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RESEARCH ARTICLE

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Unpacking the relationship between co-creation and brand equity: A multi-study approach

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Abstract

Whilst some studies have shown that co-creation positively influences brand equity, others have found only marginal or even negative effects, and several failure cases of co-creation have been reported. To overcome the confusion generated by mixed findings, this paper unpacks the relationship between co-creation and brand equity, considering two variables relevant to any co-creation process as potential mediators: customer trust and customer affective commitment. In Study 1, we used survey data from 2008 customers of financial services brands. Study 2 consisted of a randomized lab experiment with 183 participants related to financial and hospitality services brands. Both studies converge in showing that co-creation does not have a direct effect on brand equity. Rather, this effect is either fully mediated by customer trust or follows the mediated path through customer trust and then customer affective commitment. These results open interesting avenues for further research regarding the potential use of co-creation.

KEYWORDS

brand equity, co-creation, customer affective commitment, customer trust, services brands

INTRODUCTION

Over the last decade, leading financial services brands such as BNP Paribas, First Direct, and Standard Chartered have embraced co-creation practices, investing significant resources to involve customers and employees in shaping their service offerings. For instance, BNP Paribas, the French financial services group with operations in 68 countries, nearly 200,000 employees worldwide, and €44 billion in revenue, has undertaken an exhaustive co-creation process to develop a new blockchain-based web interface. This service innovation simplified information sharing for commodity-finance transactions, responding to the growing demand for efficient and transparent financial services solutions. Similarly, First Direct has integrated a co-creation platform within its app, enabling customers to directly contribute to the development of new services. This trend is not only adopted to improve a brand's existing services or generate new ones, but is also a strategic response to the shifting economic, technological, and competitive business contexts (Barile et al., 2024; Islam et al., 2024; Markovic et al., 2021; Markovic, Bagherzadeh, et al., 2023).

Economic pressures, such as the growing demand for personalized financial services solutions and cost-efficient service innovations, have made co-creation an essential practice in the current business landscape (Barile et al., 2024; Edvardsson & Tronvoll, 2022). Technological advancements, including digital transformation, fintech disruption, and the capabilities of mass customization, have enabled brands to gather and implement customer insights with unprecedented speed and accuracy (Alkhwaldi, 2024; Barile et al., 2024). Thus, co-creation can provide a crucial competitive advantage in an ever more saturated marketplace (Iglesias et al., 2020). As Joe Gordon, Head of First Direct, explains: "Co-creation helps us to put more products and services through their paces, faster, working out niggles and helping us create a truly modern and open banking service that's right for now and the future." By embracing co-creation, financial services brands can not only improve their offerings but also position themselves better to thrive in an increasingly dynamic and customer-centric business context (Hosseini & Hosseini, 2013; Nysveen & Pedersen, 2014).

However, despite the increasing adoption of co-creation, there remains a limited understanding of how it influences brand equity, namely the value a brand holds in customers' minds (Aaker, 1996; Davcik & Sharma, 2015; Yasin et al., 2012). Whilst some of the few existing studies have shown that co-creation positively influences brand equity (Christodoulides et al., 2012; Muniz & Guzmán, 2023; Zhang et al., 2015), others have found that co-creation only marginally or even negatively affects brand equity (Kristal et al., 2016, 2018), while some failure cases of co-creation (often referred to as co-destruction) have been reported (e.g., Lund et al., 2020; Quach & Thaichon, 2017; Vallaster et al., 2018). This study aims to overcome the existing ambiguity by unpacking the relationship between co-creation and brand equity and examining which mediating variables play a key role in ensuring that co-creation boosts brand equity. By doing so, this study seeks to provide clearer insights into the mechanisms through which co-creation strengthens the value brands hold in customers' minds in a competitive marketplace.

Co-creation is understood as a strategic process in which brands actively involve their stakeholders, particularly customers, in the development of innovative products and/or services (Chaudhuri et al., 2023; Markovic & Bagherzadeh, 2018). In this line, Iglesias et al. (2020, p. 152) define co-creation as an "active, creative, dynamic, and social process aimed at developing new relevant product or service innovations through collaborative brand-customer interactions and relationships… [which] can lead to a plethora of organizational advantages, including cost efficiencies, risk reduction, speed-to-market, better insights, and competitive advantage." From this perspective, the brand is not a static entity. Instead, it is a dynamic assemblage that is negotiated and discursively shaped (Csaba & Bengtsson, 2006; Parris & Guzman, 2023; Price & Coulter, 2019). This collaborative approach integrates the knowledge, preferences, and experiences of customers with the expertise and resources of brands, thereby fostering the joint development of product and/or service innovations that are closely aligned with customer needs (Iglesias et al., 2020; Markovic & Bagherzadeh, 2018).

Most of the previous research in the area has focused on when and how co-creation can be most effective (e.g., Bosch-Sijtsema & Bosch, 2015; Ind et al., 2017), and on its key outcomes, primarily the innovations that emerge from the co-creation process (Frow et al., 2015; Kazadi et al., 2016; Oliveira et al., 2024; Yen et al., 2020). However, previous research has largely neglected the potential of co-creation for more intangible, brand-building purposes (Markovic, Gyrd-Jones, et al., 2022). This is surprising because co-creation – through participants' involvement in the process – can lead to several intangible outcomes related to changes in customers' perceptions of the brand and their attitudes toward it (Ind et al., 2013, 2017). These intangible outcomes include brand image, brand loyalty, and brand equity (e.g., Aarikka-Stenroos & Jaakkola, 2012; Iglesias et al., 2020; Kennedy & Guzmán, 2016; Zhang et al., 2015), with brand equity being recognized as particularly significant (Christodoulides et al., 2012; Kristal et al., 2016).

Brand equity can be defined as the "value of a brand that is created by the brand itself or co-created with stakeholders from the perceptual associations, symbolic meaning, relationships, and social impact of a product, service, idea, place, organization, person, or community, and/or the brand's financial assets and liabilities" (Parris & Guzman, 2023, p. 198). Overall, brand equity refers to the value a brand holds in customers' minds, reflecting how much they prefer and are willing to pay for a given brand compared to competing brands (Aaker, 1996; Davcik & Sharma, 2015; Yasin et al., 2012). For example, customers might choose one financial services brand (e.g., a bank) over another not merely for its credit card features and conditions, but because they assign a greater symbolic meaning to it, deriving, for instance, from its country of origin. However, the symbolic meanings that customers assign to brands may change over time (Gyrd-Jones & Kornum, 2013). As brand equity is a dynamic and evolving concept, Parris and Guzmán (2023, p. 212) call for more research on "the boundaries and expectations of what creates, maintains, mediates and moderates, and grows brand equity".

Even if strengthening brand equity is key to building a profitable business, recent studies suggest that many brands – especially those offering financial services – are suffering from damage to their equity due to low levels of (1) customer trust and (2) customer affective commitment (e.g., Do et al., 2019; Sierra et al., 2017), both of which are key variables related to the co-creation process (Iglesias et al., 2013, 2020; Ind et al., 2013). On one hand, customer trust can be defined as the confidence that a brand will be reliable and keep its promises (Mende & Bolton, 2011; Nibras et al., 2025; Tajvidi et al., 2021; Tseng, 2021). Several scholars argue that trust is central to any co-creation process as it forms the foundation of any favorable brand–customer relationship (Gounaris, 2005; Morgan & Hunt, 1994; Schumann et al., 2010; Wang et al., 2020). Hence, when these relationships are rich in trust, customers are likely to develop a positive perception of the brand and a preference toward it over other brands, thereby enhancing brand equity (e.g., Chen, 2010; Delgado-Ballester & Munuera-Alemán, 2005; Iglesias et al., 2020; Muniz & Guzmán, 2023). On the other hand, customer affective commitment refers to the emotional bond a customer develops with the brand, characterized by feelings of attachment and positive emotions toward it (Mende & Bolton, 2011). For example, an affectively committed customer of a financial services brand (e.g., a bank) is likely to enjoy being a customer of that brand and to feel both attached to and identified with it (Markovic et al., 2018; Sierra et al., 2017) – not just because the credit card's features and conditions fulfill their needs and desires, but because of a more intangible, emotional connection derived, for instance, from the brand's generational use within their family. Similar to customer trust, many scholars argue that customer affective commitment is key to co-creation initiatives, as feelings and emotions are at the center of any relationship (Ind et al., 2017; Morgan & Hunt, 1994; Sierra et al., 2017). In addition, some studies show that when customers are affectively committed to a brand, brand equity levels are likely to increase (e.g., Mathew et al., 2012; Sierra et al., 2017). These arguments emphasize the importance of studying the relationship-related variables of customer trust and customer affective commitment as potential mediators in the link between co-creation and brand equity. Thus, in unpacking the relationship between co-creation and brand equity, our study will empirically investigate the mediating roles of customer trust and customer affective commitment in such relationship.

To address our research objective, we conducted two complementary studies. In Study 1, we used survey data from 2008 customers of financial services brands. Study 2 consisted of a randomized lab experiment with 183 participants, related to financial services brands and hospitality services brands, which complemented the survey data results with causal evidence. Both studies converged in showing that co-creation does not have a direct effect on brand equity. Instead, this effect is either fully mediated by customer trust or follows the mediated path through customer trust and then customer affective commitment. These results open interesting avenues regarding the potential use of co-creation not only to generate relevant innovations, but also for more intangible, brand-building purposes.

The following sections present: the theoretical background and development of the hypotheses; the two studies, the methods used in them, and the results of each; and finally, the general discussion and conclusion, including theoretical contributions, managerial implications, limitations, and future research opportunities.

THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

Characterizing co-creation

Co-creation consists of inviting the key stakeholders to contribute their resources (i.e., information, ideas, and insights) to jointly develop new or significantly improved products and/or services with the brand (e.g., Ind et al., 2013; Markovic & Bagherzadeh, 2018; Singh et al., 2017). At its core, co-creation revolves around a genuine partnership between the brand and various key stakeholders, including customers, suppliers, distributors, competitors, and research institutions. Among these, customers have often been identified as the most important stakeholders, given their central role as providers of valuable external resources (e.g., Breidbach et al., 2012; Füller, 2010; Füller et al., 2009; Jaakkola & Alexander, 2014).

Thus, it is essential for brands to build and maintain favorable relationships with customers during co-creation initiatives. The practice of co-creation aligns with the resource-based view (RBV), which highlights the strategic value of accessing and leveraging external resources (Eisenhardt & Schoonhoven, 1996; Kull et al., 2016). From an RBV perspective, co-creation functions as a strategic mechanism through which brands can access customers' information, ideas, and insights that can help in the development of products and/or services and reduce their risk of non-acceptance in an ever-more competitive marketplace (Markovic & Bagherzadeh, 2018). However, access to customer resources also hinges on the trust and commitment established between customers and the brand (Iglesias et al., 2013; Ind et al., 2017). Here, the commitment-trust theory (Morgan & Hunt, 1994) offers a relevant lens, emphasizing that the long-term customer-brand relationships, on which co-creation is based, are grounded in these two foundational elements.

The influence of co-creation on customer trust

For co-creation initiatives to be effective, favorable customer-brand relationships must be in place (Markovic, Gyrd-Jones, et al., 2022). According to the literature, such relationships are unlikely to flourish without a foundation of customer trust in the brand (Fournier, 1998; Schumann et al., 2010; Wong & Sohal, 2002). Customer trust involves the confidence that the brand will be reliable during customer-brand relationships and keep its promises (Dagger et al., 2009; Mende & Bolton, 2011; Nibras et al., 2025).

The development of trust is not merely a relational byproduct but a strategic necessity. According to the commitment-trust theory (Morgan & Hunt, 1994), trust is a core component of long-term relationships, facilitating cooperation and reducing uncertainty. In the context of co-creation, when brands invite customers to participate in the development of products and/or services, this deepens customers' understanding of the brand's values and intentions, thereby reinforcing their trust in the brand (Muniz & Guzmán, 2023).

Several previous studies have provided examples of co-creation – or related concepts that capture customer-brand interactions aimed at product and/or service innovation – serving as a trust-building mechanism. For instance, Madhavan & Grover (1998) found that rich interpersonal interaction during new product development increases participants' trust. In the travel industry, Rajah et al. (2008) showed that the co-creation of services with customers has a positive effect on their trust. Moreover, Iglesias et al. (2020) found a direct and significant effect of co-creation on customer trust in the health insurance service sector. Similarly, Brodie et al. (2013) found that engaged customers, in online brand communities, have an enhanced level of trust in the brand, while Ind et al. (2013) showed that customer participation in co-creation generates customer trust in the brand. Finally, Wang et al. (2020), in their study on the social commerce community, found that co-creation positively relates to the development of customers' trust in the brand.

Despite these previous studies from various industries, the potential of co-creation for building customer trust in specific service contexts, such as financial and hospitality services, remains underexamined. These sectors are shaped by customers' reliance on credible information, relational assurance, and long-term brand dependability, which are conditions that make trust more difficult to establish. To address this gap in the literature, and drawing on the reasoning and findings outlined above, we hypothesize that in the contexts of financial and hospitality services:

> **H1.** Co-creation will have a positive effect on customer trust.

The influence of co-creation on customer affective commitment

Apart from customer trust, any successful co-creation initiative also requires customer commitment to the brand (Baumann & Le Meunier-FitzHugh, 2015) – i.e., customer readiness to invest time and resources in the relationship (Martin & Benson, 2021; Nibras et al., 2025; Tseng, 2021). As argued in the commitment-trust theory (Morgan & Hunt, 1994), commitment is a relevant complement to trust in any type of relationship, reflecting the parties' enduring willingness to maintain the relationship. Especially in service contexts, where the intangible and heterogeneous nature of services prevails, commitment is likely to strengthen the customers' relational bonds with the brand (Markovic et al., 2018).

In the literature, two distinct types of customer commitment have been proposed: continuance commitment, which refers to customers' willingness to maintain their relationship with a specific brand due to a lack of alternatives or high switching costs (Evanschitzky & Wunderlich, 2006); and affective commitment, which is an emotional response arising from customers' psychological attachment to a brand (Fullerton, 2005; Hansen et al., 2003). Although both types of customer commitment are relevant in the relationship marketing literature, the practice of co-creation is more strongly associated with affective commitment, as it relies on the cultivation of positive customer feelings and emotions that deepen customer-brand relationships further (Ind et al., 2013, 2017; Markovic, Gyrd-Jones, et al., 2022).

To boost affective commitment, it is important that, in any co-creation project, brands establish a rich two-way communication channel with their customers (e.g., Baumann & Le Meunier-FitzHugh, 2015; Ind et al., 2017). In this regard, several studies on online brand communities have found that when brands establish a deep dialogue and active engagement with customers, through which they share ideas and learn together during the co-creation of new offerings, customers are more likely to develop affective bonds to such brands (e.g., Brodie et al., 2013; Lin & Wu, 2023; Nibras et al., 2025). Similarly, while understanding co-creation as a highly interactional two-way process, research in the area of financial services has provided empirical evidence of a positive effect of co-creation on brand loyalty, which has a strong affective component (e.g., Eisingerich & Bell, 2008; Nysveen & Pedersen, 2014; Saha et al., 2020). Finally, a study in the Swedish public sector found that the intense involvement of customers in the co-creation of new services generates customer affective commitment (Lundkvist & Yakhlef, 2004). Consistent with these previous findings, we postulate that in the financial and hospitality services industries:

> **H2.** Co-creation will have a positive effect on customer affective commitment.

The influence of customer trust on customer affective commitment

While co-creation practices have the potential to generate both customer trust and customer affective commitment, several scholars have argued that brands should focus on building customer trust first, as trust is the key building block of customer-brand relationships (e.g., Schumann et al., 2010; Zhang & Bloemer, 2008). As developing affective commitment takes more time, trust has the potential to develop higher levels of affective commitment (e.g., Geyskens et al., 1996; Zhang & Bloemer, 2008). This is because affective commitment entails potential customer vulnerability and sacrifice (Wong & Sohal, 2002). This is especially the case in service settings, where trust can help decrease customer-perceived purchase risk, insecurity, and the complexity of transactions, thereby fostering the creation of customer affective commitment toward the brand (Garbarino & Johnson, 1999).

Previous studies across diverse service sectors have provided consistent support for the above rationale. For instance, Gounaris (2005) found that in business-to-business (B2B) services, customer trust positively influences customer affective commitment. Similarly, Hur et al. (2011) showed that trust in a telecommunications brand community leads to a positive affective commitment toward the brand. In the field of financial services, where customers are especially sensitive to trust due to the perceived risks involved, the studies by Kassim and Abdulla (2006), Mukherjee and Nath (2003), and Yu and Asgarkhani (2015) confirmed the trust-commitment link. These findings are echoed in non-business service sectors as well. For example, studying co-creation in the context of religious services, Randall et al. (2011) found that trust not only supports interaction but also fosters affective commitment. These findings underscore the important role of customer trust as a driver of customer affective commitment, especially in service contexts.

Based on the above evidence, and to further contribute to the trust-commitment framework (Morgan & Hunt, 1994), this study aims to gain empirical insight into the role of trust in boosting affective commitment in the financial and hospitality services industries. Accordingly, we posit that, in these two industries:

H3. Customer trust will have a positive effect on customer affective commitment.

The influence of customer trust on brand equity

In addition to its critical role in fostering affective commitment, customer trust has been linked to the development of brand equity (e.g., Chen, 2010; Delgado-Ballester & Munuera-Alemán, 2005; Iglesias et al., 2020; Kim et al., 2008; Muniz & Guzmán, 2023). From a relational perspective, trust builds an alignment between the customer and the brand, laying the foundation for brand loyalty, which is a widely acknowledged dimension of brand equity (e.g., Aaker, 1996; Pappu et al., 2006). In other words, when customer-brand relationships are rich in trust, customers are likely to become loyal to the brand (Chaudhuri & Holbrook, 2001), adopting a positive attitude toward the brand and exhibiting higher purchase intentions for its services compared to those of other brands offering services with the same or similar attributes (Delgado-Ballester & Munuera-Alemán, 2005). Accordingly, there is a wide body of literature considering trust to be positively related to brand loyalty (e.g., Chaudhuri & Holbrook, 2001; Delgado-Ballester et al., 2003; Delgado-Ballester & Munuera-Alemán, 2005; Iglesias et al., 2020).

The literature generally supports two pathways through which trust influences brand equity. One is the indirect pathway that operates via brand loyalty (as a key dimension of brand equity), where trust facilitates customer-brand relationships that translate into customer retention (Delgado-Ballester et al., 2003; Kim et al., 2008). The other one is a direct pathway that considers trust as a direct antecedent of brand equity, especially in competitive and high-involvement service sectors. For example, Chen (2010) found that customer trust positively affects brand equity in the technology sector, while Delgado-Ballester and Munuera-Alemán (2005) showed the same in the cosmetics and beverages industries. Moreover, some scholars have proposed that trust itself is an integral dimension of brand equity (Christodoulides et al., 2006; Kimpakorn & Tocquer, 2010).

In line with the previous research empirically relating customer trust to brand equity, and with the recent suggestions for studying brand equity dimensions (e.g., trust) as brand equity antecedents to advance the understanding of the brand equity construct (e.g., Iglesias et al., 2019), particularly in the service sector, where customer-brand relationships are crucial due to the intangibility and heterogeneity of service offerings (Markovic et al., 2018; Markovic, Gyrd-Jones, et al., 2022), we postulate that in the financial and hospitality services industries:

H4. Customer trust will have a positive effect on brand equity.

The influence of customer affective commitment on brand equity

Apart from customer trust, affective commitment also plays an important, complementary role for developing and maintaining favorable customer-brand relationships (e.g., Cheng & Jiang, 2022; Morgan & Hunt, 1994; Wong & Chung, 2023), and therefore for building brand equity (Cheng et al., 2019; Parris & Guzman, 2023). Defined as the emotional connection and attachment a customer has with a given brand, affective commitment represents a deeper level of engagement, going beyond the purely rational or transactional to reflect a sense of emotional investment in and feelings toward the brand (Fullerton, 2005; Hansen et al., 2003).

In this regard, some scholars have proposed that the emotional connection (e.g., Christodoulides et al., 2006), attachment (Feldwick, 1996), and customers' commitment toward a brand (e.g., Burmann et al., 2009) are important dimensions of brand equity. Other scholars have related affective commitment to the dimensions of brand equity. For instance, in their study on online brand communities, Wang and Yang (2025) discussed how affective commitment acts as an intermediary between co-creation and consumers' brand loyalty. Moreover, Fullerton (2005) found that when customers develop an affective commitment to the brand during customer-brand relationships, customer switching intentions are likely to decrease. This attitude is closely tied to brand loyalty (e.g., Morgan and Hunt, 1994), which is a relevant dimension of brand equity (Aaker, 1996; Pappu et al., 2006).

Finally, some scholars have studied affective commitment as an antecedent of brand equity. For example, in the hospitality industry, Kimpakorn and Tocquer (2010) and Tsang et al. (2011) found that commitment has a positive influence on brand equity. Similarly, in the cosmetics industry, Mathew et al. (2012) showed a positive impact of brand commitment on brand equity. In a study on various service brands, including financial services, where affective commitment is essential due to the intangible and heterogeneous nature of service offerings, Sierra et al. (2017) provided empirical evidence of the positive influence of customer affective commitment on brand equity. Similarly, the study by Iglesias et al. (2019) found that customer affective commitment has a positive effect on brand equity in the banking industry. In line with this previous research, and considering commitment as inherently affective (Cook & Wall, 1980), we hypothesize that in the financial and hospitality services industries:

H5. Customer affective commitment will have a positive effect on brand equity.

The influence of co-creation on brand equity

In addition to linking customer affective commitment and customer trust with brand equity, previous studies have also proposed that co-creation is related to brand equity (e.g., Harmeling et al., 2017; Helm & Jones, 2010; Juntunen et al., 2013; Muniz & Guzmán, 2023; Parris & Guzman, 2023). As discussed above, favorable customer-brand relationships are central to any co-creation initiative, transforming customers from passive recipients of brand offerings to collaborative actors in the development of new or significantly improved products and/or services (Markovic & Bagherzadeh, 2018). This transformation is central to enhancing brand equity by focusing on building and maintaining favorable, strong, and long-term customer-brand relationships (e.g., Füller et al., 2009; Helm & Jones, 2010; Ind et al., 2017). By having favorable relationships with brands during co-creation initiatives, customers are likely to develop positive perceptions of and attitudes toward such brands (Ind et al., 2013). Accordingly, several scholars have found that co-creation has a positive effect on customer loyalty (e.g., Cossío-Silva et al., 2016), customer satisfaction (e.g., Solem, 2016), customer trust (e.g., Banytė et al., 2014), and customer commitment (e.g., Lundkvist & Yakhlef, 2004), all of which are considered to be dimensions of brand equity (e.g., Aaker, 1996; Kimpakorn & Tocquer, 2010).

Apart from studying the effect of co-creation on the dimensions of brand equity, prior research has also directly linked co-creation with brand equity. For example, Helm and Jones (2010) proposed that co-creation enhances the firm's ability to create and maintain favorable brand equity. Likewise, Juntunen et al. (2013) found that co-creation is a key determinant of brand equity construction, while Christodoulides et al. (2012) showed that user-generated content, as a form of co-creation, has a positive impact on brand equity. Using experimental methods, Roggeveen et al. (2012) confirmed a positive effect of co-creation on brand equity.

Moreover, recent studies have extended the relevance of co-creation to the CSR and B2B fields, thereby increasing its scope and impact (Iglesias et al., 2020, 2023; Markovic, Iglesias, et al., 2022; Markovic, Iglesias, & Ind, 2023). For instance, in their study on leveraging CSR for brand building, Muniz and Guzmán (2023) found that when customers perceive the brand as co-creative, this positively affects brand equity. Finally, in a B2B context, Zhang et al. (2015) provided empirical evidence of the positive impact of co-creation on brand equity. Following these findings across different settings and aiming to gain further empirical insights in the financial and hospitality services industries, we posit that in these two industries:

H6. Co-creation will have a positive effect on brand equity.

STUDY 1: A SURVEY-BASED RESEARCH DESIGN

Data collection and sample

The data were collected in Spain in 2016 using an online customer panel for the financial services industry, which was managed by Eurus e-i, an external company specialized in performing market studies. Regarding the participant recruitment process, the following strategies were used to ensure a representative sample. First, the individuals from the online customer panel were selected using filtering questions to make sure that they are part of the target population. The target population included participants from 18 to 65 years old living in Spain and having a bank account. Second, we created stratums according to census data from the Spanish National Institute of Statistics (including gender, age, and geographical location), and calculated the number of individuals needed in each stratum to ensure a representative sample, obtaining a result of about 2000 respondents. Then, the selected individuals from the online customer panel were invited to participate by email, which included a link to the survey. The recruitment process continued until each stratum was filled. The final sample consisted of 2008 customers with the following demographics (see Table 1): 49.8% were women, with age ranges from 18 to 65, with a median and an average age of 41. Some 7.3% of respondents had only completed primary school, 40.9% had completed secondary school, 25.5% had completed intermediate studies (between secondary school and

TABLE 1 Description of the sample.

	N	%
Geographical location		
Andalucía	339	16.9%
Aragón	52	2.6%
Principado de Asturias	57	2.8%
Islas Baleares	23	1.1%
Islas Canarias	60	3.0%
Cantabria	27	1.3%
Castilla- La Mancha	73	3.6%
Castilla-León	126	6.3%
Catalunya	346	17.2%
Comunidad Valenciana	248	12.4%
Extremadura	31	1.5%
Galicia	141	7.0%
La Rioja	6	0.3%
Comunidad de Madrid	296	14.7%
Comunidad Foral de Navarra	15	0.7%
País Vasco	90	4.5%
Región de Murcia	78	3.9%
Gender		
Male	1,009	50.2%
Female	999	49.8%
Age		
18–25	154	7.7%
26–35	488	24.3%
36–45	610	30.4%
46–55	508	25.3%
56–65	248	12.4%
Education		
Primary school	146	7.3%
Secondary school	821	40.9%
Intermediate studies	513	25.5%
University	528	26.3%
Social class		
Upper	519	25.8%
Middle	1,092	54.4%
Working	397	19.8%
Total	2,008	100.0%

university), and 26.3% were university graduates. Regarding their social class, 19.8% of respondents were working class, 54.4% were middle class, and 25.8% belonged to the upper class. Sampling errors were calculated for the sample of 2008 respondents, both for a confidence level of 95% and 99% (two sigma) and p = q, obtaining sampling errors of ±2.2% and ±2.9% respectively, which are considered acceptable. The sample size of 2008 participants is justified by the requirements of Structural Equation Modeling (SEM). According to Hair et al. (2019), for models comprising approximately 50 parameters (e.g., 4 constructs, 20 items, and 6 paths), a minimum of 500 cases is recommended (i.e., 10 cases per parameter). Our sample quadruples this threshold, ensuring statistical power greater than 99% for detecting small effects (MacCallum et al., 1996) and stability in parameter estimates. Furthermore, it is consistent with seminal studies on brand equity (Keller, 2016; Yoo & Donthu, 2001), in which samples exceeding 1,000 participants are standard for multivariate analyses. Finally, the post-hoc power analysis using Monte Carlo simulations in Mplus (Muthén & Muthén, 1998-2017) confirmed that, with n = 2008, the statistical power exceeds 95%.

TABLE 2 Constructs and items.

Constructs		Items*
Co-Creation (CC) Nysveen & Pedersen (2014)	*CC1*	I often find solutions to my problems together with the brand
	CC2	I am actively involved when the brand develops new solutions for me
	CC3	The brand encourages customers to create new solutions together
Customer Trust (CTR) Mende & Bolton (2011) Dagger et al. (2009)	*CTR1*	The brand keeps its promises
	CTR2	The brand can be trusted
	CTR3	The brand is trustworthy
Customer Affective Commitment (CAC) Mende & Bolton (2011)	*CAC1*	I enjoy being a customer of this brand
	CAC2	I have positive feelings regarding this brand
	CAC3	I feel attached to this brand
Brand Equity (BE) Yasin et al. (2012) Yoo et al. (2000)	*BE1*	Even if another brand has the same features as this brand, I would prefer to buy this brand
	BE2	If I have to choose among different brands offering the same type of service, I would definitely choose this brand
	BE3	Even if another brand has the same price as this brand, I would still buy this brand

**Likert scale ranging from 1 = "strongly disagree" to 7 = "strongly agree".*

Survey and measures

The survey was designed using and adapting multi-item scales from the literature to measure the constructs used in this study (Table 2). A double-blind back-translation process was applied to the survey to translate the items into Spanish. As the items were specific and simple, there was no need to adapt the scales to the Spanish cultural context, beyond direct translation. In addition, following the recommendations by Churchill (1979), the items were pre-tested in the following two ways. First, we sent the survey to several experts from the brand management field to assess the adequacy of the items and to ensure the avoidance of potential misinterpretation by respondents. The experts only gave minor suggestions for potential modifications. For instance, for the item "The brand can be trusted," the experts suggested restructuring the sentence to "Se puede confiar en la marca," as the literal translation "La marca puede ser confiada" is not a natural or commonly used phrasing in Spanish. Additionally, for the item "The brand is trustworthy," the experts recommended using "La marca es digna de confianza" instead of the literal translation "La marca es confiable," in order to make the wording more idiomatic and accessible to respondents, without altering the meaning. After introducing these minor modifications, which did not change the meaning of the original items, we tested the survey with several target respondents to assess how easy it was for them to understand the items. At this stage, no modifications were needed, and the final survey design was created.

In line with the research by Nysveen and Pedersen (2014), we measured co-creation (CC) as a first-order construct, consisting of three items (i.e., CC1: "I often find solutions to my problems together with the brand"; CC2: "I am actively involved when the brand develops new solutions for me"; CC3: "The brand encourages customers to create new solutions together"). Customer trust (CTR) was measured as a first-order construct, consisting of three items, which were taken from the research by Mende and Bolton (2011) and Dagger et al. (2009) (i.e., CTR1: "The brand keeps its promises"; CTR2: "The brand can be trusted"; CTR3: "The brand is trustworthy"). We measured customer affective commitment (CAC) with three items from Mende and Bolton (2011) (i.e., CAC1: "I enjoy being a customer of this brand"; CAC2: "I have positive feelings regarding this brand"; CAC3: "I feel attached to this brand"). To measure brand equity (BE), we used three items from the research by Yasin et al. (2012) and Yoo et al. (2000) (i.e., BE1: "Even if another brand has the same features as this brand, I would prefer to buy this brand"; BE2: "If I have to choose among different brands offering the same type of service, I would definitely choose this brand"; BE3: "Even if another brand has the same price as this brand, I would still buy this brand"). All responses for the items were recorded using a seven-point Likert scale, ranging from 1 = "strongly disagree" to 7 = "strongly agree".

Statistical analysis

We used structural equation modeling (SEM) to estimate the confirmatory factor models and the model of simultaneous equations with latent variables. SEM makes it possible to simultaneously analyze the observed and the latent variables in order to test the measurement model (Bollen, 1989). We used the well-known SEM package Mplus 8.7 (Muthén & Muthén, 1998-2017). As the variables in our research were assessed through seven-point Likert scales, the assumptions of normality were not fulfilled (Rivera & Satorra, 2002). Consequently, the method of estimation we adopted was the maximum likelihood parameter estimates with standard errors and the chi-square test statistic robust to non-normality (MLR) (Muthén & Muthén, 1998-2017). Thus, we considered the robust chi-square, robust RMSEA, SRMR, and robust CFI indexes as indicators of the model fit (Bollen, 1989; Hu & Bentler, 1999). The implication of using this method, with respect to other estimation methods, is that it ensures that the results are robust even if multivariate normality is not achieved, according to Muthén & Muthén (1998-2017).

To assess the measurement model, we followed the approach suggested by Bagozzi (1980, 2010) for validating multi-dimensional constructs: reliability, as well as convergent and discriminant validity. The standardized factor loadings need to be statistically significant and sufficiently large (i.e., above 0.70), and the R^2 must be above 50% (Bagozzi, 1980). At the same time, to measure the precision of each latent variable, we used the composite reliability (CR) values (McDonald, 1985), the average variance extracted (AVE) (Fornell & Larcker, 1981), and the Cronbach alpha coefficients (alpha) (Cronbach, 1951). The recommended CR and alpha values are above 0.70, whereas the threshold value for AVE is 0.50 (Bagozzi, 2010). With a given measurement model, the parameters of interest for the evaluation of discriminant validity are the square root of AVE and an estimation of the correlations among the latent variables. Furthermore, an analysis was performed to determine whether 1 lies within all the confidence intervals around the correlation estimate between any two factors (Anderson & Gerbing, 1988).

Regarding structural model evaluation, we first assessed models without indirect effects, and then we considered these effects (i.e., the latent variable mediation model). Thus, we evaluated the main effects to test the hypothesized relationships. Thereafter, we conducted a mediation analysis with both direct and indirect effects based on causal inference (Muthén & Muthén, 1998-2017).

Common method bias

We adopted ex-ante measures at the research design stage to control for the potential bias associated with the analysis of data obtained from the same respondents and in the same measurement context, using the same item context and similar item characteristics (Chang et al., 2010; Podsakoff & Organ, 1986). First, in the questionnaire, we included a psychological separation between predictor and criterion variables to prevent respondents from establishing a causal relationship between these variables and the various sequences of the indicators. Second, as mentioned above, a pretest of the survey was conducted. Third, we provided respondents with the opportunity to complete the survey anonymously and guaranteed complete confidentiality, making specific reference to current data protection legislation, and highlighting that there being no right or wrong answers, respondents should answer the survey questions as honestly as possible.

Despite these ex-ante measures to check for common method variance, we applied a modified test based on Lindell & Whitney's (2001) marker variable technique. We considered the marker variable of psychological risk that contains three items introduced by Keh & Pang (2010) (i.e., PR1: "The thought of using the services of this brand makes me feel psychologically uncomfortable"; PR2: "The thought of using the services of this brand causes me to experience unnecessary tension"; PR3: "I would worry a lot when buying the services of this brand"). We used this theoretically unrelated construct to: (1) determine the estimate of common method variance, which is the lowest of the absolute correlations between the marker variable and all the constructs (Lindell & Whitney, 2001); (2) adjust the correlations among the constructs in the model; and (3) conduct the test of differences between the adjusted and unadjusted correlations. We first controlled for the effect of a single unmeasured latent method factor. We estimated a single-factor confirmatory model for the 15 observed variables. This model had an unacceptable fit ($\chi^2[90] = 5462.15$, RMSEA = 0.172, SRMR = 0.134, and CFI = 0.742). Consequently, no single factor could explain either data structure. Second, we estimated a five-factor confirmatory model. The goodness-of-fit index for this model suggested we could not reject it ($\chi^2[80] = 325.33$, RMSEA = 0.039, SRMR = 0.025, and CFI = 0.988). Therefore, we analyzed the correlation between the marker variable and the four constructs of our model (Table 3). The lowest of the absolute correlations between the marker variable and the constructs was 0.08,

TABLE 3 Descriptive of the items and results of the measurement model (a survey-based research).

	Mean	STD	Co-creation	Customer trust	Customer affective commitment	Brand equity	R^2
Co-Creation							
CC1	3.92	1.85	0.89***				0.80
CC2	3.89	1.84	0.82***				0.67
CC3	3.99	1.79	0.88***				0.77
Customer Trust							
CTR1	4.89	1.53		0.88***			0.77
CTR2	5.08	1.57		0.94***			0.88
CTR3	5.10	1.57		0.94***			0.88
Customer Affective Commitment							
CAC1	4.44	1.72			0.89***		0.79
CAC2	4.75	1.64			0.92***		0.85
CAC3	4.56	1.68			0.78***		0.61
Brand Equity							
BE1	4.80	1.69				0.92***	0.84
BE2	4.83	1.67				0.93***	0.86
BE3	4.85	1.71				0.89***	0.79
alpha			0.90	0.94	0.89	0.94	
CR			0.86	0.92	0.86	0.91	
AVE			0.75	0.85	0.75	0.83	
Co-Creation			***0.87***	0.58	0.67	0.56	
Customer Trust			0.61*** [0.57,0.65]	***0.92***	0.80	0.78	
Customer Affective Commitment			0.70*** [0.66, 0.74]	0.81*** [0.77, 0.85]	***0.87***	0.81	
Brand Equity			0.60*** [0.56,0.74]	0.80*** [0.76,0.84]	0.83*** [0.79,0.86]	***0.91***	

***$p < 0.01$.
**$p < 0.05$.
*$p < 0.10$.
alpha: Cronbach Alpha; CR: Composite Reliability; AVE: Average Variance Extracted.
Correlations are below the diagonal and the confidence intervals are in brackets; adjusted correlations by marker variable (i.e., psychological risk: 0.08) are above the diagonal, and the square root of AVE is in italics-bold on the diagonal.
$\chi2$ [48] = 229.62, RMSEA = 0.043, SRMR = 0.023, CFI = 0.989.

indicating a low common source effect shared between constructs. We adjusted all the correlations among the constructs and conducted tests of differences between the adjusted and unadjusted correlations. All these tests failed to reach statistical significance at a 0.01 level, and the adjusted correlations among constructs were within the confidence intervals around the unadjusted correlations. Thus, we concluded that common method variance was not a very important issue in our study. Finally, as noted by Chang et al. (2010, p.180), "common method variance is more likely to emerge in models that are overly simple." As our model includes complex relationships (i.e., mediating effects), the test of our hypotheses should not be significantly influenced by common method variance. This means that our own theoretical model is likely to reduce common method variance per se.

Results

Table 3 presents the means of our observed variables, the target constructs' indicators. To evaluate the dimensional structure of the constructs, we estimated first-order four-factor models. Given the goodness-of-fit statistics for this model, we could not reject them ($\chi^2[48] = 229.62$, RMSEA = 0.043, SRMR = 0.023, and CFI = 0.989). Having not rejected the dimensional structure of the measurement model, we analyzed the estimated parameters. Table 3 shows the factor loading estimates and the reliability and validity coefficients of the target constructs. Regarding the estimated parameters, both the standardized factor loadings and the percentages of explained variance were significant and showed acceptable values ($\lambda > 0.78$ and $R^2 > 0.61$). Moreover, the coefficients of reliability and convergent validity of the latent variables considerably exceeded what are deemed to be acceptable values (alpha > 0.89, CR > 0.86, and AVE > 0.75). In addition, we evaluated discriminant validity by comparing the square root of the AVE of each construct with all the correlations among constructs. Table 3 shows that all the square root values of AVE were higher than all the correlations among constructs, and were not within the confidence intervals around the correlation. Thus, discriminant validity was supported.

Having tested the measurement model, we estimated the structural parameters representative of the six hypotheses that are postulated in this research (Figure 1; Table 4: Model 1A). The structural model is parallel to the measurement model, and thus the goodness-of-fit statistics are the same. Table 4 shows the estimated parameters of the structural model. The R^2 values for customer trust ($R^2 = 0.437$), customer affective commitment ($R^2 = 0.850$), and brand equity ($R^2 = 0.840$) were significant at $p < 0.01$. The results provided empirical support for the first five hypotheses. Thus, co-creation has a positive effect on customer trust (H1: $\beta = 0.661$, $p < 0.01$) and customer affective commitment (H2: $\beta = 0.296$, $p < 0.01$). Customer trust has a positive impact on customer affective commitment (H3: $\beta = 0.699$, $p < 0.01$) and brand equity (H4: $\beta = 0.143$, $p < 0.01$), and customer affective commitment has a positive influence on brand equity (H5: $\beta = 0.847$, $p < 0.01$). The last hypothesis, which proposed that co-creation will have a positive effect on brand equity, was not empirically supported (H6: $\beta = -0.082$, $p > 0.10$).

As one structural parameter was not significant, we re-estimated the model without this parameter (Table 4: Model 1B). The resulting more restrictive and parsimonious model exhibited a fair fit ($\Delta\chi2$ [1] = 2.35; $p > 0.10$). Table 4 shows the estimated parameters of this structural model with mediating effects. The R^2 values for customer trust ($R^2 = 0.436$), customer affective commitment ($R^2 = 0.843$), and brand equity ($R^2 = 0.830$) were significant at $p < 0.01$. The results indicated that the standardized indirect effect of co-creation on brand equity was 0.116 ($p < 0.01$; CC → CTR → BE) through customer trust, 0.211 ($p < 0.01$; CC → CAC → BE) through customer affective commitment, and 0.351 ($p < 0.01$; CC → CTR → CAC → BE) through customer trust and customer affective commitment. As the direct effect of co-creation on brand equity is not significant, this effect is fully mediated by customer trust and customer affective commitment and also follows the mediated path through

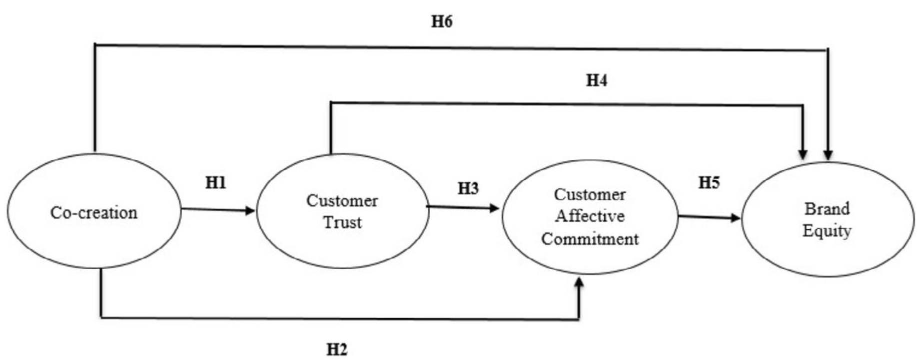

FIGURE 1 Model: a survey-based research design (study 1).

TABLE 4 Results of the structural models (a survey-based research).

Model 1A	Direct effect	SE	95% CI bias corrected	Result
H1: CC→CTR	0.661	0.016	[0.629; 0.693]	Supported
H2: CC→CAC	0.296	0.021	[0.254; 0.338]	Supported
H3: CTR→CAC	0.699	0.020	[0.659; 0.739]	Supported
H4: CTR→BE	0.143	0.050	[0.043; 0.243]	Supported
H5: CAC→BE	0.847	0.059	[0.729; 0.965]	Supported
H6: CC→BE	−0.082	0.060	[−0.202; 0.038]	Not Supported
Model 1B	**Indirect effect**	**SE**	**95% CI bias corrected**	
CC→CTR→BE	0.116	0.031	[0.054;0.178]	
CC→CAC→BE	0.211	0.018	[0.175;0.247]	
CC→CTR→CAC→BE	0.351	0.026	[0.299;0.403]	

Standardized parameters.
Model 1A. $\chi2$ [48] = 229.62, RMSEA = 0.043, SRMR = 0.023, CFI = 0.989.
Model 1B. $\chi2$ [49] = 232.33, RMSEA = 0.044, SRMR = 0.024, CFI = 0.989.

customer trust and then customer affective commitment (Figure 3: Study 1).

STUDY 2: RANDOMIZED LAB EXPERIMENT

To test for robustness and reinforce the survey results with data allowing for a strong test of causality, we complemented the survey results with an experiment in which we directly manipulated our hypothesized cause. Two factors were varied. First, we manipulated whether participants engaged in co-creation with a brand, as well as the level of involvement required by the co-creation task, to distinguish 'true' co-creation (i.e., a process in which new or significantly improved services stem from a genuine partnership with customers) from merely seeking feedback from customers on ideas that have already been developed internally. Varying the level of co-creation allowed us to directly test for the causal effect of co-creation on all the outcomes of interest. Second, we manipulated the industry of the brand with which participants engaged in co-creation, choosing a relatively high-reputation industry (i.e., hospitality services) and a relatively low-reputation industry (i.e., financial services, as in Study 1) with the aim of testing for generalizability.

Participants and procedure

The data were collected in Spain in 2018 using a randomized lab experiment. Participants were students at a large university in Spain. They were invited via email to participate in a study on brands' co-creation processes, and they joined in the experiment in exchange for €8. This produced a sample of 183 participants: 57.4% were women, and ages ranged from 18 to 37, with a median and an average age of 19. Upon their arrival in the lab, they were seated in front of a computer and informed that detailed instructions on the screen would guide them throughout the study, but that if anything was unclear, they should not hesitate to ask for help. After giving informed consent to participate in the study, the experiment started.

As mentioned above, the experiment was designed with two manipulated factors. The independent variables manipulated were the level of involvement in the co-creation process (i.e., high-involvement co-creation vs. low-involvement co-creation vs. no co-creation) and the industry to which the brand belonged (i.e., financial services vs. hospitality services). Participants were randomly assigned to one of 6 conditions of a 3 × 2 between-subjects experimental design.

In the financial services industry conditions, a large international bank supposedly planned to open a branch specializing in serving university students. The parent bank's name could not be revealed because of confidentiality issues, but the new branch would be called Apex. In the hospitality industry conditions, a large international hotel group supposedly planned to open a hostel soon, specifically addressing the needs of university students. The hotel group's name could not be revealed because of confidentiality issues, but the new hostel would be called Apex.

The high-involvement co-creation conditions were designed to mimic as closely as possible true, real co-creation activities embraced by brands. In these conditions, respondents participated in groups of 2 to 4. Participants were told that their task would be to help Apex create the ideal credit card/hostel. It was mentioned that halfway through the co-creation process, they would meet with a representative of Apex via Skype in an adjacent room so as to work together on the ideas and turn them into potentially implementable ones. Participants were given 10 minutes to work on their initial ideas. They were asked to list all the ideas that came to their mind regarding the features that they would like or find useful in a credit card/hostel, using paper and pencil provided on the desk. To avoid constraining or biasing the participants' ideas, no predefined guidelines or examples were provided regarding the specific features to be considered. This approach was intentionally designed to give participants the freedom to independently generate their own ideas, thereby enabling their creativity to emerge and flourish without the influence of pre-determined suggestions. By not imposing any limitations on the scope of features, we sought to cultivate an open environment where participants could fully engage their imaginations and explore a broad spectrum of possibilities. This also ensured that the participants' ideas were authentic and reflective of their individual preferences, values, and needs. When the 10 minutes were up, the computer made a 'beep' sound that participants heard through headphones. At this point, they were instructed to review all the features they had come up with and were given three minutes to select and refine their top 3–4 ideas. When all the participants had finished revising their ideas, the experimenter asked them to grab their paper and pencil and follow them to the adjacent room. The adjacent room featured 2 two-seater sofas facing a large screen. The experimenter established a Skype connection with the supposed Apex representative, in reality a confederate, who appeared on the screen. At this point, the experimenter left the room and mentioned they would come back in 15 minutes. The confederate asked the participants to present their ideas, and then they engaged in a joint discussion to refine them, enhance them, and develop them further. Participants discussed their ideas not only with the confederate but also with one another, engaging in a dynamic and collaborative dialogue. This interaction allowed them to complement one another's ideas, offering suggestions, refinements, and constructive feedback that contributed to the collective development of ideas. Through this interaction, participants not only refined their own contributions but also enhanced the overall quality of the co-created solutions. The interaction was very engaging and lasted about 15 minutes until the experimenter returned. Participants were then led back to the initial room to complete the remainder of the study. Back at their computers, they took 3 minutes to develop their top 1 or 2 ideas more fully (based on the discussion they had with the confederate and peers), and then inserted the paper(s) with their refined ideas inside an envelope, supposedly to be forwarded to the Apex representative. It was mentioned that a few days later, they would receive the final decision on what ideas Apex intended to implement.

In the low-involvement co-creation conditions, participants were told that their task would consist of helping Apex in the creation of the ideal credit card/hostel, by evaluating a series of features that Apex's design and innovation team had come up with. The features had been selected based on a pre-test in which respondents from the same subject pool were asked to list features of their ideal credit card/hostel. Regarding the credit card, these features could include the design (e.g., sleek, customizable, eco-friendly), functionalities like contactless payments and mobile wallet integration, rewards programs such as cash-back or travel points, and enhanced security features like two-factor authentication or virtual card numbers. Regarding the hostel, features could include an ambiance with themed rooms, layouts such as private rooms or dorms with privacy options, and communal spaces like lounges, game rooms, or kitchens. Other features might include free wifi, organized social events, and convenient food options. When doing the evaluation, participants should consider whether the proposed features would make their life easier/enhance their leisure travel as a university student. The key difference between the high-involvement and the low-involvement conditions is that, in the latter, the participants are submitting their individual feedback, without engaging in a deep discussion between them or with the Apex representative.

Finally, in the no co-creation conditions, participants were told that Apex wanted to create a credit card/hostel that specifically satisfied the needs of university students. They were shown features that Apex was considering offering, and they were asked to indicate what they thought of them. The key difference between the low-involvement and the no co-creation conditions was that in the former, Apex supposedly wanted their feedback, whereas in the latter, no mention was made of Apex wanting their feedback.

Measures

Participants in all conditions then completed a series of questions about Apex. Concretely, the questions were the same as in Study 1, albeit adapted to Apex. The last two questions, measuring co-creation, served as manipulation check questions. The items that followed measured customer trust (CTR), customer affective commitment (CAC), and brand equity (BE). These key measures were followed by two items measuring participants' level of fatigue. The two items assessing the level of fatigue (i.e., "Do you feel fatigued?" and "Was this study tiring for you?", were recorded on a seven-point Likert scale, ranging from 1: "not at all" to 7: "extremely") were intended to control for differences in fatigue between the high-involvement co-creation conditions and the other two co-creation conditions. This was followed by an open-ended question in which participants could express any thoughts they had during the experiment, and finally, demographic questions. In the low-involvement and no co-creation conditions, after answering the demographic questions, participants also completed a series of unrelated pretests. This was done to keep the total time spent at the lab equal across conditions. It was mentioned that although they had little information on which to base their answers, they should respond based on how they honestly and intuitively felt. It was highlighted that there were no right or wrong answers.

Internal validity

In order to present a preliminary perspective of the internal validity of the experiment, we began by carrying out an analysis of variance for one dependent variable by two factors (GLM Univariate) tests for mean comparisons between groups. This methodology allows us to determine if there are significant differences between groups in the two manipulated factors. We first ran an analysis of the variance in participants' levels of fatigue (Table 5). There were no significant effects across the two factors (co-creation $F(2, 177) = 0.745$, $p > 0.47$ and industry $F(1, 177) = 0.245$, $p > 60$), and the interaction ($F[2,177] = 0.969$, $p > 0.38$) (Table 5). Thus, there were no differences in fatigue.

Secondly, we performed the same analysis on participants' perceptions of co-creation. As expected, there was a main effect of involvement in the co-creation process ($F(2, 177) = 14.56$, $p < 0.01$), indicating that the manipulation worked as intended. Participants in the high-involvement co-creation conditions felt they had been involved in co-creation with Apex to a greater degree than participants in the low-involvement and no co-creation conditions (HighICC = 6.07 > LowICC = 5.41 > NoCC = 5.02, $p < 0.10$). There was also a significant main effect of industry ($F(1, 177) = 5.24$, $p < 0.02$). Participants in the hospitality services industry conditions felt they had been involved in co-creation with Apex to a greater degree than participants in the financial services industry conditions (5.67 vs. 5.32, respectively). However, the interaction between co-creation and industry was not significant ($F[2, 177] = 0.660$, $p > 0.50$). Thus, the analysis reported below collapses across industry conditions. These results suggest that our experiment (i.e., to expose the participants to HighICC, LowICC, and NoCC by industries) has no significant effects on fatigue and significant positive effects on the self-reported levels of their perceptions of co-creation.

Results

Once we preliminarily confirmed the positive effects of participants' perceptions of co-creation, we proceeded to undertake a post-hoc analysis in order to test our hypotheses. To begin with, to evaluate the dimensional structure of the constructs, we estimated a first-order three-factor model (i.e., customer trust, customer affective commitment, and brand equity). Given the goodness-of-fit statistics for this model, we could not reject it ($\chi^2[24] = 87.96$, RMSEA = 0.079, SRMR = 0.064, and CFI = 0.946). Regarding the estimated parameters (Table 6), the coefficients of reliability and convergent validity of the latent variables showed acceptable values (alpha > 0.70, CR > 0.70, and AVE > 0.50). All the square root values of AVE were higher than all the correlations among constructs. Thus, construct validity was supported.

Having tested the measurement model, we estimated the structural parameters representative of the six hypotheses (Figure 2, Table 7: Model 2A). We used dummy variables for the high-involvement and low-involvement co-creation conditions (HighICC/LowICC), and the control group represented the no co-creation conditions (NoCC). We could not reject this model ($\chi^2[36] = 104.08$, RMSEA = 0.079, SRMR = 0.056, and CFI = 0.943). Table 7 shows the estimated parameters of the structural model. The R^2 values for customer trust ($R^2 = 0.044$), customer affective commitment ($R^2 = 0.191$), and brand equity ($R^2 = 0.369$) were significant at $p < 0.01$.

The results provided empirical support for four hypotheses. Namely, (high-involvement) co-creation has a positive effect on customer trust (H1: $\beta = 0.240$, $p < 0.01$). Customer trust has a positive impact on customer affective commitment (H3: $\beta = 0.441$, $p < 0.01$) and on brand equity (H4: $\beta = 0.270$, $p < 0.01$), and customer affective commitment has a positive influence on brand equity (H5: $\beta = 0.399$, $p < 0.01$). The second and sixth hypotheses, which proposed that (high-involvement) co-creation will

TABLE 5 Descriptive of the manipulation check questions and participants' levels of fatigue.

	No co-creation			Low-inv. co-creation			High-inv. co-creation			Total		
	Bank	Hostel	Total	Bank	Hostel	Total	Bank	Hostel	Total	Bank	Hostel	Total
Co-Creation	**4.77**	**5.30**	**5.02**	**5.18**	**5.63**	**5.41**	**6.02**	**6.13**	**6.07**	**5.32**	**5.67**	**5.49**
CC2	4.13	5.17	4.63	4.63	5.39	5.02	5.75	5.86	5.80	4.84	5.46	5.14
CC3	5.41	5.43	5.42	5.73	5.87	5.80	6.28	6.39	6.33	5.81	5.89	5.85
Fatigue	**1.89**	**1.70**	**1.80**	**1.57**	**1.84**	**1.70**	**1.84**	**1.98**	**1.91**	**1.77**	**1.84**	**1.80**
FAT1	2.19	2.10	2.15	1.77	2.23	2.00	1.97	2.25	2.10	1.98	2.19	2.08
FAT2	1.59	1.30	1.45	1.37	1.45	1.41	1.72	1.71	1.72	1.56	1.48	1.52
N	32	30	62	30	31	61	32	28	60	94	89	183

CC2: I have been actively involved in developing new solutions with Apex.
CC3: Apex encourages customers to create new solutions together.
FAT1: Do you feel fatigued?
FAT2: Was this study tiring to you?
**Likert scale ranging from 1 = "strongly disagree" to 7 = "strongly agree".*

TABLE 6 Descriptive of the items and results of the measurement model (a randomized lab experiment).

	Mean	STD	Customer trust	Customer affective commitment	Brand equity	R^2
Customer Trust						
CTR1	4.75	1.12	0.81***			0.66
CTR2	5.07	1.09	0.94***			0.88
CTR3	5.02	1.10	0.89***			0.79
Customer Affective Commitment						
CAC1	5.95	1.01		0.77***		0.59
CAC2	6.15	0.87		0.87***		0.69
CAC3	4.38	1.51		0.60***		0.36
Brand Equity						
BE1	4.46	1.38			0.87***	0.76
BE2	4.50	1.37			0.95***	0.90
BE3	4.55	1.38			0.91***	0.83
alpha			0.91	0.72	0.93	
CR			0.88	0.73	0.91	
AVE			0.78	0.55	0.83	
Customer Trust			***0.88***			
Customer Affective Commitment			0.44*** [0.30,0.57]	***0.74***		
Brand Equity			0.47*** [0.34,0.59]	0.53*** [0.40,0.65]	***0.91***	

***p < 0.01.
**p < 0.05.
*p < 0.10.
alpha: Cronbach Alpha; CR: Composite Reliability; AVE: Average Variance Extracted.
Correlations are below the diagonal, and the confidence intervals are in brackets, and the square root of AVE is in italics-bold on the diagonal.
$\chi2[24] = 87.96$, RMSEA = 0.079, SRMR = 0.064, and CFI = 0.946.

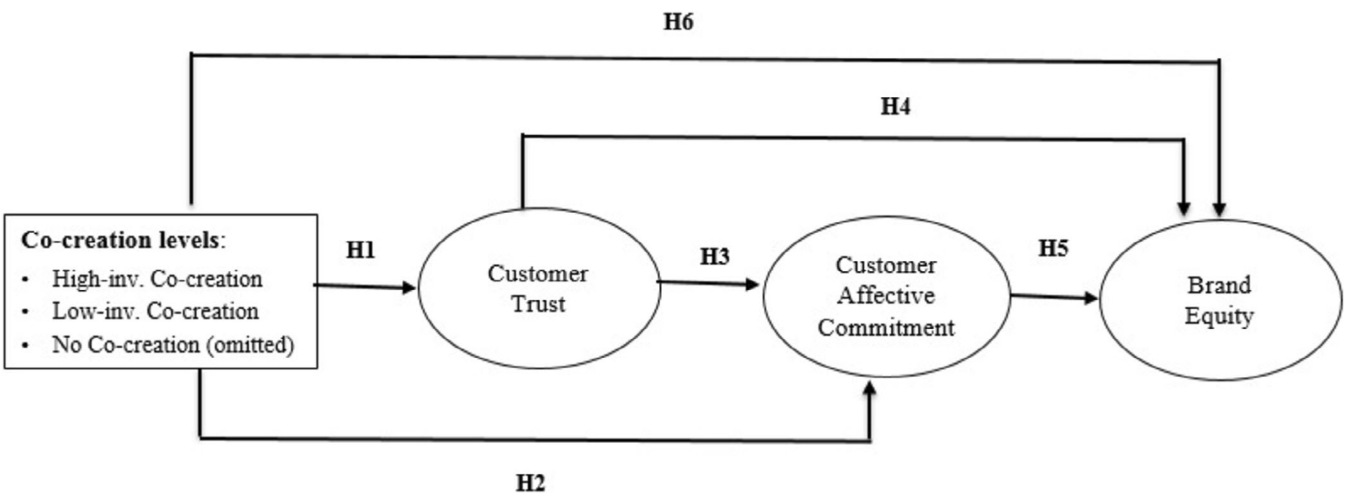

FIGURE 2 Model: a randomized lab experiment (study 2).

have a positive effect on customer affective commitment and on brand equity, were not empirically supported (H2: $\beta = -0.034$, $p > 0.10$; and H6: $\beta = 0.128$, $p > 0.10$).

As some structural parameters were not significant (i.e., all the effects of LowICC, HighICC→CAC, and HighICC→BE), we re-estimated the model without these parameters (Table 7: Model 2B). These parameters were removed in accordance with the principle of parsimony in SEM, which advocates for estimating the fewest number of parameters necessary to adequately explain the data (e.g., Aiken & West, 1991; Babyak, 2004; Burnham & Anderson, 2002). The resulting, more

TABLE 7 Results of the structural model (a randomized lab experiment).

Model 2A	Direct effect	SE	95% CI bias corrected	Result
H1: HighICC→CTR	0.240	0.085	[0.070; 0.410]	Supported
LowICC→CTR	0.091	0.086	[−0.081; 0.263]	
H2: HighICC→CAC	−0.034	0.088	[−0.210; 0.142]	Not Supported
LowICC→CAC	−0.027	0.087	[−0.201; 0.147]	
H3: CTR→CAC	0.441	0.074	[0.293; 0.589]	Supported
H4: CTR→BE	0.270	0.076	[0.118; 0.422]	Supported
H5: CAC→BE	0.399	0.076	[0.247; 0.551]	Supported
H6: HighICC→BE	0.128	0.074	[−0.020;0.276]	Not Supported
LowICC→BE	−0.037	0.073	[−0.183;0.109]	
Model 2B	**Indirect effect**	**SE**	**95% CI bias corrected**	
HighICC→CTR→BE	0.060	0.027	[0.006;0.114]	
HighICC→CTR→CAC→BE	0.034	0.016	[0.002;0.066]	

Standardized parameters.
Model 2A. The control group was "no co-creation conditions".
Model 2A. $\chi2$ [36] = 104.08, RMSEA = 0.070, SRMR = 0.056, CFI = 0.943.
Model 2B. The control groups were "low involvement co-creation conditions" and "no co-creation conditions".
Model 2B. $\chi2$ [32] = 103.11, RMSEA = 0.080, SRMR = 0.066, CFI = 0.940.

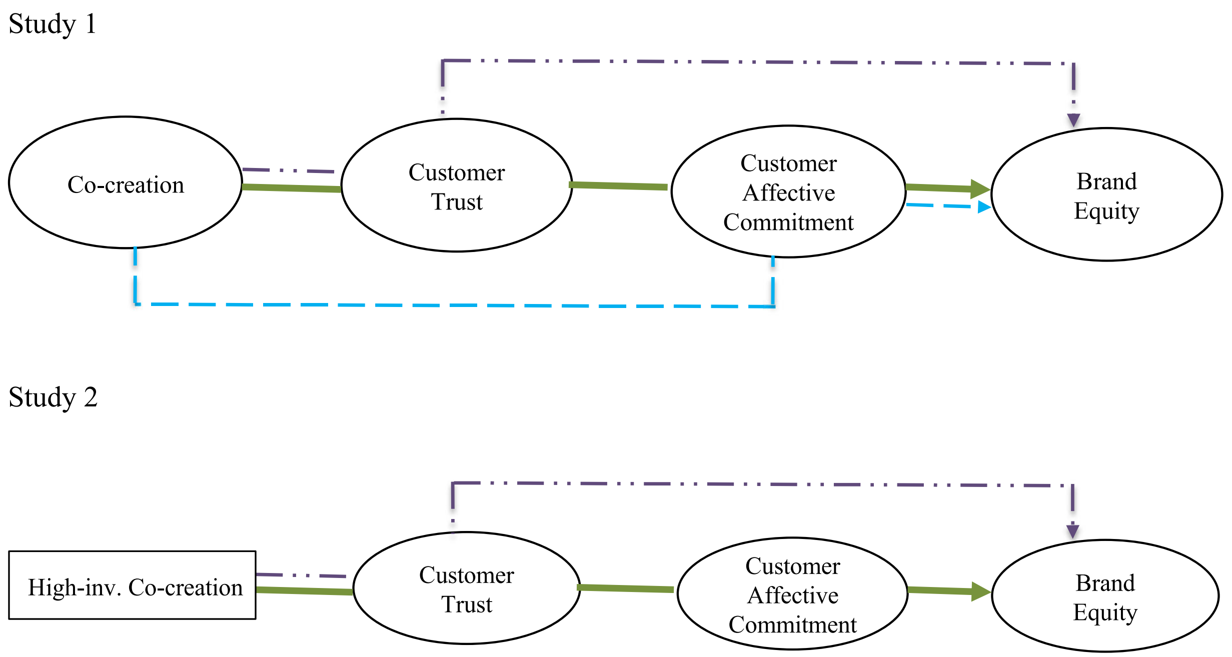

FIGURE 3 Results of the mediation effects.

restrictive and parsimonious model exhibited a fair fit (χ^2[32] = 103.11, RMSEA = 0.080, SRMR = 0.066, and CFI = 0.940). Table 7 shows the estimated parameters of this structural model with mediating effects. The R^2 values for customer trust ($R^2 = 0.040$), customer affective commitment ($R^2 = 0.190$), and brand equity ($R^2 = 0.349$) were significant at $p < 0.01$. The results indicated that the standardized indirect effect of (high-involvement) co-creation on brand equity was 0.060 ($p < 0.01$) through customer trust, and 0.034 ($p < 0.01$) through customer trust and customer affective commitment. As the direct effect of (high-involvement) co-creation on brand equity is not significant, this effect is fully mediated by customer trust and also follows the mediated path through customer trust and then customer affective commitment (Figure 3: Study 2).

DISCUSSION AND CONCLUSIONS

Theoretical contributions

Even if manifold brands are increasingly embracing co-creation to develop new or significantly improved products and/or services (Markovic & Bagherzadeh, 2018), not many are aware of its potential for more intangible, brand-building purposes (Markovic, Gyrd-Jones, et al., 2022), such as strengthening the brand image (Iglesias et al., 2020), and ultimately increasing brand equity. Additionally, it is still not evident how brands can realize the full potential of co-creation. Uncertainty exists because, whilst some of the existing research has found that co-creation positively influences brand equity (e.g., Christodoulides et al., 2012; Muniz & Guzmán, 2023; Roggeveen et al., 2012; Zhang et al., 2015), other studies have shown only marginal or even negative effects (e.g., Kristal et al., 2016, 2018), and some failure cases of co-creation have been reported (e.g., Lund et al., 2020; Quach & Thaichon, 2017; Vallaster et al., 2018). These previous mixed findings highlight the need to unpack the relationship between co-creation and brand equity, and examine which mediating variables related to the co-creation process can help ensure that co-creation enhances brand equity. Our work has addressed this research need and thereby generated several theoretical contributions.

Study 1 contributes to the literature by showing that the impact of co-creation on brand equity is fully mediated by customer trust and customer affective commitment. This is a relevant contribution because it suggests that involving customers in co-creation activities is not likely to generate higher levels of brand equity unless trust and affective commitment are developed. This is consistent with the commitment–trust theory in relationship marketing (Morgan & Hunt, 1994), which proposes that these two variables are key to building strong and long-lasting relationships, which are at the core of the concept of brand equity. Surprisingly, however, the commitment–trust theory has been largely neglected in the co-creation literature, while representing a well-suited approach to examine deep brand–customer relationships, which are also essential in co-creation processes.

On one hand, developing customer trust is important if service brands want to turn their co-creation initiatives into higher levels of brand equity. This is most probably because services are highly heterogeneous in nature (Zeithaml et al., 1985). As the same service may vary depending on the employee delivering it, the customer using it, and the moment of usage, trust can act as a guarantee that decreases customer perceived risk (Dall'Olmo Riley & de Chernatony, 2000). Additionally, ensuring that a co-creation project generates customer trust is valuable at the brand level because it reinforces the customer's assumption that the brand will be reliable during the entire brand–customer relationship. This is consistent with the results of previous studies (e.g., Chen, 2010; Delgado-Ballester & Munuera-Alemán, 2005; Iglesias et al., 2020; Muniz & Guzmán, 2023; Wang et al., 2020). On the other hand, generating customer affective commitment, thus making an emotional connection with customers, is also key if service brands want to turn co-creation into higher levels of brand equity. This is probably due to the intangible and heterogeneous nature of services (e.g., Zeithaml et al., 1985), which makes it more difficult for customers to evaluate services than goods (Athanassopoulos et al., 2001). For this reason, when customers develop affective commitment to a brand as a consequence of their involvement in co-creation (e.g., Iglesias et al., 2013), they tend to be more positive when evaluating the service performance and even tend to relate service failures to external circumstances, which is likely to boost brand equity.

So as study 1, study 2 shows that the direct effect of (high-involvement) co-creation on brand equity is not significant. However, in study 2, there is not a full mediation effect via customer affective commitment. Instead, study 2 shows that the effect of (high-involvement) co-creation on brand equity is fully mediated only by customer trust, and it also provides support for the mediated path through customer trust and then customer affective commitment. These results underscore the central role that customer trust plays in turning (high-involvement) co-creation into higher levels of brand equity and, subsequently, the importance for brands to prioritize the development of customer rational responses (trust) over the emotional ones (affective commitment). This is consistent with the commitment–trust theory, which argues that "because commitment entails vulnerability, parties will only seek trustworthy partners" (Morgan & Hunt, 1994, p. 24). From this perspective, and in line with the results of our research, affective commitment is an emotional response that emerges over time (Fullerton, 2005) and which has trust as a major determinant.

Interestingly, study 2 shows that the positive impact of co-creation on customer trust only exists in the high-involvement conditions. This is likely because, in high-involvement conditions, customers feel more engaged and valued, with the sense that their input directly influences the shaping of the service, and thereby develop stronger trust in the brand. In contrast, in low-involvement conditions, where co-creation is typically used to gather surface-level feedback, customers may not perceive their contributions as impactful, which can inhibit the development of customer trust. This emphasizes the importance of strategically embracing co-creation by fostering deep interactions with the customers, rather than using them to obtain superficial feedback on internally generated service ideas. This finding resonates with the results from Ind et al. (2017), who, in their "co-creation continuum," underscore that, to be able to realize the full potential of co-creation, brands need to embrace it strategically, considering customers as key partners with whom deep collaborative relationships ought to be established and maintained over time.

Overall, both studies suggest that engaging in co-creation, per se, is not likely to result in improved brand equity, namely in a greater strength of the brand in customers' minds. Thus, merely by involving themselves in co-creation with a given brand, customers are unlikely to prefer that brand over other brands offering the same or similar services. The reasons could lie in the specific characteristics of the financial services and hospitality contexts, where the nature of the services – often unreliable and unpredictable – necessitates a high level of trust and affective commitment. Here, our research shows that co-creation can help to generate such customer trust and customer affective commitment (the latter via customer trust in study 2). Thus, our research builds on the previously dominant co-creation literature, which argues that co-creation is a key tool to generate relevant product and/or service innovations (e.g., Frow et al., 2015; Markovic & Bagherzadeh, 2018), by showing that co-creation is also a critical tool for achieving intangible brand-related outcomes, such as higher levels of customer trust, customer affective commitment, and, ultimately, brand equity. This is a relevant perspective that has not received enough scholarly attention, despite previous tentative claims in the brand co-creation literature highlighting the potential of building brands together with customers (e.g., Iglesias et al., 2020; Kennedy & Guzmán, 2016; Markovic, Gyrd-Jones, et al., 2022).

Finally, our research sheds light on the contradictory findings in the literature. First, while the majority of studies present a positive perspective on the outcomes of co-creation, our research suggests that the impact of co-creation on customers' perceptions and attitudes may vary depending on their level of involvement in the co-creation process. This resonates with the findings of Kristal et al. (2016), which show only a marginal effect of co-creation on brand equity among non-integrated consumers – those who are not actively involved in the co-creation process. Second, the literature on co-destruction (Kristal et al., 2018; Lund et al., 2020; Quach & Thaichon, 2017; Vallaster et al., 2018) suggests that it tends to occur when participants hold values that differ from those of the co-creating brand (Vallaster et al., 2018), and when they are not emotionally connected or affectively committed to the brand (Lund et al., 2020). In this regard, our study reinforces the crucial role that customer affective commitment plays in turning co-creation into enhanced brand equity (study 1), but also underscores the importance of customer trust in enabling such affective commitment (studies 1 and 2). Interestingly, the commitment-trust theory (Morgan & Hunt, 1994) proposes that both commitment and trust are fostered by the presence of shared values with the brand. Third, co-destruction seems to be especially prominent in online environments (Lund et al., 2020; Quach & Thaichon, 2017). In this regard, our research conducted in offline environments highlights the key role that in-person interactions play in co-creation processes, enabling the development of higher levels of trust and affective commitment (via trust only in study 2). This resonates with the findings of Ind et al. (2017), which show that realizing the full potential of co-creation necessitates ongoing, long-term personal relationships that are rich in trust and affective commitment.

Managerial implications

Our findings provide several important managerial implications, especially for brands operating in the services sector. First of all, managers should be aware of the potential of co-creation, not only to generate relevant product and/or service innovations but also for brand-building processes. Embracing co-creation can be particularly relevant in sectors characterized by low levels of customer trust and high levels of customer detachment, especially those facing serious reputational challenges. This is, for instance, the case of the financial services industry, which has suffered reputational damage due to scandals involving unethical practices in the past. Interestingly, the traditional approach that brands have adopted to address such challenges and attempt to reshape customer perceptions has been to invest in corporate social responsibility (CSR) (Markovic, Iglesias, et al., 2022; Sen & Bhattacharya, 2001). However, CSR initiatives are currently facing a legitimacy crisis (Iglesias et al., 2020). In many cases, CSR remains largely disconnected from the brand's core strategy, making it appear inauthentic and reactive (Markovic, Iglesias, et al., 2022). Moreover, widely publicized instances of greenwashing practices have further contributed to the broader legitimacy crisis surrounding CSR (Skarmeas et al., 2014). Thus, if brands want to avoid using CSR for the above-mentioned reasons, our research suggests that they can use co-creation to boost customer trust, and thereby improve customer affective commitment and ultimately brand equity. One way to do so is to integrate co-creation into the brand's core strategy. More specifically, brands could develop strategic co-creation programs that focus on service improvements to demonstrate their trustworthiness and foster continued customer engagement. To do this effectively, brands should follow several key steps. First, they should actively invite customer input by creating accessible platforms (e.g., feedback portals, interactive workshops) that encourage participation. Second, they need to ensure transparency throughout the co-creation process, clearly communicating how customer input is being used and what impact it has. Third, brands should regularly iterate and refine services based on this input, showing a clear feedback loop that validates customer contributions. A good example of this in action is BNP Paribas and its introduction of a simplified information-sharing program, which was developed in response to the growing customer demand for more transparent and efficient financial services solutions. By streamlining the way information is communicated and involving customers in shaping the solution, BNP Paribas not only addressed a critical need but also reinforced its commitment to co-creation. This approach shows how co-creation, when strategically managed, can build long-term trust and deepen customer engagement, particularly in industries where clarity, reliability, and responsiveness are essential to the brand-customer relationship.

Moreover, brands should understand the importance of making the brand-customer relationship a genuine one. As study 2 shows, the positive impact of co-creation on customer trust only exists in the high-involvement conditions, where customers are truly involved in co-creation by actively interacting with the brand to generate new relevant services together, rather than just providing feedback on internally generated ideas. This implies that if managers want to realize the full potential of co-creation and embrace a genuine partnership with their customers, they must break down the internal cultural barriers. This often requires a cultural shift. Many brands are still guided by hierarchical, inward-looking mindsets that – at least in part – resist external input. To overcome this obstacle to co-creation, managers should cultivate an organizational culture grounded in openness, transparency, and collaboration. Importantly, to unlock the full potential of co-creation, this culture ought to be embedded throughout all departments and business units; not just within innovation or R&D teams. This can be achieved through targeted training programs that build collaborative and customer-focused skills, along with communication initiatives that consistently reinforce co-creation values across the organization. Internal storytelling, leadership endorsement, and clear recognition of cross-functional efforts can further help embed these principles into everyday practice, making co-creation a shared responsibility rather than a siloed function.

Additionally, managers should also bear in mind that, to build the above open, transparent, and collaborative culture, they need to foster a leadership style that emphasizes humility, empathy, and the importance of authentic listening (Iglesias et al., 2020). This means being open to critique, responsive to customer insights, and willing to co-own brand development with customers. A successful case of this approach is First Direct, which enabled customers to directly contribute to the development of the new services within their app. This is also an example of strategic responses to the currently shifting economic, technological, and competitive business environments, in which co-creation can provide a crucial competitive advantage, especially for brands operating in service industries.

Limitations and future research suggestions

Notwithstanding its theoretical and managerial implications, this research also has some limitations. First, Study 1 was conducted entirely with customers from Spain, which limits the generalizability of the findings. Cultural context plays a critical role in shaping how customers perceive and engage with brands, particularly in service settings where interactions are more personal and experience-driven (Imrie, 2005). Spanish customers tend to place a high value on their personal relationships and emotional bonds with brands, aligning more closely with collectivistic cultures such as China, rather than with individualistic cultures like the United States (Liu et al., 2001). Moreover, Spanish customers are generally more attuned to intangible cues (e.g., emotional resonance) when evaluating service brands. In contrast, customers from individualistic cultures tend to prioritize tangible attributes (e.g., attributes and pricing) (Mattila, 1999). Thus, understanding cultural nuances is essential for developing contextually-relevant co-creation initiatives. Even though the participants in Study 2 had 23 different nationalities, which helps to mitigate the above-mentioned generalizability concern to some extent, future research should test our model in countries with relevant cultural differences to determine whether the relationship between co-creation and brand equity would become significant in more individualistic contexts, and explore the role that cultural values may eventually play in this relationship. Moreover, it would be relevant to examine the moderating role of key cultural factors, such as power distance or uncertainty avoidance, in the relationships between (a) co-creation and customer trust, and (b) co-creation and customer affective commitment, as such cultural factors may alter the impact co-creation has on customer trust in brands and affective commitment to them.

Second, although the sample is representative of two service industries (i.e., financial services and hospitality services), the external validity of the findings remains a limitation. Thus, future research could investigate whether the results of our hypothesized model would be the same in other service industries, where co-creation plays a particularly central role. For instance, in the healthcare industry, co-creation between providers and patients is increasingly recognized as essential for delivering personalized and effective care, making it a relevant context for testing our model's external validity. Similarly, the technology sector – particularly in user-driven innovation platforms or software development communities – heavily relies on co-creation to shape products and services, which can influence customer perceptions of and attitudes toward brands, as well as brand equity. Thus, the technology sector also represents a suitable context for further validating our model. Moreover, future research could also replicate our model in B2B contexts. B2B relationships often involve more complex, long-term engagements and mutual commitments between brands and customers compared to business-to-consumer (B2C) environments (e.g., Sierra et al., 2017), which may alter the roles of customer trust and customer affective commitment. It would be especially interesting to examine whether there would be any changes related to the role of customer trust, as B2B relationships tend to be more rational in nature than those in a B2C context.

Third, our research relies on self-reported data, which may introduce some biases (e.g., social desirability bias, mood-related bias, situational bias) potentially compromising the validity of our findings. To at least partially mitigate the issue of social desirability, during the data collection process, we informed respondents that their answers would be anonymized and only used at an aggregated level. However, future research could employ longitudinal designs to track changes in brand equity over time following specific co-creation initiatives. Collecting data at multiple time points could help to mitigate the influence of diverse biases (e.g., mood-related and situational biases) on participants' responses by allowing for the evaluation of the stability and consistency of their perceptions over time. Additionally, real-world case studies – particularly those using multiple data sources including direct observation and objective data – could further help to overcome the biases of self-reported data and offer a richer, more nuanced understanding of how co-creation impacts brand equity in practice.

Fourth, the use of fictitious brands in study 2 may also represent a limitation of our study. As participants did not have ex-ante background information about these brands, their responses might have been different from those with real brands. Moreover, although we have tried to design the lab experiment as close to reality as possible, the experimental settings and manipulations used in study 2 may not be fully aligned with real-life settings and co-creation initiatives. To address these issues, future research should complement our study via a field experiment with real brands that are well established in the service sector and have high levels of awareness in their respective service industries, considering the real co-creation practices embraced by such brands.

There are also other interesting avenues for future research. For instance, it would be interesting to investigate the ethical challenges and implications of involving customers in co-creation initiatives in service contexts. On the one hand, it would be relevant to understand the ethical expectations of participants involved in service co-creation. On the other hand, it would also be interesting to explore the managerial practices that need to be promoted to ensure that the ethical expectations of the participants in co-creation initiatives are met. In addition, following the emerging literature on business ethics and brands with a conscience, it would be relevant to investigate how co-creation processes can be used to develop innovations aimed at creating value not only for the brand and its customers but also for society and the environment.

AUTHOR CONTRIBUTIONS

Stefan Markovic: Conceptualization; investigation; methodology; project administration; supervision; validation; visualization; writing – original draft preparation; writing – review and editing. **Oriol Iglesias:** Conceptualization; investigation; resources; supervision; validation; writing – original draft preparation; writing – review and editing. **Anna Torres:** Conceptualization; investigation; writing – original draft preparation; writing – review and editing. **Pilar Rivera-Torres:** Formal Analysis; investigation; methodology; validation; visualization; writing – original draft preparation; writing – review and editing. **Nikolina Koporcic:** Conceptualization; investigation; validation; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors do not have any conflict of interest.

DATA AVAILABILITY STATEMENT

The data used in this research is confidential.

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