | BNP RₙCₘ   |

The next step consists of defuzzification, which transforms the fuzzy numbers into non-fuzzy numbers (Zimmermann, 1996). To that end, we opted for the approach of Tsaur et al. (2002) by using the following equation:

\[ BNP_{ij} = \left( \frac{(UV_{ij} - LV_{ij}) + (MV_{ij} - LV_{ij})}{3} \right) + LV_{ij}. \] (2)

In the literature, the non-fuzzy number is called \( BNP = \text{Best Non-Fuzzy Performance}. \) Here, \( UV_{ij} \) stands for the upper value, \( MV_{ij} \) for the medium value, and \( LV_{ij} \) for the lower value of restaurant \( i \) on the criterion \( j \). Therefore, we obtained the performance matrix–non-fuzzy in Table 6.

In multicriteria decision analysis, the weights of each criterion are critical. In this regard, AHP was used to determine the weights of the selected criteria. Based on Saaty’s (1977) scale (Table 7), a questionnaire was developed to make a pairwise comparison of the criteria. If we compare a set of criteria \( n \), where the criteria are designated as \( a_1, a_2, \ldots, a_n \) and the weights of these criteria as \( w_1, w_2, \ldots, w_n \), respectively, the pairwise comparison can be presented in the questionnaire as follows:

\[
A = \begin{bmatrix}
    a_{11} & \cdots & a_{1j} & \cdots & a_{1n} \\
    \vdots & \ddots & \vdots & \ddots & \vdots \\
    a_{i1} & \cdots & a_{ij} & \cdots & a_{in} \\
    \vdots & \ddots & \vdots & \ddots & \vdots \\
    a_{n1} & \cdots & a_{nj} & \cdots & a_{nm}
\end{bmatrix}
\] (1-AHP)

where \( a_{ij} \approx 1/a_{ji} \) (reciprocal value and always positive) and \( a_{ij} = a_{ik}/a_{jk} \). Note that in a real situation, \( w_i/w_j \) is unknown. In this respect, the problem for the AHP method is to find

Table 7 Saaty’s (1977) scale

| Verbal appreciation | Intensity | Reciprocal value |
|---------------------|-----------|------------------|
| Equally             | 1         | 1                |
| Moderately          | 3         | 1/3              |
| Strongly            | 5         | 1/5              |
| Very strongly       | 7         | 1/7              |
| Extremely           | 9         | 1/9              |
| Intermediate values | 2, 4, 6, 8| 1/2, 1/4, 1/6, 1/8|
For example, \( a_{ij} \approx w_i / w_j \). The weight matrix is presented as follows:

\[
W = \begin{bmatrix}
\frac{w_1}{w_1} & \frac{w_1}{w_j} & \cdots & \frac{w_1}{w_n} \\
\frac{w_j}{w_1} & \frac{w_j}{w_j} & \cdots & \frac{w_j}{w_n} \\
\vdots & \vdots & \ddots & \vdots \\
\frac{w_n}{w_1} & \frac{w_n}{w_j} & \cdots & \frac{w_n}{w_n}
\end{bmatrix}
\]  

(2-AHP)

If we multiply \( W \) by \( w \), we will have:

\[
W \times w = \begin{bmatrix}
\frac{w_1}{w_1} & \frac{w_1}{w_j} & \cdots & \frac{w_1}{w_n} \\
\frac{w_j}{w_1} & \frac{w_j}{w_j} & \cdots & \frac{w_j}{w_n} \\
\vdots & \vdots & \ddots & \vdots \\
\frac{w_n}{w_1} & \frac{w_n}{w_j} & \cdots & \frac{w_n}{w_n}
\end{bmatrix} \times \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{bmatrix} = \begin{bmatrix} n \\ w_j \\ \vdots \\ w_n \end{bmatrix}
\]  

(3-AHP)

Otherwise \((W - nI)w = 0\),

(4-AHP)

To determine the weights of the selected criteria, the respondents (i.e., the seven hospitality professionals who had eaten in the 13 selected restaurants) gave a relative verbal appreciation between the two criteria rather than a numerical judgment, using Saaty’s (1977) scale presented in Table 7.

Saaty’s (1977) scale (Table 7) ranges from 1 to 9, where 1 indicates equal importance between two criteria, and 9 indicates extreme importance.

On the one hand, given that solving Eq. (4-AHP) is an eigenvalue problem, we can obtain the comparative weights by finding the eigenvector \( w \) with the respective \( \lambda_{\text{max}} \) that satisfies \( Aw = \lambda_{\text{max}} w \), where \( \lambda_{\text{max}} \) is the largest eigenvalue of the matrix \( A \) (1-AHP). In other words, we have to find the eigenvector \( w \) with \( \lambda_{\text{max}} \) for \((A - \lambda_{\text{max}} I)w = 0\).

On the other hand, one of the disadvantages of the AHP method is the inconsistency of judgments. Thus, to ensure consistency, we considered the consistency index (CI) and the consistency ratio (CR). According to Saaty (1980), the CR score should not exceed 0.1 to yield a relevant result. In the current study, the CR is obtained by using the following equation:

\[
CI = \frac{\lambda_{\text{max}} - n}{n - 1}
\]  

(5-AHP)

where \( \lambda_{\text{max}} \) is the largest eigenvalue, and \( n \) is the number of criteria. In addition, the following equation is also used:

\[
CR = \frac{CI}{RI}
\]  

(6-AHP)

where RI (Table 8) refers to the random coherence indices constructed by Saaty (1977) using a large sample of random reciprocal matrices with the help of Saaty’s (1977) scale (Table 7).

After obtaining the weights of the selected criteria \( (W_j) \) via the AHP method, we applied the formula \((3) = BN P_{ij} \times W_j \) to get the weighted-sum performance matrix—non-fuzzy. Finally, using the normalization method, we obtained the normalized weighted-sum performance matrix—no-fuzzy (Table 9).
Given that all the criteria should be maximized to be considered as high performance, the ideal solution \( I^* \) and the anti-ideal solution \( I^- \) for each criterion were thus obtained from Eqs. (4) and (5).

\[
I^* = \left\{ \left( \max R_{R_iC_j} \right), i = 1, \ldots, n \right\}
\]

\[
I^- = \left\{ \left( \min R_{R_iC_j} \right), i = 1, \ldots, n \right\}
\]

The distances \( D \) with the ideal situation \( I^*_i \) and the anti-ideal solution \( I^-_i \) were obtained from Eqs. (6) and (7).

\[
D^*_i = \sqrt{\sum_{j=1}^{m} \left( R_{R_iC_j} - \max R_{R_iC_j} \right)^2} \quad i = 1, \ldots, n
\]

\[
D^-_{ii=1,\ldots,n} = \sqrt{\sum_{j=1}^{m} \left( R_{R_iC_j} - \min R_{R_iC_j} \right)^2} \quad i = 1, \ldots, n
\]

Finally, the relative proximity to the ideal solution was calculated using Eq. (8).

\[
P_i = \frac{D^-_i}{D^*_i + D^-_i}, \quad i = 1, \ldots, n
\]

here \( 0 \leq P_i \leq 1 \). If \( P_i \) is close to 1, it shows that restaurant \( i \) is close to the ideal solution \( I^*_i \), thereby allowing us to rank the restaurants according to their performance in terms of perceived innovativeness.

5 Customer satisfaction assessment

In the hospitality industry, competition is intense, and customers are very demanding (Zaman et al., 2016b). Thus, customer satisfaction is crucial for a hospitality firm’s performance and competitive advantage (Anderson & Mittal, 2000; Zaman et al., 2016b). “Customer satisfaction” is defined as the positive attitude of consumers toward a product or service (Albayrak & Caber, 2015). However, customer satisfaction is a complex concept that depends
on several criteria (Robinot & Giannelloni, 2010; Zaman et al., 2016b). In recent years, customers’ online reviews have been regarded as an essential source for assessing customer experience and satisfaction (Clauzel et al., 2019; Vo-Thanh & Kirova, 2018; Zaman et al., 2016a, 2016b). In line with these studies, we used customers’ online reviews and ratings on TripAdvisor to capture customer satisfaction with the 13 selected fine-dining restaurants. In this way, we can enrich our understanding of the link between perceived innovativeness and customer satisfaction. For the last point, after identifying the restaurant that obtained the best overall rating in terms of customer satisfaction, we captured only reviews related to that restaurant to examine the elements contributing to customer satisfaction. Operationally, to evaluate customer satisfaction, we first took customer ratings related to four criteria (food, service, value for money, and atmosphere) from the TripAdvisor review site (Fig. 1). Second, to obtain the weights of the four abovementioned criteria, we employed the AHP method, as explained in Sect. 3. Finally, the customer ratings were multiplied by the weights of these criteria to gain the weighted sum scores for customer satisfaction.

Next, to identify the elements of perceived innovativeness that ensure customer satisfaction, a content analysis of customer reviews was performed on the best restaurant in terms of customer satisfaction from TripAdvisor. In particular, we analyzed 217 positive online reviews of that restaurant from October 1, 2018, to September 1, 2021. To ensure internal validity, positive reviews were selected when they achieved ratings of 5 (excellent) or 4 (very good) stars on a scale of 5 stars (Sann et al., 2020). After collecting the data, these were transferred to NVivo 12 software and analyzed by two of the researchers.

In the initial processing step, we ran the text frequency to determine the most frequently appearing keywords. Then, a thematic content analysis was performed based on the six criteria obtained from the RIMF as key themes. First, following previous studies (e.g., Kirova & Vo-Thanh, 2019; Vo-Thanh & Kirova, 2018; Vo-Thanh et al., 2022a, 2022b), the two researchers coded the first 10 reviews together to reach agreement on the coding process. Second, each researcher independently analyzed the remaining corpus, strictly respecting the double encoding procedure (Kirova & Vo-Thanh, 2019; Miles et al., 2020; Vo-Thanh & Kirova, 2018; Vo-Thanh et al., 2022a, 2022b). Then, the qualitative results from the
two researchers were compared. Coding consistency was achieved by comparing the coding results of both researchers. As indicated by Vo-Thanh et al., (2022a, 2022b), the two researchers utilized the Coding Comparison Query function in NVivo 12 software to accomplish this comparison. The agreement rate between the two researchers was 91.7%. Finally, the remaining inconsistencies were examined to obtain a consensus. The overall methodology is summarized in Fig. 2.

6 Results

First, thanks to the AHP method, we obtained the weights of six criteria presented in Table 10. The results show that Criteria 3 (menu-related innovativeness), 4 (service-related innovativeness), and 5 (experience-related innovativeness) are considered the most important criteria by the seven evaluators.

By applying the fuzzy-TOPSIS method, we obtained the ranking of the 13 fine-dining restaurants according to their perceived innovativeness (Table 11). The results in Table 11 reveal that none of the 13 restaurants reached the ideal solution. The most innovative restaurant is R9, with a score of 0.85, indicating that R9 has 85% similarity to the ideal solution. The least innovative restaurant is R5, with a low score of 0.19.

Second, regarding customer satisfaction, by using the AHP method, we obtained the weights of the four customer satisfaction criteria: food (0.39), service (0.28), value for money (0.18), and atmosphere (0.15). To calculate the weighted sum scores for customer satisfaction,
Table 10 Weights of each criterion related to perceived innovativeness

| Criteria                                | Weight |
|-----------------------------------------|--------|
| Innovativeness of demand generation     | 0.08 \(W_1\) |
| Innovativeness of preparation           | 0.06 \(W_2\) |
| Innovativeness of menu                  | 0.27 \(W_3\) |
| Innovativeness of service               | 0.22 \(W_4\) |
| Innovativeness of customer experience   | 0.26 \(W_5\) |
| Innovativeness of customer engagement  | 0.11 \(W_6\) |

Table 11 Ranking of restaurants according to their perceived innovativeness

| Rank | Restaurants | Performance related to perceived innovativeness \(P_i\) |
|------|-------------|-------------------------------------------------------|
| 1    | R9          | 0.85                                                  |
| 2    | R12         | 0.84                                                  |
| 3    | R3          | 0.75                                                  |
| 4    | R2          | 0.73                                                  |
| 5    | R13         | 0.57                                                  |
| 6    | R11         | 0.54                                                  |
| 7    | R13         | 0.52                                                  |
| 8    | R8          | 0.43                                                  |
| 9    | R6          | 0.42                                                  |
| 10   | R1          | 0.39                                                  |
| 11   | R4          | 0.32                                                  |
| 12   | R7          | 0.23                                                  |
| 13   | R5          | 0.19                                                  |

we multiplied the customer ratings extracted from TripAdvisor (accessed on September 1, 2021) by the weights of each of the four customer satisfaction criteria (i.e., food, service, value for money, and atmosphere). Table 12 illustrates the weighted sum scores for customer satisfaction. The results indicate that R3 has the highest overall score (4.62 out of 5) and is ranked first in customer satisfaction.

Next, we compared this customer satisfaction ranking with the perceived innovativeness ranking. The results indicate a fairly strong correlation between perceived innovativeness and customer satisfaction of the selected restaurants \(R^2 = 0.7324\), as shown in Fig. 3 (Evans, 1996).

The thematic content analysis of 217 positive online reviews of the restaurant ranked first in customer satisfaction (i.e., R3, Restaurant Kei) reveals that the most cited words are “dish” (171 recurrences), “chef” (162), “service” (125), “cuisine” (103), “menu” (99), and “flavor” (82). Customers expressed themselves in a very positive way vis-à-vis three criteria: innovativeness of menu, service, and customer experience, respectively. With 198 references, these three criteria account for 79% of all the references.
Table 12 Weighted sum scores for customer satisfaction

| Restaurants | Food   | Service | Value for money | Atmosphere | Weighted sum scores for customer satisfaction (out of 5) | Rank       |
|-------------|--------|---------|----------------|------------|-------------------------------------------------------|------------|
| R1          | 1.560  | 1.120   | 0.630          | 0.600      | 3.910                                                 | 8 or 9 or 10 |
| R2          | 1.560  | 1.260   | 0.720          | 0.525      | 4.065                                                 | 7          |
| R3          | 1.950  | 1.260   | 0.810          | 0.600      | 4.620                                                 | 1          |
| R4          | 1.365  | 0.980   | 0.540          | 0.450      | 3.335                                                 | 13         |
| R5          | 1.365  | 1.120   | 0.630          | 0.600      | 3.715                                                 | 11         |
| R6          | 1.560  | 1.120   | 0.630          | 0.600      | 3.910                                                 | 8 or 9 or 10 |
| R7          | 1.365  | 1.120   | 0.630          | 0.450      | 3.565                                                 | 12         |
| R8          | 1.560  | 1.120   | 0.630          | 0.600      | 3.910                                                 | 8 or 9 or 10 |
| R9          | 1.755  | 1.260   | 0.720          | 0.675      | 4.410                                                 | 2 or 3     |
| R10         | 1.755  | 1.260   | 0.720          | 0.525      | 4.260                                                 | 4          |
| R11         | 1.755  | 1.120   | 0.720          | 0.600      | 4.195                                                 | 6          |
| R12         | 1.755  | 1.260   | 0.720          | 0.675      | 4.410                                                 | 2 or 3     |
| R13         | 1.560  | 1.260   | 0.720          | 0.675      | 4.215                                                 | 5          |

Fig. 3 Correlation between perceived innovativeness and customer satisfaction of the selected restaurants

A significant number of references (31%) refer to menu-related innovativeness. Customers were delighted with the flavor, precision, and presentation of the dishes offered by Restaurant Kei. They also greatly appreciated the priorities given by the restaurant to local products and its ability to respond to market trends.

The dishes (asparagus, signature salad, duck and Wagyu beef, and dessert with strawberries and basil) are refined, tasty, and delicate. These dishes have been prepared with love and, above all, using local products. It is truly haute cuisine. (Comment 37)
All the dishes are beautiful, with absolutely incredible marriage of flavors. In each dish, we managed to separate, in the mouth, the announced flavors. Everything is light, smooth, [and] creamy as it should be, with an exceptional beauty of presentation. […] Each dish is a treat […] Everything is a highlight. Moreover, in that lunch, from the caviar as a starter to the final desserts, everything was beautiful, original, tasty, and smooth. (Comment 103)

The dishes followed one another with, always, the same precision: the signature salad was exceptional and never seen before, the bloody mary shrimp and caviar, as well as the Wagyu marked us forever! (Comment 49)

I much appreciate the fact that the restaurant often changes menus. As a vegetarian, I love the vegetarian dishes that the restaurant offers, which is its strong point and perfectly responds to market trends. (Comment 18)

With 25% of the references, service-related innovativeness was also highlighted positively by guests. They greatly enjoyed and recognized the professionalism, responsiveness, patience, and culinary knowledge of the staff.

[…] and the room staff’s service was perfect, never intrusive. We have always liked the passionate explanations of the composition of the dishes, which is systematic in the Restaurant Kei. We will come back great with pleasure! […] (Comment 89)

[…] We will also retain the performance of the restaurant supervisor with whom we discussed at length our common passion for the gastronomy […] (Comment 162)

A very good and atypical restaurant. The staff is perfect, friendly, smiling, and not snobbish, like in other places. […] (Comment 5)

Customer experience-related innovativeness represents 23% of the references. In particular, customers experienced delightful moments when they could watch the chef prepare the dishes while waiting to be served. They also appreciated the unique decoration and atmosphere of the Restaurant Kei. Moreover, the friendliness and benevolence provided by the chef also seem to trigger a memorable and positive culinary experience, which in turn shapes a fundamental element of satisfaction.

I really enjoy watching the chef prepare the dishes from my table. It reassures me about the dishes that I am going to experience. On the other hand, it allows me to psychologically reduce the waiting time. I don’t like to wait lengthily without doing anything at all. (Comment 55)

[…] When we left, Chef Kei simply introduced himself and we were able to exchange a few words about gastronomy. It was an unforgettable moment! (Comment 124)

Faithfully accustomed to Gérard Besson, we were overwhelmed by his departure from the premises. Participants in the “four-handed” dinner for the handover of powers between Mr. Besson and Chef Kei, promises of very beautiful things were emerging without having the irrepressible desire to come and discover them. It took several years to say to ourselves: “Chick, let’s go! And there, Wow! The sublime! Amazing! and one could endlessly enumerate all the superlatives contained in the dictionary. Everything matches: the staff, the place (discreet and chic), the service—nothing is to be thrown away. In short, of a very high gastronomic standard in a very pleasant atmosphere. (Comment 13)

Fourth visit and fourth extraordinary experience. All superlative merit. […] The welcome and the location (quiet, beautiful, sober) deserve congratulations. Principle of the unique and surprise menu. […] (Comment 23)
Figure 4 presents the fine-dining restaurant innovativeness based on customer-generated online review data. It shows the most important elements of a customer’s fine-dining experience and which aspects restaurant managers should invest in to introduce innovations.

7 Contributions, limitations, and future research

7.1 Theoretical contributions

Theoretically, this research contributes to extending the body of literature on operations management and strategic management by demonstrating how fine-dining restaurants should manage the perceived customer journey innovativeness to achieve the dual goals of satisfying their guests and achieving the sustainable development of their activities. First, this study proposes the RIMF that restaurant managers can use to assess restaurants’ perceived innovativeness throughout the entire customer journey. The study by Kim et al. (2018) did not take into consideration the entire customer journey; hence, our study filled this research gap by proposing the RIMF. Second, in the context of fine-dining restaurants, this research mobilized a mixed-method approach (i.e., the multicriteria decision-making method and the qualitative one), revealing a positive correlation between perceived customer journey innovativeness and customer satisfaction, with a more substantial explanatory power compared with the existing literature. This contribution is significant because prior research on this issue has, on the one hand, investigated a single product or service innovativeness (Hoeffler, 2003; Kunz et al., 2011). On the other hand, there has been a shortcoming in qualitatively explaining the correlation between perceived innovativeness and customer satisfaction in the existing literature (Xu et al., 2016).

Third, our study enriches the literature and the implications of DDI by including customer data. Martin-Rios and Ciobanu (2019) presented different innovation strategies for hospitality firms to optimize their financial performance. However, no research has considered customer satisfaction as a key indicator of firm performance. In addition, DDI allows firms to include customers and their experiences in the innovation process as part of co-innovation (Bresciani...
et al., 2021). Thus, our study deepens the existing literature on co-innovation by putting customers of fine-dining restaurants at the center of the innovation process. In particular, customers were integrated into the evaluation process, and customer-generated online review data were included to better understand the customer journey and their dining experience and find ways to innovate them.

Fourth, according to Kim et al. (2018) and Sean Hyun and Han (2012), few studies have examined the correlation between restaurants’ perceived innovativeness and satisfaction from a customer’s perspective. In addition, no study on this correlation has been conducted in the context of fine-dining restaurants in France. By addressing this gap, our study contributes to enriching the service innovativeness literature and fills the void of research on the French restaurant industry. This is especially significant because this industry plays a vital role in the French economy (5th sector in terms of job creation) and worldwide cultural heritage (UNESCO heritage).

### 7.2 Managerial implications

In this research, we employed both multicriteria decision-making methods (e.g., AHP and fuzzy-TOPSIS) and thematic content analysis of customer online reviews and ratings from TripAdvisor. This process enabled us to examine the link between perceived customer journey innovativeness and customer satisfaction and obtain—based on the actual lived experiences of consumers—the explanatory elements of the quantitative results. From a managerial point of view, this work proposes an evaluation grid of the perceived customer journey innovativeness of fine-dining restaurants and sheds light on the main elements of customer satisfaction, which can support restaurant managers in choosing effective and operational innovation strategies. To the best of our knowledge, this study is the first to propose a benchmarking tool for fine-dining restaurants. Benchmarking has been regarded as an effective tool for optimizing organizational performance (Aumüller et al., 2020; Yaseen et al., 2018). Therefore, our proposed framework (i.e., RIMF) will allow restaurant managers to compare their performance with that of their competitors and identify the best practices they should apply thereafter.

Second, there have been profound changes in consumer behaviors, especially in the hospitality industry, due to the rapid development of online review sites, mobile devices, and home food delivery applications (Clauzel et al., 2019; Kirova & Vo-Thanh, 2019; Vo-Thanh & Kirova, 2018; Vo-Thanh et al., 2021; Zaman et al., 2016a, 2016b, 2021). Related to this, our RIMF considers all possible online and offline touchpoints of a restaurant customer’s journey, thus allowing restaurant managers to understand which of these require innovations. In other words, it provides a detailed overview of their performance in terms of innovativeness. For example, our analysis of online reviews shows that in the context of fine-dining catering, the quality of the dishes, room service, and experience with the room staff and the chef (all falling under three criteria, namely, menu-, service-, and experience-related innovativeness, respectively) are the main elements of customer satisfaction. Hence, restaurant managers should take these elements into consideration when implementing their innovation projects.

Third, this study investigates the weights of four TripAdvisor criteria and underlines which of these are considered most important by fine-dining restaurant customers. This information will help restaurant managers determine which criteria they should work on as a priority and what types of information they should communicate to customers. Such information may also help managers optimize their operations. Concretely, from an expert standpoint, the
weights of four fine-dining restaurant customer satisfaction criteria are as follows: food (0.39), service (0.28), value for money (0.18), and atmosphere (0.15). Therefore, food and service appear to be the two key criteria that should be prioritized by fine-dining restaurant managers. Furthermore, restaurant managers can use customer online reviews as a tool for co-creation and service innovation (Vo-Thanh & Kirova, 2018; Zhang et al., 2018).

Finally, this study’s findings indicate that firms should employ DDI from big customer data to arrive at correct business decisions, implement sound strategies, and achieve efficient operations. Having access to the strategic resources of big data is not enough; firms must develop management capabilities to create value from such strategic resources and explore them for better business decisions. However, creating value from big data to achieve innovative outcomes is not an easy process (Saura et al., 2022; Shamim et al., 2021). Fortunately, DDI provides the right approach for procuring, analyzing, and making the right decisions (Babu et al., 2021; Bhatti et al., 2022). Furthermore, DDI enables businesses to derive value from data, suggest innovation, and advise on competitive advantages. From an operational perspective, DDI is not only confined to fine-dining restaurants but can also be applied to other industries, such as banking and retail.

7.3 Limitations and future research directions

Despite its significant contributions, this research calls for caution and has limitations that may lead to new research avenues. First, by using the suggested multicriteria decision-making methods, the robustness and relevance of the findings widely depend on the experts’ judgment. Therefore, the selection of the right experts involved in the decision-making process is crucial. Second, this study deals with fine-dining restaurants, a specific segment of the catering industry. Thus, it would be interesting to conduct further research on other segments of the industry to obtain a more global view of the relative weights of the identified criteria related to both customer satisfaction and restaurants’ perceived innovativeness throughout the entire customer journey. Wall and Berry (2007) suggested that customers of quick-service restaurants tend to have different service quality perceptions compared with customers patronizing other types of restaurants. Therefore, future studies should consider other types of restaurants (e.g., fast food). Third, our study focused only on the French context. As fine-dining restaurant consumption is experientially, symbolically, and culturally oriented (Dedeoğlu et al., 2022; Vo-Thanh et al., 2022a, 2022b), it would be necessary to replicate our methodology to other cultural contexts to enrich the present findings.

References

Acar, O. A., Tarakci, M., & van Knippenberg, D. (2019). Creativity and innovation under constraints: A cross-disciplinary integrative review. *Journal of Management, 45*(1), 96–121. https://doi.org/10.1177/0149206318805832

Akter, S., Bandara, R., Hani, U., Wamba, S. F., Foropon, C., & Papadopoulos, T. (2019). Analytics-based decision-making for service systems: A qualitative study and agenda for future research. *International Journal of Information Management, 48*, 85–95. https://doi.org/10.1016/j.ijinfomgt.2019.01.020

Akter, S., Michael, K., Uddin, M. R., McCarthy, G., & Rahman, M. (2022). Transforming business using digital innovations: The application of AI, blockchain, cloud and data analytics. *Annals of Operations Research, 308*(1), 7–39. https://doi.org/10.1007/s10479-020-03620-w

Akter, S., & Wamba, S. F. (2016). Big data analytics in e-commerce: A systematic review and agenda for future research. *Electronic Markets, 26*(2), 173–194. https://doi.org/10.1007/s12525-016-0219-0
Akter, S., Wamba, S. F., Gunasekaran, A., Dubey, R., & Childe, S. J. (2016). How to improve firm performance using big data analytics capability and business strategy alignment? International Journal of Production Economics, 182, 113–131. https://doi.org/10.1016/j.ijpe.2016.08.018

Albayrak, T., & Caber, M. (2015). Prioritisation of the hotel attributes according to their influence on satisfaction: A comparison of two techniques. Tourism Management, 46, 43–50. https://doi.org/10.1016/j.tourman.2014.06.009

Amatulli, C., De Angelis, M., & Stoppani, A. (2019). Analyzing online reviews in hospitality: Data-driven opportunities for predicting the sharing of negative emotional content. Current Issues in Tourism, 22(15), 1904–1917. https://doi.org/10.1080/13683500.2019.1594723

Anderson, E. W., & Mittal, V. (2000). Strengthening the satisfaction-profit chain. Journal of Service Research, 3(2), 107–120. https://doi.org/10.1177/1094670500320001

Aumüller, M., Bernhardsson, E., & Faithfull, A. (2020). ANN-Benchmarks: A benchmarking tool for approximate nearest neighbor algorithms. Information Systems, 87, 101374. https://doi.org/10.1016/j.is.2019.02.006

Babu, M. M., Rahman, M., Alam, A., & Dey, B. L. (2021). Exploring big data-driven innovation in the manufacturing sector: Evidence from UK firms. Annals of Operations Research. https://doi.org/10.1007/s10479-021-04077-1

Bai, B., Law, R., & Wen, I. (2008). The impact of website quality on customer satisfaction and purchase intentions: Evidence from Chinese online visitors. International Journal of Hospitality Management, 27(3), 391–402. https://doi.org/10.1016/j.ijhm.2007.10.008

Bhatti, S. H., Hussain, W. M. H. W., Khan, J., Sultan, S., & Ferraris, A. (2022). Exploring data-driven innovation: What’s missing in the relationship between big data analytics capabilities and supply chain innovation? Annals of Operations Research. https://doi.org/10.1007/s10479-022-04772-7

Binder, P., Mair, M., Stummer, K., & Kessler, A. (2016). Organizational innovativeness and its results: A qualitative analysis of SME hotels in Vienna. Journal of Hospitality & Tourism Research, 40(3), 339–363. https://doi.org/10.1177/1096348013496277

Bolden, D., Hadlock, P., Martin, M., Luther, A., & Taylor, L. (2017). The new digital reality for restaurants. Retrieved October 27, 2021, from https://www.bcg.com/fr-fr/publications/2017/technology-value-creation-strategy-new-digital-reality-restaurants

Bordeaux, N. (2019). Opinion | La livraison à domicile, un nouveau champ de croissance pour la restauration. Les Echos. Retrieved October 27, 2021, from https://www.lesechos.fr/idees-debats/cercle/opinion-la-livraison-a-domicile-un-nouveau-champ-de-croissance-pour-la-restauration-964118

Bresciani, S., Ciampi, F., Meli, F., & Ferraris, A. (2021). Using big data for co-innovation processes: Mapping the field of data-driven innovation, proposing theoretical developments and providing a research agenda. International Journal of Information Management, 60, 102347. https://doi.org/10.1016/j.ijinfomgt.2021.102347

Chan, H. K., Wang, X., Lacka, E., & Zhang, M. (2016). A mixed-method approach to extracting the value of social media data. Production and Operations Management, 25(3), 568–583. https://doi.org/10.1111/poms.12390

Chick, J. (2021). The restaurant of the future: Engaging the next-generation consumer. Deloitte United States. Retrieved October 27, 2021, from https://www2.deloitte.com/us/en/pages/consumer-business/articles/restaurant-future-survey-technology-customer-experience.html

Ciampi, F., Demi, S., Magrini, A., Marzi, G., & Papa, A. (2021). Exploring the impact of big data analytics capabilities on business model innovation: The mediating role of entrepreneurial orientation. Journal of Business Research, 123, 1–13. https://doi.org/10.1016/j.jbusres.2020.09.023

Clauzel, A., Delacour, H., & Liarte, S. (2019). When cuisine becomes less haute: The impact of expert ratings on consumers’ legitimacy judgments. Journal of Business Research, 105, 395–404. https://doi.org/10.1016/j.jbusres.2019.03.038

Conseil G. (2021). Relevons ensemble les défis de la restauration. Gira Conseil. Retrieved October 27, 2021, from https://www.giraconseil.fr/

Crawford, M., & Di Benedetto, A. (2011). New products management (10th ed.). McGraw Hill.

Cukier, K. (2021). Commentary: How AI shapes consumer experiences and expectations. Journal of Marketing, 85(1), 152–155. https://doi.org/10.1177/0022249320972932

Danneels, E., & Kleinschmidt, B. J. (2001). Product innovativeness from the firm’s perspective: Its dimensions and their relation with project selection and performance. Journal of Product Innovation Management, 18(6), 357–373. https://doi.org/10.1111/1540-5885.1860357

Daries, N., Cristobal-Fransi, E., Ferrer-Rosell, B., & Marine-Roig, E. (2018). Maturity and development of high-quality restaurant websites: A comparison of Michelin-starred restaurants in France, Italy and Spain. International Journal of Hospitality Management, 73, 125–137. https://doi.org/10.1016/j.ijhm.2018.02.007
Klein, J. F., Zhang, Y., Falk, T., Aspara, J., & Luo, X. (2020). Customer journey analyses in digital media: Exploring the impact of cross-media exposure on customers’ purchase decisions. *Journal of Service Management, 31*(3), 489–508. https://doi.org/10.1108/JOSM-11-2018-0360

Kleis, L., Chwelos, P., Ramirez, R. V., & Cockburn, I. (2012). Information technology and intangible output: The impact of IT investment on innovation productivity. *Information Systems Research, 23*(1), 42–59. https://doi.org/10.1287/isre.1100.0338

Kumar, V., Dixit, A., Javalgi, R. G., & Dass, M. (2016). Research framework, strategies, and applications of intelligent agent technologies (IATs) in marketing. *Journal of the Academy of Marketing Science, 44*(1), 24–45. https://doi.org/10.1007/s11747-015-0426-9

Kunz, W., Schmitt, B., & Meyer, A. (2011). How does perceived firm innovativeness affect the consumer? *Journal of Business Research, 64*(8), 816–822. https://doi.org/10.1016/j.jbusres.2010.10.005

Lai, Y.-J., Liu, T.-Y., & Hwang, C.-L. (1994). TOPSIS for MODM. *European Journal of Operational Research, 76*(3), 486–500. https://doi.org/10.1016/0377-2217(94)90282-8

Laine-Devroede, N. (2019). *La Fevad publie la nouvelle cartographie du e-commerce en 2019*. Retrieved October 27, 2021, from https://www.fevad.com/cartographie-du-e-commerce-en-2019/

Lamberton, C., & Stephen, A. T. (2016). A thematic exploration of digital, social media, and mobile marketing: Research evolution from 2000 to 2015 and an agenda for future inquiry. *Journal of Marketing, 80*(6), 146–172. https://doi.org/10.1509/jm.15.0415

Lee, H. L. (2018). Big data and the innovation cycle. *Production and Operations Management, 27*(9), 1642–1646. https://doi.org/10.1111/poms.12845

Li, J., Xu, L., Tang, L., Wang, S., & Li, L. (2018). Big data in tourism research: A literature review. *Tourism Management, 68*, 301–323. https://doi.org/10.1016/j.tourman.2018.03.009

Li, Q. (2013). A novel Likert scale based on fuzzy sets theory. *Expert Systems with Applications, 40*(5), 1609–1618. https://doi.org/10.1016/j.eswa.2012.09.015

Ma, J., Ruan, D., Xu, Y., & Zhang, G. (2007). A fuzzy-set approach to treat determinacy and consistency of linguistic terms in multi-criteria decision making. *International Journal of Approximate Reasoning, 44*(2), 165–181. https://doi.org/10.1016/j.ijar.2006.07.007

Mahmoud, M. A., Hinson, R. E., & Anim, P. A. (2018). Service innovation and customer satisfaction: The role of customer value creation. *European Journal of Innovation Management, 21*(3), 402–422. https://doi.org/10.1108/EJIM-09-2017-0117

Mariani, M. (2020). Big data and analytics in tourism and hospitality: A perspective article. *Tourism Review, 75*(1), 299–303. https://doi.org/10.1108/TR-06-2019-0259

Martin-Rios, C., & Ciobanu, T. (2019). Hospitality innovation strategies: An analysis of success factors and challenges. *Tourism Management, 70*, 218–229. https://doi.org/10.1016/j.tourman.2018.08.018

Miles, M. B., Huberman, A. M., & Saldaña, J. (2020). *Qualitative data analysis: A methods sourcebook* (4th ed.). Sage.

Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1985). A conceptual model of service quality and its implications for future research. *Journal of Marketing, 49*(4), 41. https://doi.org/10.2307/1251430

Raymond, L., Bergeron, F., & Croteau, A.-M. (2013). Innovation capability and performance of manufacturing SMEs: The paradoxical effect of it integration. *Journal of Organizational Computing and Electronic Commerce, 23*(3), 249–272. https://doi.org/10.1080/10991939.2013.807714

Rindfleisch, A., O’Hern, M., & Sachdev, V. (2017). The digital revolution, 3D printing, and innovation as data. *Journal of Product Innovation Management, 34*(5), 681–690. https://doi.org/10.1111/jpim.12402

Robinot, E., & Giannelloni, J.-L. (2010). Do hotels’ “green” attributes contribute to customer satisfaction? *Journal of Services Marketing, 24*(2), 157–169. https://doi.org/10.1108/08876041011031127

Rosenbaum, M. S., Otalora, M. L., & Ramírez, G. C. (2017). How to create a realistic customer journey map. *Business Horizons, 60*(1), 143–150. https://doi.org/10.1016/j.bushor.2016.09.010

Rubera, G., & Kirca, A. H. (2012). Firm innovativeness and its performance outcomes: A meta-analytic review and theoretical integration. *Journal of Marketing, 76*(3), 130–147. https://doi.org/10.1509/jm.10.0494

Saaty, T. L. (1977). A scaling method for priorities in hierarchical structures. *Journal of Mathematical Psychology, 15*(3), 234–281. https://doi.org/10.1016/0022-2496(77)90033-5

Saaty, T. L. (1980). *The analytic hierarchy process: Planning, priority setting, resource allocation*. McGraw-Hill.

Sandvik, I. L., Duhan, D. F., & Sandvik, K. (2014). Innovativeness and profitability: An empirical investigation in the Norwegian hotel industry. *Cornell Hospitality Quarterly, 55*(2), 165–185. https://doi.org/10.1177/1938965514520963

Sann, R., Lai, P.-C., & Liaw, S.-Y. (2020). Online complaining behavior: Does cultural background and hotel class matter? *Journal of Hospitality & Tourism Management, 43*, 80–90. https://doi.org/10.1016/j.jhtm.2020.02.004
Saura, J. R., Ribeiro-Soriano, D., & Palacios-Marqués, D. (2022). Data-driven strategies in operation management: Mining user-generated content in Twitter. *Annals of Operations Research*. https://doi.org/10.1007/s10479-022-04776-3

Sean Hyun, S., & Han, H. (2012). A model of a patron’s innovativeness formation toward a chain restaurant brand. *International Journal of Contemporary Hospitality Management*, 24(2), 175–199. https://doi.org/10.1108/09596111211206132

Shamim, S., Yang, Y., Zia, N. U., & Shah, M. H. (2021). Big data management capabilities in the hospitality sector: Service innovation and customer generated online quality ratings. *Computers in Human Behavior*, 127, 106777. https://doi.org/10.1016/j.chb.2021.106777

Shankar, V., Venkatesh, A., Hoefacker, C., & Naik, P. (2010). Mobile marketing in the retailing environment: Current insights and future research avenues. *Journal of Interactive Marketing*, 24(2), 111–120. https://doi.org/10.1016/j.intmar.2010.02.006

Sorescu, A. (2017). Data-driven business model innovation. *Journal of Product Innovation Management*, 34(5), 691–696. https://doi.org/10.1111/jpim.12398

Subramanian, A. (1996). Innovativeness: Redefining the concept. *Journal of Engineering and Technology Management*, 13(3–4), 223–243. https://doi.org/10.1016/S0923-4748(96)01007-7

Tan, T. F., & Staats, B. R. (2020). Behavioral drivers of routing decisions: Evidence from restaurant table assignment. *Production and Operations Management*, 29(4), 1050–1070. https://doi.org/10.1111/poms.13155

Tsaur, S.-H., Chang, T.-Y., & Yen, C.-H. (2002). The evaluation of airline service quality by fuzzy MCDM. *Transportation Research Part A: Policy and Practice*, 36(3), 311–322. https://doi.org/10.1016/S0965-8564(01)00050-4

Vo-Thanh, T., & Kirova, V. (2018). Wine tourism experience: A netnography study. *Journal of Business Research*, 83, 30–37. https://doi.org/10.1016/j.jbusres.2017.10.008

Vo-Thanh, T., Vu, T.-V., Nguyen, N. P., Nguyen, D. V., Zaman, M., & Chi, H. (2022a). COVID-19, frontline hotel employees’ perceived job insecurity and emotional exhaustion: Does trade union support matter? *Journal of Sustainable Tourism*, 30(6), 1159–1176. https://doi.org/10.1080/09669582.2021.1910829

Vo-Thanh, T., Zaman, M., Hasan, R., Akter, S., & Dang-Van, T. (2022b). The service digitalization in fine-dining restaurants: A cost-benefit perspective. *International Journal of Contemporary Hospitality Management*. https://doi.org/10.1108/IJCHM-09-2021-1130

Vo-Thanh, T., Zaman, M., Hasan, R., Rather, R. A., Lombardi, R., & Secundo, G. (2021). How a mobile app can become a catalyst for sustainable social business: The case of Too Good To Go. *Technological Forecasting and Social Change*, 171, 120962. https://doi.org/10.1016/j.techfore.2021.120962

Wall, E. A., & Berry, L. L. (2007). The combined effects of the physical environment and employee behavior on customer perception of restaurant service quality. *Cornell Hotel and Restaurant Administration Quarterly*, 48(1), 59–69. https://doi.org/10.1177/0010880406297246

Wamba, S. F., Gunasekaran, A., Akter, S., Ren, S. J., Dubey, R., & Childe, S. J. (2017). Big data analytics and firm performance: Effects of dynamic capabilities. *Journal of Business Research*, 70, 356–365. https://doi.org/10.1016/j.jbusres.2016.08.009

Wang, Y., & Ahmed, P. K. (2009). The moderating effect of the business strategic orientation on eCommerce adoption: Evidence from UK family run SMEs. *The Journal of Strategic Information Systems*, 18(1), 16–30. https://doi.org/10.1016/j.jsis.2008.11.001

Xiang, Z., Magnini, V. P., & Fesenmaier, D. R. (2015). Information technology and consumer behavior in travel and tourism: Insights from travel planning using the internet. *Journal of Retailing and Consumer Services*, 22, 244–249. https://doi.org/10.1016/j.jretconser.2014.08.005

Xu, B., Zheng, H., Xu, Y., & Wang, T. (2016). Configurational paths to sponsor satisfaction in crowdfunding. *Journal of Business Research*, 69(2), 915–927. https://doi.org/10.1016/j.jbusres.2015.06.040

Yang, G., Ji, G., & Tan, K. H. (2022). Impact of artificial intelligence adoption on online returns policies. *Annals of Operations Research*, 308(1), 703–726. https://doi.org/10.1007/s10479-020-03602-y

Yaseen, M. M., Sweis, R. J., Abdallah, A. B., Obeidat, B. Y., & Sweis, N. J. (2018). Benchmarking of TQM practices in the Jordanian pharmaceutical industry (a comparative study). *Benchmarking: an International Journal*, 25(9), 4058–4083. https://doi.org/10.1108/BJ-04-2017-0076

Zadeh, L. A. (1965). Fuzzy sets. *Information and Control*, 8, 338–353. https://doi.org/10.1016/S0019-9958(65)90241-X

Zaman, M., Hasan, R., & Shams, S. M. R. (2022). Impact of big data on tourism and hospitality: Challenges and organisational adaptation. In D. Vrontis, A. Thrassou, Y. Weber, S. M. R. Shams, E. Tsoukatos, & L. Efthymiou (Eds.), *Business under crisis* (Vol. II, pp. 185–202). Springer. https://doi.org/10.1007/978-3-030-76575-0_9

Zaman, M., Botti, L., & Vo-Thanh, T. (2016a). Weight of criteria in hotel selection: An empirical illustration based on TripAdvisor criteria. *European Journal of Tourism Research*, 13, 132–138.
Zaman, M., Botti, L., & Vo-Thanh, T. (2016b). Does managerial efficiency relate to customer satisfaction? The case of Parisian boutique hotels. *International Journal of Culture, Tourism and Hospitality Research, 10*(4), 455–470. https://doi.org/10.1108/IJCTHR-08-2015-0095

Zaman, M., Vo-Thanh, T., Hasan, R., & Babu, M. M. (2021). Mobile channel as a strategic distribution channel in times of crisis: A self-determination theory perspective. *Journal of Strategic Marketing*. https://doi.org/10.1080/0965254X.2021.1959629

Zhan, Y., Tan, K. H., Li, Y., & Tse, Y. K. (2018). Unlocking the power of big data in new product development. *Annals of Operations Research, 270*(1–2), 577–595. https://doi.org/10.1007/s10479-016-2379-x

Zhang, H., Gordon, S., Buhalis, D., & Ding, X. (2018). Experience value cocreation on destination online platforms. *Journal of Travel Research, 57*(8), 1093–1107. https://doi.org/10.1177/0047287517733557

Zimmermann, H.-J. (1996). *Fuzzy set theory-and its applications* (3rd ed.). Springer. https://doi.org/10.1007/978-94-015-8702-0

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