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Technical efficiency, combination of innovation strategies and group membership

Manuel Guisado-González, Jennifer González-Blanco and
 María del Mar Rodríguez-Domínguez
University of Vigo, Vigo, Spain

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Abstract

Purpose – This research aims to study the impact that the interaction between internal R&D and R&D cooperation has on the technical efficiency of firms, as well as to analyse whether firms belonging to a group achieve any additional level of technical efficiency.

Design/methodology/approach – We employ the stochastic frontier version of a knowledge production function, particularly the inefficiency model, and we combine the stochastic frontier analysis (SFA) and the complementarity approach.

Findings – The interaction between internal R&D and R&D cooperation has a positive and significant impact on technical efficiency when the complementarity test is applied between companies belonging to a group, and there is no interaction when they do not belong to a group.

Practical implications – Knowing this type of information in advance is critical for managers and policymakers, as it allows them to avoid undesirable combinations of innovation strategies or contexts not favourable for their implementation, as well as the formulation of policies leading to an efficient allocation of public resources.

Originality/value – To the best of the authors' knowledge, this paper contributes an original approach in evaluating the complementarity of internal R&D and R&D cooperation from the perspective of technical efficiency and group membership, combining the SFA and the complementarity approach.

Keywords Internal R&D, R&D cooperation, Business group, Complementarity approach, Stochastic frontier analysis

Paper type Research paper

1. Introduction

At present, the flows of knowledge required by companies to sustain success are increasingly complex and have a very heterogeneous territorial and sectoral origin. As a result, a large number of companies cannot access all the technological knowledge they need to carry out their innovation activities through their internal R&D (Park *et al.*, 2004), and moreover, due to their strategic nature and their proximity to the so-called technological frontier, this knowledge is often not available on the market. In situations of this nature, the available alternative lies in the establishment of R&D cooperation agreements with other public and private organisations (Park *et al.*, 2004). Thus, R&D cooperation agreements pose an alternative that companies can use to complement their internal R&D capabilities (Vanhaverbeke *et al.*, 2002) by accessing the advanced technological knowledge of interest possessed by relevant partners (Rothaermel, 2001).

Now, the absorption of knowledge from these partners is not achieved by simple contact with them (Escribano *et al.*, 2009). In addition to occasional or intentional contact, companies need to possess a plethora of resources and skills that allow them to recognise the value of new external knowledge, assimilate it, and, finally, be in a position to use this knowledge for

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commercial purposes (Todorova and Durisin, 2007). In short, prior to the establishment of R&D cooperation agreements, companies must build a powerful absorption capacity (Cohen and Levinthal, 1989).

Not only is there a direct and positive influence of internal R&D and R&D cooperation on the productivity of companies, but there is also an indirect impact, derived from the potential complementary/substitutive relationship between both innovation strategies. This potential complementary effect stems from the dual nature of internal R&D (Cohen and Levinthal, 1989), as this process generates new knowledge and increases the company's ability to detect and integrate knowledge flows from other organisations. Therefore, the more a company invests in internal R&D, the more likely it is that the company will try to take advantage of external knowledge flows. In addition, as the company increasingly uses these external knowledge flows, the company will also have to correspondingly increase its internal R&D capacity (Becker and Dietz, 2004).

However, empirical studies on the complementarity between internal R&D and R&D cooperation have not led to conclusive results. Some studies have found that both strategies are complementary (e.g. Schmiedeberg, 2008), while others have concluded that they are substitutive (e.g. De Marchi, 2012). This heterogeneous behaviour does not constitute an idiosyncratic characteristic of the relationship between both strategies but is instead common to the interaction of the different innovation strategies (Catozzella and Vivarelli, 2014). In this regard, Cassiman and Veugelers (2006) have previously pointed out that there are characteristics of companies that favour complementarity, while others hinder it. For example, Hagedoorn and Wang (2012) have found that the existence of complementarity/substitutability is conditioned by the previous level reached by the corresponding internal R&D. In the same vein, it is worth pointing out that some studies have shown that the results of R&D activity are strongly conditioned by belonging to a group of companies (Cefis *et al.*, 2009; Hsieh *et al.*, 2010), to the extent that many R&D strategies are relatively frequently conceived and developed within these kinds of groups. However, to the best of our knowledge, there is a dearth of literature that analyses the influence of belonging to a group of companies on the results achieved at the R&D level, and we are not aware of any study that has analysed this influence from the complementarity approach. This is one of the gaps that this study aims to fill, thus contributing to expanding the existing literature on the influence of business groups on the results of innovation processes.

In addition, it is also worth noting that existing studies have analysed the relationship between different R&D strategies and some measures of firms' innovative performance. But to our knowledge, these studies have not used technical efficiency as a measure of innovative performance, even though differences in technical efficiency between firms reflect greater or lesser proximity to the corresponding innovation frontier. Consequently, in this study, we use technical efficiency as a measure of innovative performance, thus filling the existing knowledge gap and broadening the framework for analysing the impact of different innovation strategies on the innovative performance of companies.

Finally, as a consequence of the two gaps we try to fill, we combine the stochastic frontier analysis (SFA) and the complementarity approach in order to estimate the coefficients of the model we propose. This procedure in empirical research, to the best of our knowledge, is also a novelty.

In summary, the specialised literature is still at an early stage in terms of analysing the characteristics of companies that can act as catalysts for the complementarity between internal R&D and R&D cooperation. In this sense, regarding the complementarity between these two innovation strategies and the characteristics of the companies that have some kind of influence on it, this study makes two important contributions.

Firstly, for the extant analysis of complementarity, most of the studies that have used data from the Community Innovation Survey tend to regress companies' labour productivity (e.g. Belderbos *et al.*, 2004), or a measure of performance of the innovation process (e.g. Guisado-González *et al.*, 2019), through an exclusive combination of innovation strategies.

However, the literature on innovation strongly emphasises that productivity is driven by technical efficiency (Aigner *et al.*, 1977). It also posits that investment in R&D is characterised by decreasing marginal returns and by the fact that the effectiveness of firms' internal R&D efforts to produce innovation output varies drastically between companies (Mairesse and Mohnen, 2002; Korres, 2008), even between companies belonging to the same industry (Cohen and Levinthal, 1989; Thompson, 2001). There are notable differences in inefficiency between companies in their corresponding innovation processes.

Therefore, in order to adequately capture the joint interaction of two or more innovation strategies, it seems more convenient to use a measure of inefficiency instead of using productivity as a reference variable since inefficiency is possibly the variable that can best explain the existing differences across companies' innovative performances. In other words, there are companies that are close to the technological frontier and others that are further away. For this reason, when we implement the complementarity approach (Milgrom and Roberts, 1990), we use technical inefficiency as a dependent variable, estimated using SFA techniques, applied to a knowledge production function – that is, we combine the SFA with the complementarity approach. Therefore, following the analogy with the production function, which relates capital and labour inputs to production output, in this study, we use a knowledge production function that relates knowledge capital and labour inputs to an innovative output (Bos *et al.*, 2016).

Secondly, the relations of complementarity or substitutability between innovation strategies are not exogenous and automatic (Catozzella and Vivarelli, 2014). They can vary depending on the context in which the interaction between them takes place (Cassiman and Veugelers, 2006). In order to extend our knowledge about the importance of context, in this article, we analyse whether belonging to a group of companies influences the results of the interaction between internal R&D and R&D cooperation.

The ecosystem of companies that belong to a group is not exactly the same as that of companies that compete independently. Consequently, the companies' respective knowledge bases will also be different, as will their corresponding capacities to generate complementarity in the interaction between internal and external flows of knowledge. In fact, some studies have found that group-affiliated firms are more innovative than standalone firms (e.g. Chang *et al.*, 2006; Mahmood *et al.*, 2011). Likewise, different studies on absorptive capacity (e.g. Lane and Lubatkin, 1998) have suggested that the capacity of companies to absorb the knowledge of others decreases if their respective knowledge bases do not have a certain degree of similarity. However, belonging to a group of companies not only facilitates the transfer of intra-group knowledge but also facilitates the absorption of knowledge from organisations outside the group, even if the similarity between the knowledge bases of the companies that are associated is relatively distant (Carnabuci and Operti, 2013). Critically, the other companies in the group can supply the necessary knowledge to bridge these differences.

Finally, it should be noted that the shared norms and morality embedded in the intragroup network reduce the transaction costs of knowledge transfers between group members (Chang *et al.*, 2006). All these indications make us intuit that the groups of companies constitute an ecosystem that favours the appearance of complementarities between internal R&D and R&D cooperation.

2. Framework and hypotheses

Cohen and Levinthal (1989) were the first to argue that in order for companies to be able to identify and assimilate knowledge flows generated by other organizations, it is necessary that they have previously been capable of developing powerful internal R&D. Obviously, there are different ways in which companies can access available external knowledge, being R&D cooperation agreements one of the most efficient. This is because they allow access to complementary resources and capabilities, facilitate the availability of hard-to-reach advanced knowledge (Sampson, 2007), contribute to the gain of experience in the use of technologies and research methods that reinforce the corresponding absorption capacity (Schmiedeberg,

2008) and contribute to the reduction of costs and times of the corresponding internal activities research (Fleming and Sorenson, 2004). All of this can lead to the generation of important synergies between R&D cooperation agreements and the corresponding internal R&D.

However, the generation of synergies can still be much greater than previously specified, since the knowledge incorporated through R&D cooperation agreements can give rise to substantial modifications in the development and production of internal knowledge (Keil *et al.*, 2008). That would allow companies to broaden their respective knowledge bases (Vasudeva and Anand, 2011), which in turn can give rise to new applications and research routines (Rosenkopf and Nerkar, 2001). This broadening is possible as long as there is a delicate balance between similarity and disparity between the respective knowledge bases of the cooperating companies. In fact, a significant percentage of common knowledge between knowledge bases facilitates knowledge transfer and learning (Cohen and Levinthal, 1990), since the respective research teams share skills and languages that help communication and coordination between them, thus facilitating the absorption of new knowledge that they do not share (Lane and Lubatkin, 1998). All this facilitates the development of more elaborate ideas and greater efficiency of the corresponding R&D department. In addition, it also increases the chances that shared projects can be successfully completed (Bougrain and Haudeville, 2002), thereby increasing the confidence and experience of companies in the management of subsequent R&D cooperation agreements. Consequently, these deep synergies between R&D cooperation and internal R&D can positively influence innovation performance (Laursen and Salter, 2006).

However, outside the range in which the “similarity-disparity” of the partners reinforces the internal R&D capacities of each one of them, the transfer and learning of knowledge can be inefficient. On the one hand, if there is too much similarity between the knowledge bases of the partners, there is no opportunity for mutual learning, since these bases overlap and are redundant (Boschma, 2005; Vassolo *et al.*, 2004). On the other hand, if the similarity is too low and the disparity high, there is not enough absorption capacity to benefit from the new knowledge held by the other partner, nevertheless incurring high costs as a result of the established R&D cooperation agreement (Laursen and Salter, 2006; Sampson, 2007; Vasudeva and Anand, 2011). In either case, there is a high probability that the relationship between R&D cooperation and internal R&D becomes substitutive, which contributes to reducing the efficiency of the companies, or that there is no relationship between both innovation strategies, so that there is no additional impact on efficiency, that is, there is no complementarity.

Consequently, the literature indicates that companies tend to concentrate their learning efforts by establishing cooperation agreements with partners that have relatively similar knowledge bases so that the disparity between them is not too high (Ahuja and Katila, 2001; Keil *et al.*, 2008). Therefore, it is worth asking how wide or narrow the range in which the complementarity between R&D cooperation and internal R&D can take place.

In this sense, it should be noted that there is empirical evidence that this band is not too narrow, since the number of empirical studies that have detected complementarity is greater than those that have detected substitutability or no relationship (Martynov, 2019). For example, the following studies found evidence of complementarity between R&D cooperation and internal R&D: Choi *et al.* (2012) in relation to the firm’s share of sales from new products, Rothaermel and Hess (2007) and Schmiedeberg (2008) taking patent activity as a reference, Lin *et al.* (2012) on innovation performance, Zahra and Hayton (2008) on firms’ return on equity, and Martynov (2019) on the market value of the firm. Based on the cited literature, we propose the following hypothesis:

- H1.* The relationship between R&D cooperation and internal R&D is complementary in relation to technical efficiency.

The complementary relationship between different innovation strategies is not predetermined, but, to a certain extent, depends on the context in which the joint implementation of these strategies takes place (Catozzella and Vivarelli, 2014). In this regard, Cassiman and Veugelers (2006) point out that there are characteristics of companies that favor complementarity, while

others hinder it. In this sense, some studies found that the effects derived from the combination of internal R&D and R&D cooperation show a certain dependence on market conditions, company characteristics and other factors. For example, Hagedoorn and Wang (2012) found evidence that the complementarity between internal R&D and R&D cooperation depends on the level of absorption capacity, since for high levels, the relationship is complementary, and for low levels, substitutive. Likewise, Martynov (2019) finds evidence that the complementarity/substitutability between internal R&D and R&D cooperation is related to the phase of the market cycle, which affects the level of technological uncertainty.

In this study, we are interested in exploring whether or not the complementarity between internal R&D and R&D cooperation is contingent on belonging to a group of companies. For the approach of the previous hypothesis, we had argued that there is a range of “similarity-disparity” in which the R&D cooperation can lead to a broadening of the knowledge base of the companies that cooperate. This generates an additional increase (complementarity) on the corresponding performance measure. Consequently, we intuit that belonging to a group of companies increases the extension of said range, contributing to an increase in the probability that complementarity will take place and that it will be more intense.

When two companies cooperate in R&D and their respective knowledge bases are very dissimilar, the emergence of complementarity is very difficult, since there is not a sufficient proportion of common knowledge base between both companies. In these cases, the cooperating companies are not capable of adequately and efficiently interpreting and assimilating the new knowledge that could be of interest to them. However, if one of the companies belongs to a group of companies, it may receive knowledge transfers and *ad hoc* resources from other members of the group that enable it to understand and integrate the new knowledge provided by the cooperating partners.

Consequently, belonging to a group of companies increases the probability that there will be complementarity between internal R&D and R&D cooperation. This probability will increase the higher the level of integration of the companies that make up the group and the greater the degree of diversity of their respective knowledge bases (Carnabuci and Operti, 2013). Groups with a high degree of integration between the companies that make them up facilitate the transfer of knowledge to those companies that need it (Allen *et al.*, 2007; Burns and Stalker, 1961) and, therefore, the continuous redefinition of tasks and methods in the corresponding R&D centers (Burns and Stalker, 1961). If the degree of integration between group companies is weak, that is, the intra-organizational network is more fragmented and transfers between group companies are lower (Lazer and Friedman, 2007). However, these companies always receive more transfers than companies that compete individually. In short, business groups constitute organizational structures that can achieve greater efficiency than independent companies (Cainelli and Iacobucci, 2011; Hamelin, 2011). According to the aforementioned literature, we propose the following hypotheses:

H2.1. The relationship between R&D cooperation and internal R&D is not complementary (it may be substitutive or independent) in relation to technical efficiency when companies do not belong to a group.

H2.2. The relationship between R&D cooperation and internal R&D is complementary in relation to technical efficiency when companies belong to a group.

3. Data, variables and methodology

3.1 Data

The data used for the analysis is from the Survey of Innovation Technology Companies for 2016, available in the Technology Innovation Panel (PITEC). PITEC is a panel survey based on the Community Innovation Survey (CIS) and was carried out according to the methodological guidelines set out in the Oslo Manual (OECD, 1997). PITEC is a firm-level panel database on the

innovative activities of Spanish firms. We selected manufacturing companies from this database, and after removing the observations with missing values and those that had some sort of impact on the variables of interest, we obtained a database with 3,858 observations. Of these, we selected only innovative companies, those that report having introduced product or process innovations, and, at the same time, present a positive expenditure on innovation during the period analysed by the survey, leaving 2,218 observations.

3.2 Variables

In order to apply the complementarity approach it is necessary to use a measure of company performance as a dependent variable (Cassiman and Veugelers, 2006). Usually, the firm innovative or overall performance is used. In this study, we use a measure of inefficiency as a dependent variable, extracted from a knowledge production function of the companies and estimated using stochastic frontier techniques. Consequently, we combine the SFA (Coelli *et al.*, 2005) with the complementary approach (Milgrom and Roberts, 1990). Using the complementarity approach requires that the variables whose complementarity is to be evaluated have to be defined in binary mode. Consequently, the variables internal R&D and R&D cooperation are thus defined in mode (0,1). That is, internal R&D and R&D cooperation take the value 1 if the company carries out R&D activities internally and cooperates in R&D with other organizations, respectively; and “0” otherwise.

In relation to the evaluation of complementarity, we have also introduced a set of control variables, according to their potential effect on the company’s innovation activities. Relying on the evidence in the economic literature, we incorporated the following variables: R&D subsidy, capital and high-tech. The R&D subsidy variable takes the value 1 if the company receives some kind of public support for innovation; and “0” otherwise. Using the 2003 OECD classification, the high-tech variable takes the value 1 if the company belongs to a medium-high or high technological intensity industry; and “0” otherwise.

We use the capital variable as a measure of firm size, as innovation performance could benefit from economies of scale and scope (Henderson and Cockburn, 1994). PITEC does not directly supply data on the capital variable, but it does provide information on the gross investment made by the company (I_t). Using the perpetual inventory method (OECD, 2009), and assuming the existence of a growth rate of total innovation expenditures (g) and a depreciation rate of accumulated knowledge (δ), we can construct a proxy for the capital stock using the following equation:

$$capital_t = \frac{I_t}{g + \delta}$$

In line with previous studies, the depreciation rate is assumed to be 15% and the pre-sample growth rate of gross investment 5% (e.g. Bos *et al.*, 2016). Likewise, it must be considered that the gross investments of companies can experience strong variations from one year to the next. To minimize this kind of bias, in this study, we use five-year averages (in constant monetary units) instead of a single year. In this way, we generate more stable and reliable capital stock estimates (Harberger, 1978).

The knowledge production frontier is estimated using the standard variables comprising output, knowledge and labor. In relation to the output, we use the natural logarithm of the sales from new or improved products as our measure of innovation output ($\ln newemp$). The advantage of using this measure is that it directly captures the volume of the firm’s success in the commercial introduction of new products resulting from its innovative activity, as well as its corresponding failure. The knowledge variable [1] measures the accumulated knowledge stock of the company, and its construction follows the same procedure that we have used for the construction of the capital variable, using the average of the total innovation expenses of the last five years, measured in constant monetary units. The stock of accumulated

total innovation expenditures represents the knowledge capital of a company, that is, the accumulated innovation experience. Finally, the labour variable is represented by the number of employees in the company, expressed in natural logarithms.

In addition, to apply the Heckman correction, we also use the innovator variable, as well as a series of variables representing different obstacles to innovation. Innovative companies (innovator) are defined as those that report having introduced product or process innovations and, at the same time, present a positive amount of total expenditures on innovation.

3.3 Methodology

To implement the complementarity approach, it is necessary to have a measure of the company's performance. In this study, we use the technical efficiency (the ability of firms to produce maximum output for a given set of inputs), extracted from the estimation of the frontier knowledge function using SFA techniques. The SFA model has been proposed by Aigner *et al.* (1977) and Meeusen and van den Broeck (1977) to get the firm's technical efficiency value. The SFA specification (e.g. Battese and Coelli, 1995) involves a production model with two error components: the first explains the random effect (v_i) and the second the technical inefficiency (u_i). The SFA specification can be expressed as follows:

$$Y_i = X_i\beta + (v_i - u_i) \quad i = 1, 2, \dots, N \quad (5)$$

where, Y_i is the logarithm for the output of the i -th firm, X_i is the $(k \times 1)$ vector of input and other explanatory variables associated with of the i -th firm and β is the $(k \times 1)$ vector of unknown parameters to be estimated. V_i is a random error assumed to be iid $(0, \sigma_v^2)$. U_i is a non-negative random variable, represents the technical inefficiency and is assumed to be independently distributed as truncations at zero of the (μ, σ_u^2) distribution.

With the assumption of a linear functional relationship, the mean distribution of u_i is a function of a set of explanatory variables (z_i) and can be specified as:

$$u_i = z_i\delta \quad i = 1, 2, \dots, N \quad (6)$$

where z_i is a $(p \times 1)$ vector of variables which may influence the (in)efficiency of the i -th firm and δ is a $(1 \times p)$ vector of unknown parameters to be estimated.

To estimate the parameters of Models (5) and (6) we use the one-step approach since it avoids the inconsistency that arises from using a two-step approach (e.g. Amsler *et al.*, 2016; Kumbhakar *et al.*, 2012).

In general, in relation to the specification of Equation (5), without endogenous explanation of the inefficiency components, two basic specifications are usually considered (Coelli *et al.*, 2005): a knowledge Cobb–Douglas production function and a knowledge translog production function. These basic specifications are initially used to explore which of the two is more appropriate. The one with the best fit will finally be used to analyse the relationship between inefficiency and the corresponding explanatory variables, expressed in Equation (6).

The complementarity approach (Milgrom and Roberts, 1990) starts from the basis that a pair of innovation activities is complementary if the sum of the benefits of doing just one or the other is no greater than the benefit of doing both together.

Suppose that there are two activities X_i and X_j and Z is a vector of exogenous variables in an objective function $F(X_i, X_j, Z)$ (in this study Equation (6)). Assume that X_i and X_j are dichotomous choices that take the value 1 if they are adopted by the firm and the value 0 if they are not. The complementarity approach regresses the objective function on exclusive combinations of innovation activities and the vector of exogenous variables:

$$F(X_i, X_j, Z) = \beta_{00}(1-X_i)(1-X_j) + \beta_{10}X_i(1-X_j) + \beta_{01}(1-X_i)X_j + \beta_{11}X_iX_j + \beta_zZ + e$$

where

β_{11} measures partial cross return of choosing X_i and X_j jointly.

β_{10} measures the return of only choosing X_i .

β_{01} measures the return of only choosing X_j .

β_{00} measures the return derived from not choosing either of the two activities.

Then, X_i and X_j are complementary if:

$$\beta_{11} + \beta_{00} - \beta_{10} - \beta_{01} > 0$$

Conversely, X_i and X_j are substitutes if:

$$\beta_{11} + \beta_{00} - \beta_{10} - \beta_{01} < 0$$

In this study, we estimate four models. In Model 1, we estimate a knowledge Cobb–Douglas production function and in Model 2, a knowledge translog production function, both without endogenous explanation of the inefficiency components. The variables of interest in both models are knowledge and labour, expressed in natural logarithms. In addition, we use hightech as a control variable, since belonging to sectors with high or low technological intensity influences the innovative performance of companies (Veugelers and Cassiman, 1999).

Our analysis of complementarity is focused on innovative manufacturing companies (2,218), selected from the set of Spanish manufacturing companies (3,858). Consequently, the sample is not strictly random, so there may be sample selection bias. To correct this bias, the so-called Heckman correction method is used.

After applying the Heckman correction to Models 1 and 2, and estimating both models, we run the likelihood ratio test to verify which of the two models best fits the data.

Model 3 will have the previously selected functional form and will also incorporate Equation (6), that is, the variables that potentially affect inefficiency (internal R&D and R&D cooperation) as well as the corresponding control variables (R&D subsidy, hightech and capital, the latter expressed in natural logarithms). The implementation of the complementarity approach requires that the variables whose complementarity is to be tested are expressed through a combination of exclusive profiles. For this purpose, the dummy variables internal R&D and R&D cooperation are transformed into four exclusive profiles. For example, the exclusive profile (1 0) represents a company that has internal R&D and does not cooperate in R&D with other companies. The coefficients of these four exclusive profiles are essential to carry out the complementarity test, and, therefore, verify if Hypothesis 1 is fulfilled. Model 3 is implemented in innovative manufacturing companies (2,218 companies).

Model 4 is identical to Model 3, but instead of being implemented on all the innovative manufacturing companies, it is applied on two different subsamples: on the one hand, it applies to innovative manufacturing companies that do not belong to a group (998), and, on the other, to innovative manufacturing companies that belong to a group (1,120). In this way, we are in a position to test Hypotheses 2.1 and 2.2 and, consequently, to verify whether belonging to a group might be an important driver of the complementarity between internal R&D and R&D cooperation.

4. Results and discussion

The basic descriptive statistics of the variables used in this study are shown in Table 1. In this table, it can be verified that 87% of the innovative manufacturing companies develop internal R&D activities, 46% cooperate in R&D with other organizations, 45% receive some kind of public aid for innovation and 51% are medium-high and high technology intensity companies.

Table 1. Basic descriptive statistics

Variable	Average	Minimum	Maximum	SD
Newemp	17615186.65	0	3612114839.00	141680749.1
Knowledge	10986712.35	4412.00	1169353266.00	62912807.48
Labour	229.38	2.00	9941.00	614.57
Internal R&D	0.87	0	1	0.33
R&D cooperation	0.46	0	1	0.49
R&D subsidy	0.45	0	1	0.49
Capital	17775677.74	0	1371074581.00	82815500.39
Hightech	0.51	0	1	0.50
Observations	2,218			

Source(s): Authors' own work

Table 2 presents the results of the SFA estimates of Equation (5), centred on the basic Cobb–Douglas and translog specifications. In the first place, we try to check if there is inefficiency in both specifications, since if it is not detected, an ordinary least squares estimation would be more adequate instead of one with SFA. To do this, after making the corresponding estimates, we implement a likelihood-ratio test assuming the null hypothesis of no technical inefficiency ($H_0: \sigma_u = 0$). The results of both tests indicate that the null hypothesis must be rejected at the 1% level. Therefore, there is inefficiency in both specifications estimated with SFA. Next, it is a matter of checking which of the two specifications best fits the available data. To this end, we implement an likelihood ratio (LR) test that compares the log-likelihoods of the two basic specifications and tests whether this difference is statistically significant. If the difference is statistically significant, this assumes that the translog specification fits the data significantly better than the Cobb–Douglas specification. The value of the LR test is 8.74 and it is statistically significant at the 5% level, which means that the two specifications are not nested and that, therefore, the translog specification is better suited to the data. In addition, at the end of the aforementioned Table 2, it is reflected that the proportion ($\sigma_u^2 / \sigma_u^2 + \sigma_v^2$) is slightly higher for the translog specification than for the Cobb–Douglas. In this regard, we find that the aforementioned proportion is 0.9983 and 0.9984, respectively. That is, in the translog specification, 99.84% of the total variation from the frontier is due to technical

Table 2. Regression coefficients of the SFA. Innovative manufacturing companies

Variables	Model 1: basic Cobb–Douglas specification	Model 2: basic translog specification
lnKnowledge	0.0350692 (0.1119859)	0.6470763 (0.8260182)
lnLabour	1.165001 *** (0.0709715)	1.408287 *** (0.4219106)
1/2ln ² Knowledge	–	–0.0471283 (0.05999)
1/2ln ² Labour	–	–0.2406441 ** (0.0991352)
lnKnowledge lnLabour	–	0.0577067 (0.0482341)
Hightech	–0.2118566* (0.1278171)	–0.1132144 (0.1422059)
Constant	12.04565 *** (1.67767)	5.443 (6.495939)
Observations	2,218	2,218
LR test of $\sigma_u = 0$	9.7e+02 ***	9.6e+02 ***
LR test (assumption: Model 1 nested within Model 2)	8.74 **	
$\sigma_u^2 / \sigma_u^2 + \sigma_v^2$	0.9983	0.9984

Note(s): Standard errors are in parentheses
 *Significant at 10%, **significant at 5%, ***significant at 1%
Source(s): Authors' own work

inefficiency. Consequently, in what follows we will use the translog specification, estimated using SFA.

In Table 3, we omit the presentation of the estimates of the frontier parameters since these are not the object of our investigation. We only show the results of the estimation of the determining parameters of inefficiency.

As the dependent variable of Equation (6) is inefficiency, and our hypotheses have been raised in relation to efficiency, the interpretation of the signs of the estimated parameters must be carried out exactly in the opposite sign of the one derived from the corresponding estimates.

It may turn out that the independent implementation of in-house R&D and R&D cooperation has a positive and significant influence on the technical efficiency of the company, but what happens when both innovation alternatives are implemented together? Does their joint implementation increase or decrease the sum of the corresponding individual impacts?

On this issue, we had already conjectured that R&D cooperation agreements not only provide new knowledge but also lead to a broadening of the corresponding knowledge bases. This effect allows the emergence of new research methods and routines, thus increasing the efficiency of R&D activities carried out internally. In addition, the expanded knowledge base makes it possible for the company to be in a better position to take advantage of new opportunities to incorporate knowledge and technologies from other organizations that were previously not feasible to access (Wang and Gao, 2021). All this is thanks to the fact that R&D cooperation agreements promote the exchange of heterogeneous knowledge (Fu, 2019) and increase the accumulated experience of the company (Van Burg and Van Oorschot, 2013). For all these reasons, we had hypothesized that the variables of internal R&D and R&D cooperation, in the context of innovative manufacturing companies, were complementary. In this sense, it is worth emphasizing that the estimators of Model 3, which are shown in Table 3, and the corresponding complementarity test, which is shown in Table 4, supports Hypothesis 1 of complementarity that we had proposed. Therefore, the combination of both innovation alternatives increases the efficiency of the company beyond the sum of their respective individual contributions. In previous empirical works, based on the role of technological spillovers, this type of complementarity has also been suggested (Arora and Gambardella, 1990; Cassiman and Veugelers, 2006). On the other hand, in the absence of

Table 3. Determinants of the inefficiency

Variable	Model 3	Model 4	Model 4.2
	Innovative manufacturing companies (innovator = 1)	Model 4.1 Innovator = 1 and Group = 0	Innovator = 1 and Group = 1
Internal R&D	—	—	—
R&D cooperation	—	—	—
β_{00}	4.845647*** (0.2044767)	4.824221*** (0.3001282)	4.840527*** (0.2899151)
β_{11}	4.465548*** (0.1749623)	4.574315*** (0.2581408)	4.378176*** (0.2464726)
β_{01}	4.879358*** (0.2280599)	4.678575*** (0.3696399)	4.895522*** (0.3026941)
β_{10}	4.76741*** (0.1688428)	4.802847*** (0.2534155)	4.746385*** (0.2370749)
R&D subsidy	0.1799818*** (0.0667922)	0.1736986* (0.0997972)	0.1905134** (0.0899295)
lnCapital	0.0091358 (0.0087392)	−0.0033113 (0.0131913)	0.012731 (0.0127931)
Hightech	−0.1814565*** (0.0671373)	−0.210239** (0.1006647)	−0.1546067* (0.0914683)
Constan	—	—	—
Observations	2,218	998	1,220

Note(s): Standard errors are in parentheses
 *Significant at 10%, **significant at 5%, ***significant at 1%
Source(s): Authors' own work

Table 4. Complementarity test in relation to efficiency and group membership

Sample/Sub-sample	Model	Complementarity test	Chi2	p-value
Innovative manufacturing companies (Innovator = 1)	3	$\beta_{11} + \beta_{00} - \beta_{01} - \beta_{10} = 0$ $\beta_{11} + \beta_{00} - \beta_{01} - \beta_{10} \leq 0$	3.01	0.0826 0.9587
Innovative manufacturing companies Innovator = 1 and group = 0	4.1	$\beta_{11} + \beta_{00} - \beta_{01} - \beta_{10} = 0$ $\beta_{11} + \beta_{00} - \beta_{01} - \beta_{10} \leq 0$	0.07	0.7938 No relation
Innovative manufacturing companies Innovator = 1 and group = 1	4.2	$\beta_{11} + \beta_{00} - \beta_{01} - \beta_{10} = 0$ $\beta_{11} + \beta_{00} - \beta_{01} - \beta_{10} \leq 0$	2.79	0.0946 0.9527
				Complementary

Source(s): Authors' own work

spillovers and under certain market conditions, Goyal *et al.* (2008) also find that in-house R&D and R&D cooperation are complementary.

Finally, we suggested that belonging to a group of companies could be an important driver of complementarity between internal R&D activities and R&D cooperation agreements. In this regard, in Hypotheses 2.1 and 2.2, we suggested a different behavior, depending on whether or not the companies belonging to a group of companies. In this sense, the hypothesis tests that we have implemented (Table 4) indicate that the internal R&D and R&D cooperation variables are complementary between the companies that belong to a group, while there is no relationship between these variables if the companies do not belong to a group. Hypotheses 2.1 and 2.2 were therefore supported.

Different papers that have analysed the relationship between internal R&D and external R&D have found no complementarity between the two or have found indications that these strategies are substitutes (e.g. Basant and Fikkert, 1996; Blonigen and Taylor, 2000; Hagedoorn and Wang, 2012; Krzeminska and Eckert, 2016). However, this non-complementarity may originate from an insufficient absorptive capacity of firms incorporating external knowledge. In this sense, some papers have found evidence that external R&D has a positive impact on firm productivity provided that there is a sufficient level of internal R&D expenditure (Hagedoorn and Wang, 2012; Lokshin *et al.*, 2008), i.e. sufficient absorptive capacity (Griffith *et al.*, 2004).

External knowledge from the R&D partner is only valuable if it is internalized, incorporated, stored, combined and used together with the internal R&D of the absorbing company (Peeters and Martin, 2015). For this, the absorbing firm must have an appropriate absorptive capacity, otherwise, it is not possible to effectively internalize and combine externally obtained knowledge. Consequently, firms with low levels of absorptive capacity and low innovation dynamism will have to endure negative indirect effects as a result of the incorporation of external knowledge (Gkypali *et al.*, 2017). However, the low absorptive capacity of the absorbing firm can be overcome if that firm belongs to a group of firms and receives appropriate knowledge transfers to adequately integrate knowledge from outside.

5. Conclusions

Companies have multiple alternatives to carry out their innovation processes. The literature on innovation has abundantly and reliably shown how these different alternatives have contributed to improving companies' performance. However, there is little empirical work that has examined which combinations or contexts should be avoided, since it is likely that there are policies or strategies that should never be implemented together or contexts that act as inhibitors of such combinations.

In this sense, we could say that internal R&D activities constitute the main ingredient of all the possible combinations of the different innovation alternatives available, as all knowledge

ultimately flowing in from outside the company must be valued and integrated by the corresponding internal R&D. That is why in this study we analyse whether, for Spanish innovative manufacturing companies, the simultaneous implementation of internal R&D activities and R&D cooperation agreements generates an impact on the technical efficiency greater than the sum of their respective individual impacts.

In the same vein, it is worth emphasising that the results of this study indicate that the combination of both innovation alternatives is complementary, meaning the aforementioned combination is extremely beneficial. But we have also analysed this combination in two different contexts, and we have verified that belonging to a group of companies constitutes a powerful driver of the complementarity of both alternatives, and that among companies that do not belong to a group, said complementarity does not exist.

In this regard, we had conjectured that belonging to a group allows companies to quickly and easily access the knowledge flows of the other companies in the group. This makes it easier for them to scan and integrate knowledge flows from external sources, thus helping to generate greater efficiency in their corresponding internal R&D activities and, therefore, contributing to the emergence of the corresponding complementarity.

In this way, we have filled the two gaps mentioned in the introductory section, since the use of a novel research procedure (combining the SFA and the complementarity approach) and the use of technical efficiency as a measure of innovation performance has led us to extend the existing literature on the influence of business groups on the outcomes of innovation processes.

Our finding has an important theoretical implication, as it contributes to the literature on open innovation with a specific relevant approach, insofar as it facilitates an understanding of how belonging to a group of companies influences the achievement of higher innovation performance. This is important, because in order to be successful in innovation processes, companies must master multiple knowledge types, and knowing the existence of contexts that positively or negatively influence these processes is critical in this regard. Relatedly, the results obtained allow us to confirm the existence of a positive link between innovative performance and belonging to a group of companies.

Furthermore, another relevant theoretical implication pertains to the possibility of using our novel working procedure (technical efficiency as a performance variable and the combined use of the SFA and the complementarity approach) to analyse the relationship of other innovation strategies and other contexts on the innovative performance of the company. For example, these methods can be used to investigate the influence of the interaction of R&D outsourcing and R&D cooperation on the technical efficiency of companies, differentiating between companies with high and low absorptive capacity.

Moreover, the empirical findings of our study have practical implications for both managers and policymakers. Knowing this type of information in advance is extremely important since it allows managers to avoid combinations or contexts that are presumably counterproductive. In addition, the results of this study have important implications for managers of companies with low absorptive capacity. If they choose to belong to an appropriate group, they may be in a position to take advantage of R&D cooperation agreements with more technologically advanced companies, achieving greater efficiency in the management of their internal resources. Likewise, these results are also relevant for policymakers, since they provide them with vital information for the design of their corresponding innovation promotion policies, thus helping to avoid the implementation of policies that lead to an inefficient allocation of public resources.

Notes

1. The variables capital, newemp and knowledge have observations with zero values. These variables are expressed in natural logarithms, and since the natural logarithm of zero does not exist and the natural logarithm of 1 is zero, before calculating the corresponding logarithm we add a 1 to the value of these variables, as is usual in this type of situation (e.g. Escribano *et al.*, 2009).

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Corresponding author

Manuel Guisado-González can be contacted at: manuelguisado@uvigo.gal

Enablers of satisfaction with coworking spaces: assessing the influence of users' personality and experience

Óscar Rodríguez-Ruiz, Maribel Labrado-Antolín,
 José Fernández-Menéndez and Isabel Delgado-Piña
Universidad Complutense de Madrid, Madrid, Spain

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Abstract

Purpose – This study analysed the extent to which differences in personality traits and coworking experiences affect coworkers' satisfaction with coworking spaces (CWS).

Design/methodology/approach – The present study is based on employee-workplace alignment theory (Appel-Meulenbroek *et al.*, 2021). This approach addresses people's ability to do their jobs in a certain work environment and studies job satisfaction as an outcome variable. We used a dataset of 135 CWS members grouped in the Spanish Association of Flexible Office Spaces, Prowork Spaces. The regression models were fitted using satisfaction with coworking as the dependent variable.

Findings – The findings support the idea that some psychological traits of coworkers, such as extroversion and agreeableness, have a significant influence on their satisfaction with coworking. Our study also shows that the relationship between coworking experience and satisfaction is curvilinear.

Originality/value – This study contributes to the advancement of employee-workplace alignment theory by showing that some personality traits are relevant variables for person-organisation fit in CWS. While extroversion and agreeableness are traditionally associated with prosocial outcomes, we found that agreeable coworkers were not more satisfied with CWS. In addition, the study identified a nonlinear relationship between experience and satisfaction with CWS, which has not been detected in previous studies.

Keywords Coworking spaces, Satisfaction with coworking, Employee-workplace alignment, Personality-based fit, Big five personality traits, Extraversion, Openness, Conscientiousness, Agreeableness, Emotional stability, Coworking experience

Paper type Research paper

1. Introduction

The phenomenon of coworking has acquired significant international relevance in recent years (Dell'Aversana and Miglioretti, 2024). Today, public and private sector organisations use coworking spaces (CWS) as an alternative to home-based telework. It is estimated that there will be approximately 42,000 such spaces in the world by the end of 2024 (Servín, 2024). User satisfaction is an outcome derived from the coworking experience related to retention and performance (Rådman *et al.*, 2023). Therefore, satisfaction with coworking has emerged as an important topic of study.

This study analysed the extent to which differences in personality traits and coworking experience affect coworkers' satisfaction with CWS. A CWS represents a cross-sectional working community with opportunities for social interaction (Bouncken and Reuschl, 2018). Users at these locations can be entrepreneurs, freelancers, self-employed individuals, or

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people working on contracts for larger companies (Clifton *et al.*, 2022). The literature has shown that specific workplaces affect worker satisfaction. In the case of CWS users, satisfaction is not determined only by the physical and functional characteristics of their location. The innate characteristics of subjects, such as personality traits, are also relevant (Hartog *et al.*, 2018). It is reasonable to assume that an individual's personality predisposes him or her to like or dislike CWS. Moreover, as more experience accumulates over time, users may better adjust to coworking dynamics.

Research on the different drivers of work satisfaction in CWS is centred on aspects such as design and infrastructure. There is a clear gap in the understanding of why some coworkers experience greater levels of satisfaction. Some explanatory approaches, such as the *employee-workplace alignment theory* (Appel-Meulenbroek *et al.*, 2021), have not been explored in the field of coworking. Additionally, there is a lack of empirical evidence on personality-based fit among CWS. Our research objective was to study the *Big Five personality traits* (Norman, 1963) as variables that condition the degree of satisfaction with a new way of working. In this line, this study attempted to cover this gap and expand research on the explanatory factors of user satisfaction by answering two research questions: (1) How do coworkers' personalities influence satisfaction with CWS? (2) Does member satisfaction with coworking activities vary as their coworking experience increases?

CWS hosts must understand users' personalities to foster their satisfaction, which is crucial for explaining their intention to leave the space (Orel *et al.*, 2024). To study the correlation between personality and satisfaction with coworking, we assumed that individuals would experience more satisfaction when the coworking environment fits with their personality. The *five-factor* personality model provided the conceptual basis for our study. Extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience have been used to analyse personality traits in numerous studies (Judge and Zapata, 2015). We utilised a dataset comprising 135 Spanish CWS users. Spain is particularly interesting as coworking has experienced rapid growth in recent years. Considering that it is the fourth country in the world for coworking in terms of numbers (1,400 spaces) and capacity (Universitat Oberta de Catalunya, 2024), the coworking surface has increased by one million square metres since 2014.

Our study makes several novel contributions to the literature. First, it adopts a person-centred perspective. While most studies on place in management have attempted to understand how workplace characteristics impact workers (Ashforth *et al.*, 2024), we explored how coworkers' personalities and experiences influence satisfaction with the work environment. The person-environment fit literature highlights the idea that there is an interaction between employee characteristics, environmental work characteristics, and job attitudes. Values and skills are studied as employee characteristics. However, the role of personality predispositions has not yet been considered. We add to the fit theories by exploring a specific form of person-environment fit related to the Big Five personality traits as employee characteristics. This study focuses specifically on understanding satisfaction with coworking. Comparative measures of satisfaction with other workplaces are not used. Our results show that extroverted individuals tend to have a more positive attitude towards coworking and challenge the common idea that agreeableness is key to adjusting to environments characterised by social and group activities. We also add to the knowledge on new workplaces by showing a nonlinear association between experience as a function of time and satisfaction with CWS.

2. Theoretical framework

2.1 Previous studies about satisfaction in CWS

The literature has explored some motivational aspects of coworking. Fuzi (2015) conducted an eight-month study of two CWS in South Wales to examine their motivations and expected outcomes. Kojo and Nenonen (2017) found that attractiveness and work-life balance are important drivers for the use of these spaces. Recently, Dell'Aversana and Miglioretti (2024)

noted that satisfying social relationships is one of the benefits that motivates workers to use CWS. However, studies about satisfaction of members of CWS are limited and diverse. Gerdenitsch *et al.* (2016) hypothesised that social support from coworkers in CWS was positively related to satisfaction. Avdikos and Kalogeresis (2017) described the profile of those working in third places and their level of satisfaction, in contrast to those working from home and formal offices. Robelski *et al.* (2019) examined overall satisfaction with CWS, noting that 8 out of 10 respondents reported higher job satisfaction in the coworking space than in the home office. In a study on multi-tenant offices, Hartog *et al.* (2018) found that users who were extroverted, open to new experiences, and more agreeable were generally more satisfied with these working arrangements. Along a different line, Lashani and Zacher (2021) pointed out that the congruence between coworkers' needs and supplies by CWS relates to job satisfaction. Recently, Berdicchia *et al.* (2023) showed that CWS positively impacted happiness when workers were more proactive. Orel *et al.* (2024) highlighted the impact of CWS on the satisfaction and well-being of microentrepreneurs.

2.2 Conceptual approach

Various theoretical approaches have been used to study worker satisfaction in work environments. The underlying assumption of these visions is that different people require different environments. The *person-environment fit framework* (Edwards, 2008) is a prominent research field that focuses on the outputs of the adjustment between workers and environmental characteristics (Ghetta *et al.*, 2020). This congruence occurs when the characteristics of the individuals and work environment are well matched (Kristof-Brown *et al.*, 2005). Within this framework, some theories have paid special attention to the workplace. For instance, the *employee-workplace alignment theory* (Appel-Meulenbroek *et al.*, 2021) addresses people's ability to do their job in a certain work environment and studies job satisfaction as an outcome variable. Satisfaction is determined by the technical, functional, and behavioural attributes of the workplace (Armitage and Amar, 2021). It is possible to distinguish between the three types of employee-workplace alignment. First, alignment between the person and the workplace is achieved when the needs of the users are satisfied. The second alignment occurs when individuals enter a space and respond to the environment in a manner that is consistent with their personality traits. Finally, employee-workplace alignment depends on the social environment and organisational culture of employees. This study is based on the second type of alignment, according to which personality influences how well workers adapt to the workplace environment. Following this reasoning, we suggest that innate characteristics such as personality traits influence the level of satisfaction with coworking activities. Additionally, we advocate that acquired characteristics, such as experience, can contribute to a better fit with the work environment, increasing the level of satisfaction.

2.3 Hypotheses

The notion of person-environment fit indicates that job satisfaction is higher when there is a match between the person and the environment. Personality traits influence users' beliefs and attitudes and may predispose them to engage in CWS.

One of the most validated personality taxonomies is the five-factor model. It parsimoniously represents the human personality with five traits: extroversion, openness, conscientiousness, agreeableness, and mental stability (Bozionelos, 2004). According to this model, extroversion refers to warmth, excitement seeking, and positive emotions (Seddigh *et al.*, 2016). Individuals who score high in openness tend to be open to feelings and emotions. Conscientiousness can be understood as a tendency towards duty and competence (Shi *et al.*, 2018). People high in conscientiousness are organised and responsible. Agreeableness refers to sympathy, tolerance, and cooperation (McCrae and Costa, 1987). Lastly, a lack of mental stability (neuroticism) is described as a source of negative affectivity and stress (Judge *et al.*, 2002).

These five personality traits affect people's workplace engagement in two ways. First, each personality feature predisposes a person to behave in a specific manner. Second, personality traits may facilitate adaptation to the workplace environment. Thus, we can expect significant relationships between the Big Five personality traits and satisfaction with CWS. Our main assumption was that personality traits determine work behaviour, which in turn influences individual satisfaction with the coworking space.

H1. Satisfaction with CWS varies depending on the personality traits of the coworker.

Those with extraversion tend to be more sociable. This includes characteristics such as activity assertiveness and positive emotions (John and Srivastava, 1999). This trait has been found to be positively correlated with job satisfaction (Smith *et al.*, 2018). Extroverted people tend to be affectionate and desire interaction with others (Özbek *et al.*, 2014). Shared workspaces, such as coworking centres, can answer extroverted users' demands for recognition and social belonging (Merkel, 2015). Therefore, we argue the following:

H1.1. Coworkers high on extraversion can be expected to be more satisfied with CWS.

Openness is characterised by imagination and curiosity (Peeters *et al.*, 2006). Open-minded individuals tend to be behaviourally flexible, independent, and interested in variety (Özbek *et al.*, 2014). Openness is also one of the main characteristics of CWS (Berdicchia *et al.*, 2023). Co-workers who are open to experience may appreciate the contributions of other users of the space, which could affect their satisfaction (Hofeditz *et al.*, 2020). Thus, we hypothesised the following:

H1.2. Coworkers high on openness can be expected to be more satisfied with CWS.

Conscientiousness refers to the extent to which a person is organised and the work is involved (Matzler and Renzl, 2007). Conscientious individuals tend to be careful and disciplined, showing higher levels of goal-directed behaviour (Özbek *et al.*, 2014). As CWS facilitate a structured organisational environment (Orel *et al.*, 2024), conscientious workers can fit within these enclaves, which are an ideal setting for stimulating challenges (Berdicchia *et al.*, 2023). Coworking can offer users self-determination and proactivity, which are essential for satisfaction (Waters-Lynch and Duff, 2021). Thus, we propose the following hypothesis:

H1.3. Coworkers high on conscientiousness can be expected to be more satisfied with CWS.

Agreeableness is a personality trait which includes courtesy and friendliness (Peeters *et al.*, 2006). Individuals with high levels of agreeableness are assumed to be cooperative and helpful (Özbek *et al.*, 2014). Some studies have found a positive relationship between *agreeableness* and user satisfaction in multi-tenant offices (Hartog *et al.*, 2018). This relationship can be explained by the fact that agreeable individuals interact with others. Members of CWS who prefer socialising may have higher levels of satisfaction. Thus, we can assume the following:

H1.4. People high in agreeableness can be expected to be more satisfied with CWS.

Emotional stability is another factor that affects work experience. Employees with high or low levels of this feature experience different levels of stress and anxiety. Emotionally stable individuals are calm, secure, and better able to cope with job changes (Kang and Malvaso, 2023). Conversely, emotional instability (neuroticism) has been consistently found to be negatively related to job satisfaction. While workers with high neuroticism experience less control in exposed workspaces, individuals with emotional stability can fit CWS better. Thus, we hypothesise as follows:

H1.5. Coworkers high in emotional stability can be expected to be more satisfied with CWS.

The coworking experience may positively influence member satisfaction. First, individuals with experience place a greater emphasis on adaptation (Kristof-Brown *et al.*, 2002). Second, previous experience guides workers towards work environments in which they find value congruence. Additionally, time is an essential element in developing routines and perceiving a coworking space as a social place (Endrissat and Leclercq-Vandelannoitte, 2021). Individuals become aware of the match between their attributes and work environment over time. People who work more hours in multi-tenant offices have been found to be more satisfied with the office climate (Hartog *et al.*, 2018). When users cooperate more intensively, they have a better understanding of coworking dynamics and perceive benefits, such as social integration (Lescarret *et al.*, 2022). In this vein, it is possible to say that experience generally leads to a better fit with the workplace facilitating the process of “learning to cowork” (Butcher, 2018). The longer coworkers work in a coworking space, the higher their degree of adjustment. Thus, we hypothesise the following:

H2. Previous coworking experience increases satisfaction with coworking.

3. Methods

3.1 Data sample

The study population was professionals who were independent or part of an enterprise and who had experience carrying out their duties from the premises of a coworking space located in Spain. Finding reliable data on the number of CWS users worldwide and in Spain is difficult (Martínez-Navarrete and Sánchez-Hernández, 2016). The size and characteristics of this group of individuals is not easy to explore and it is possible to consider them a “hard-to-reach population”. Accessing these populations is complicated and probability sampling is not possible. Conversely, purposive sampling is a valid option to understand these groups. Different authors have used this type of sample in the coworking literature (e.g. Dell’Aversana and Miglioretti, 2024; Orel *et al.*, 2024).

In this study, we used “facility-based sampling” (Shaghghi *et al.*, 2011). This technique recruits members of a target population from various facilities. We signed an agreement with Prowork Spaces of the Spanish Association of Flexible Office Spaces. In the first phase, the association requested collaboration from the CWS to disseminate the survey. Fifty-two centres agreed to place a QR code on their premises to respond. In the second phase, some users of each centre decided to answer the questionnaire. With this type of sampling, we were exposed to two potential sources of self-selection bias at the CWS and coworker levels. Dealing with self-selection bias requires additional information about non-respondent units. In the case of CWS, after several semi-structured interviews with managers, we noticed that there could be an over-representation of larger centres in the sample. This bias seems to be small as most coworkers were concentrated in the largest CWS. Regarding self-selection bias at the coworker level, anecdotal evidence shows that coworkers who spend more time in CWS tend to pay more attention to QR codes and respond. The higher representation of more intensive coworkers is mostly unproblematic, as these individuals are the most interesting to analyse.

Another potential risk in our sample is the presence of common method variance (Podsakoff *et al.*, 2003). Respondents who provided information about the dependent variable (satisfaction with the CWS) were the same as those answering questions related to the independent variables (e.g. extroversion, openness, agreeableness, etc.). We can expect that those who declare that they are very satisfied with coworking will also tend to proclaim that they are more extroverted or agreeable. To control for the tendency to emphasise consistency over reality, we separated personality measures from satisfaction measures in the questionnaire. We also conducted Harman’s single-factor test, loading the variables suspected to cause bias into an exploratory factor analysis. We found that by loading the variables satisfaction, extroversion, agreeableness, and openness, the null hypothesis that a single factor is sufficient was rejected, with a *p*-value of 0.026. When adding the two other

personality traits, conscientiousness and mental stability, the null hypothesis was also rejected, with a p -value that became nearly equal to zero. Therefore, there is no indication that our data were affected by common method variance.

After fieldwork, 135 valid responses were obtained. The average age of respondents was 37 years. The sex composition was balanced. One out of two respondents held a master's degree or PhD.

3.2 Data collection

We used a web survey for data collection. Participation was voluntary and anonymous. No reward was offered for participation.

3.3 Empirical methodology

Our research fitted regression models using satisfaction with coworking as a dependent variable. Regression analysis has been found to be a suitable method for understanding person-environment fit (Edwards *et al.*, 1998).

3.4 Variables

According to the *employee-workplace alignment theory* (Appel-Meulenbroek *et al.*, 2021), compatibility between an individual and the work environment is the key to satisfaction. In this study, we analysed different variables that could explain adjustment to the workplace. For instance, certain psychological traits are better suited for working in a CWS. Moreover, time and experience are needed for coworkers to successfully engage with CWS dynamics.

The dependent variable was coworker satisfaction (SATISFACTION). Overall satisfaction is commonly used in workplace studies and reflects perceptions of the value of the work environment. This measure attempts to capture user satisfaction as an outcome of coworking activity (Clifton *et al.*, 2022). According to a meta-analysis conducted by Wanous *et al.* (1997), single-item measures of job satisfaction perform comparably to multi-item measures. Consequently, we measured satisfaction with a single item that reflects an overall assessment of the coworking experience ("Taking everything into consideration, how satisfied do you feel about your coworking activity?"). The items were anchored to a 5-point Likert-type scale ranging from 1 ("very unsatisfied" to 5 "very satisfied"). Our measure is similar to that of Lashani and Zacher (2021).

The main explanatory variables were extroversion (EXTROVERTED), agreeableness (NICE), conscientiousness (DILIGENT), openness (OPEN_NEW), emotional stability (STABLE), and experience (TIME). The first five variables refer to the Big Five personality traits, which are considered valid and robust frameworks for studying personality traits. Traditionally, personality trait measures have consisted of multi-item scales which can provoke fatigue among respondents. Following Gosling *et al.* (2003), we developed items that captured the definition of five prototypical adjectives (for example, "Do you consider yourself an extroverted person? Extroverted: sociable, assertive, talkative, active, not reserved or shy"). Each item was rated on a 5-point scale from 1 ("strongly disagree") to 5 ("strongly agree").

Experience (TIME) was a numerical variable which records the length of time spent in the coworking space. Participants were asked to indicate how long they had been working in their current coworking space ("less than 6 months", "between 6 and 12 months", "between 13 and 18 months", and "more than 18 months"). The literature on remote work has frequently used quantitative measures (days, weeks, months, or years) to reflect individuals' experiences (see, for instance, Labrado-Antolín *et al.*, 2024).

We also included a set of control variables. For instance, age (AGE), gender (GENDER), and coworker profile (POSITION) have been found to influence self-reported job satisfaction (Danielsson and Bodin, 2008). Educational attainment (STUDIES), payment of a fee by the

user (FEE), virtual applications for the coworking space (USERAPP), and the number of activities for social interaction (COMMINT) can interact with each other and influence the explained variable. The size (SIZE) of the firm where users work is a relevant measure, but was not the focus of our study.

Table 1 describes these variables briefly.

4. Results

To test our hypotheses, we used a regression model with satisfaction (SATISFACTION) as the dependent variable and five personality traits (EXTROVERTED, NICE, DILIGENT, STABLE, and OPEN_NEW) and experience (TIME) as explanatory variables. We also included several control variables as regressors: age (AGE), gender (GENDER), educational level (STUDIES), professional profile (POSITION), membership fees (FEE), firm size (FIRM_SIZE), face-to-face social events (COMMINT), and digital platforms (USERAPP).

Each coworking space defines a group of observations that share certain characteristics and a correlation between them was expected. The regression model must consider the correlated nature of the observations. A simple and effective way to achieve this is to introduce a random effect into the regression model, which is the realisation of a random variable that takes a value for each group in the data. The random effect reflects the two-stage nature of the sampling process through which observations were obtained. In the first step, we obtained a sample of CWS, and in the second step, we obtained a sample of coworkers within each centre.

With the random effect the regression model becomes as follows:

$$\text{SATISFACTION} = \alpha + b_i + \beta_1 \cdot \text{PERS TRAITS} + \beta_2 \cdot \text{TIME} + \beta_3 \cdot \text{POSITION} + \text{controls} \\ + \varepsilon_j$$

In this model, there are two random variables, the usual error term ε_j , and the random effect b_i . We first fit two linear regression models: a baseline model with only the control variables and a full model that included our variables of interest, different personality traits, and experience. To consider the clustered nature of the data, we fit two other regression models with a random effect that was added to the intercept of the linear models. Table 2 shows the estimated coefficients of the fixed effects (i.e. β s in the regressions) and their standard errors (in parentheses) for the four models. Random-effects models were fitted using the lme function in the nlme R package (Pinheiro *et al.*, 2023).

In Table 2, the values of the columns of the models with and without random effects are identical. This may seem surprising, but looking at the variance components of the full random effects model, the between-group variability is negligible. Thus, it is not necessary to use a random-effects model.

To account for the potential effects of outliers, high leverage, and influential observations, whose presence could distort the estimated regression coefficients, we performed a robust linear regression (see Table 2). A robust regression model was fitted using the rlm function of the MASS package in R (Venables and Ripley, 2002). This function uses an M-estimator for the model coefficients. This estimator underweights the residuals based on their size; thus, the effect of observations with large residuals is attenuated. As shown in Table 2, the robust model is quite similar to the other models, which is a clear sign that there were no outlier observations in the data that could compromise the validity of the results.

With respect to the different personality traits, Table 2 shows that EXTROVERTED and NICE were significant but not the other traits (Hypotheses 1.2, 1.3, and 1.5). The more extroverted a coworker is, the more satisfied he/she will be with the coworking space (Hypothesis 1.1). Agreeableness was also a significant negative predictor of satisfaction with coworking spaces. This contradicts Hypothesis 1.4. The results obtained are interesting for the

Table 1. Variables

Dependent variable	SATISFACTION_COWORKING	Satisfaction with coworking: Degree of satisfaction with coworking activity 1 (<i>Very high</i>) 5 (<i>very low</i>)
	EXTROVERTED	Self-definition as an extroverted person: Agreement with the statement "you are an extroverted person." 1 (<i>Strongly disagree</i>) 5 (<i>very low</i>)
	NICE	Self-definition as an agreeable person: Agreement with the statement "you are an agreeable person." 1 (<i>Strongly disagree</i>) 5 (<i>very low</i>)
Independent variables	DILIGENT	Self-definition as a conscientious person: Agreement with the statement "you are a conscientious person." 1 (<i>Strongly disagree</i>) 5 (<i>very low</i>)
	OPEN_NEW	Self-definition as a person open to new experiences: Agreement with the statement "you are a person open to new experiences." 1 (<i>Strongly disagree</i>) 5 (<i>very low</i>)
	STABLE	Self-definition as a person emotionally stable: Agreement with the statement "you are an emotionally stable person." 1 (<i>Strongly disagree</i>) 5 (<i>very low</i>)
	TIME	Coworking experience: 1 (<i>Less than one month</i>) 2 (<i>6–12 months</i>) 3 (<i>13–18 months</i>) 4 (<i>More than 19 months</i>)
Control variables	AGE	Age in Years
	GENDER	Declared gender: <i>Male</i> <i>Female</i> <i>Other</i>
	STUDIES	Educational attainment: <i>Completed primary</i> <i>Upper secondary</i> <i>College degree</i> <i>Master</i> <i>PhD</i>
	FEE	Payment of a fee by the user: <i>Yes</i> <i>No</i>
	USERAPP	Virtual application for the coworking space: <i>Yes</i> <i>No</i>
	COMMIT	Number of activities for social interaction: 1 (<i>None</i>) 2 (<i>1 in a month</i>) 3 (<i>2–4 in a month</i>) 4 (<i>More than 4 in a month</i>)
	FIRM SIZE	

(continued)

Table 1. Continued

POSITION	Number of employees of the firm:
	1 (one) 2 (2–10) 3 (11–50) 4 (51–250) 5 (251 more)
	Profile of the coworker:
	1 (Entrepreneur) 2 (Corporate employee, manager) 3 (Rest of corporate employees)

Source(s): Authors' own work

progress of *employee-workplace alignment theory*. According to the notion of person-environment fit, workplace satisfaction arises as a result of the alignment between employee characteristics such as skills and values, and environmental characteristics. Our findings reveal the need to include personality traits among employee characteristics that have a strong relationship with subjective wellbeing. This contribution mitigates the lack of empirical evidence on personality-based fit among CWS. Our analysis advances our understanding of the effects of personality on satisfaction with coworking. Two of the five personality traits (extroversion and agreeableness) were related to changes in the dependent variables. Conversely, openness, conscientiousness, and mental stability were not significant predispositions for adjusting to CWS.

Hypothesis 2 stated that satisfaction with CWS depends on how long one has worked in a coworking space. TIME represents coworking experience in months. As the form of the relationship between coworking experience and satisfaction is not clear, we tested a linear trend for this relationship, as well as quadratic, cubic, and so on. The linear, quadratic, and cubic terms were significant; the higher-order terms were not significant, and we discarded them.

Therefore, the relationship between experience and satisfaction can be described using a third-order polynomial. This complex functional relationship can be better understood through graphing. This is done in Figure 1, which shows how the effect of TIME (x-axis) on SATISFACTION (y-axis) has a “sine wave” shape. Satisfaction increases when coworking experience starts, reaches a peak after a few months (about six), then decreases, and after about a year of experience, increases again. Because coworking experience is very recent, we have no information to predict its long-term effect on satisfaction beyond a couple of years. The non-linear relationship between experience and satisfaction points to the dynamic nature of the alignment between employees and the workplace environment. Person-environment fit theories are process theories, and it is important to study the effects of an acquired variable, such as experience, at different points in time.

It is noteworthy that the control variable POSITION (entrepreneur, worker, manager) was significant. Specifically, the results showed that among CWS users, workers and managers were more satisfied with coworking than entrepreneurs.

5. Discussion

The findings of this study support the idea that some psychological traits of coworkers, such as extroversion and agreeableness, influence their satisfaction with coworking. Previous studies have highlighted that both traits are important for job satisfaction in social occupations (Judge *et al.*, 2002). Conversely, no evidence was found of a significant relationship between openness, conscientiousness, mental stability, and the dependent variable. Our study also showed that satisfaction varies depending on the coworking experience.

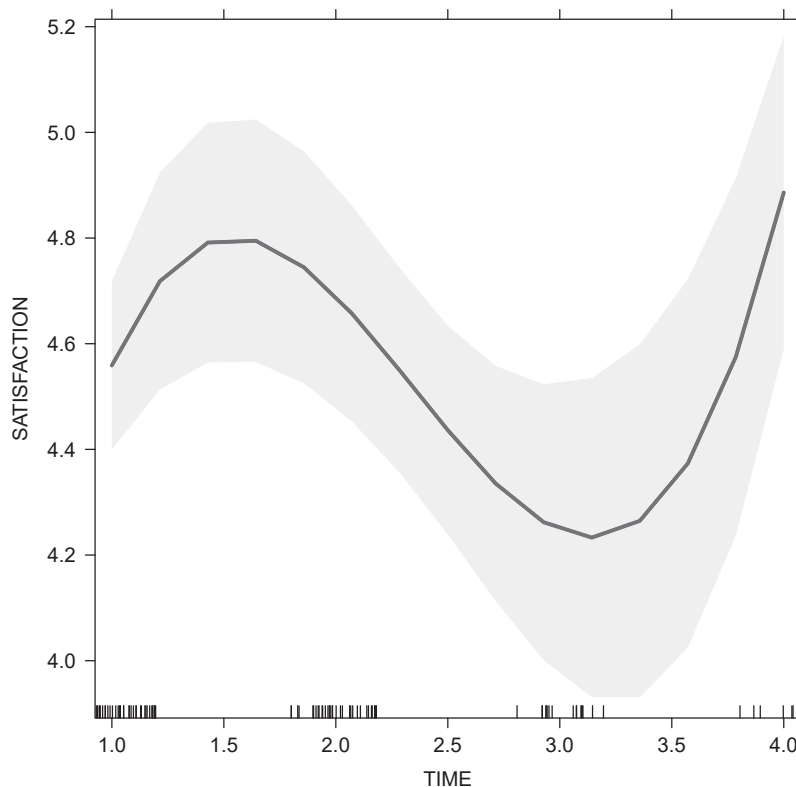
Table 2. Statistical models

	Baseline linear model	Full linear model	Robust linear model	Random eff. Model	Random eff. Full model
(Intercept)	3.8598*** (0.6543)	1.3526 (1.2492)	1.4879 (1.2265)	3.8598*** (0.6543)	1.3526 (1.2492)
AGE	−0.0026 (0.0069)	0.0001 (0.0070)	0.0012 (0.0069)	−0.0026 (0.0069)	0.0001 (0.0070)
GENDERMan	0.1763 (0.4647)	0.4056 (0.4645)	0.3968 (0.4561)	0.1763 (0.4647)	0.4056 (0.4645)
GENDERWoman	0.0801 (0.4611)	0.2369 (0.4578)	0.2260 (0.4495)	0.0801 (0.4611)	0.2369 (0.4578)
STUDIES	−0.0462 (0.0816)	−0.0845 (0.0848)	−0.0722 (0.0833)	−0.0462 (0.0816)	−0.0845 (0.0848)
FEEyes	0.5002 ⁺ (0.2312)	0.5814 ⁺ (0.2307)	0.5134 ⁺ (0.2266)	0.5002 ⁺ (0.2312)	0.5814 ⁺ (0.2307)
FIRM_SIZE	−0.1292 ⁺ (0.0682)	−0.1902** (0.0681)	−0.1723* (0.0669)	−0.1292 ⁺ (0.0682)	−0.1902** (0.0681)
COMMINT	0.2568 ⁺ (0.1215)	0.2520 ⁺ (0.1205)	0.2541 ⁺ (0.1183)	0.2568 ⁺ (0.1215)	0.2520 ⁺ (0.1205)
USERAPP	0.4890 ⁺ (0.2212)	0.5944 ⁺ (0.2242)	0.5746 ⁺ (0.2201)	0.4890 ⁺ (0.2212)	0.5944 ⁺ (0.2242)
POSITIONmanager	0.9133*** (0.2628)	0.9496*** (0.2561)	0.8244*** (0.2515)	0.9133*** (0.2628)	0.9496*** (0.2561)
POSITIONworker	0.7756** (0.2662)	0.8304** (0.2598)	0.7178** (0.2550)	0.7756** (0.2662)	0.8304** (0.2598)
EXTROVERTED		0.2016* (0.0909)	0.1942* (0.0893)		0.2016* (0.0909)
NICE		−0.3346** (0.1188)	−0.3303** (0.1167)		−0.3346** (0.1188)
DILIGENT		0.1487 (0.1155)	0.1431 (0.1134)		0.1487 (0.1155)
STABLE		−0.0834 (0.0994)	−0.0707 (0.0976)		−0.0834 (0.0994)
OPEN_NEW		0.0853 (0.1066)	0.0867 (0.1047)		0.0853 (0.1066)
TIME		4.0269* (1.6792)	3.7852* (1.6488)		4.0269* (1.6792)
TIME^2		−1.9428* (0.7745)	−1.8267* (0.7605)		−1.9428* (0.7745)
TIME^3		0.2760* (0.1062)	0.2596* (0.1042)		0.2760* (0.1062)
R ²	0.1761	0.2918			
Adj. R ²	0.0992	0.1631			
Num. obs.	118	118	118	118	118
AIC	240.3836	238.5259		242.3836	240.5259
Log likelihood				−108.1918	−99.2629
Num. groups: centre				16	16

Note(s): *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; + $p < 0.1$
Source(s): Authors' own work

5.1 Explanation of the results for Hypotheses 1.1 to 1.5

Regarding personality traits, extroversion was associated with a higher level of satisfaction with coworking (Hypothesis 1.1). This result is in line with the study by Hartog *et al.* (2018), who noted that extroverted users are more satisfied with the features of CWS. In contrast, the buzz of CWS activities may not be adequate for introverted people who have a lower need for relatedness. Extroverted people are characterised by sociability. This feature fits with the idea



Source(s): Authors' own work

Figure 1. Effect of time on satisfaction

of CWS as places to “meet people” (Dell’Aversana and Miglioretti, 2024). Conversely, introverted individuals appreciate privacy and seek fewer daily social interactions. Our results also showed that agreeableness had a significant negative impact on coworkers’ satisfaction (Hypothesis 1.4). This intriguing result requires reflection. Several studies found that agreeableness positively influences employee satisfaction (e.g. Matzler and Renzl, 2007). Logic suggests that those who score high on agreeableness are more satisfied with the synchronous forms of communication that take place in CWS. However, the prosocial behaviour of agreeable individuals could collide with the competitive dimensions of the coworking environment. Other personality traits did not have an important effect on work satisfaction. Openness is a distinctive characteristic of the coworking movement. Apparently, open-minded people should be more attracted to the receptivity to new ideas often seen in CWS (Hypothesis 1.2). However, this was not the case in the present study. High openness scores were not correlated with satisfaction. Conscientiousness reflects a greater need for order and proactivity. In this vein, we could expect that individuals with high scores on conscientiousness would be more satisfied with coworking because it is an adequate environment for self-determination (Hypothesis 1.3). However, this association was not supported by our data. The lack of a relationship between mental stability and satisfaction among CWS is noteworthy (Hypothesis 1.5). The literature presents emotional support as an advantage of coworking (Kopplin *et al.*, 2022). Nevertheless, our findings contradicted the

idea that individuals who score low on emotional stability (neuroticism) can engage in coworking to learn how to cope with uncertainty.

5.2 Explanation of results for Hypothesis 2

The main assumption of Hypothesis 2 was that satisfaction with coworking increases with accumulated coworking experience. We found a nonlinear relationship between experience and satisfaction. This means that increasing experience in the low-experience phase (nine months) has a positive effect on satisfaction. During this early stage of coworking, it is possible that people are keener to adapt to themselves. However, acquiring more experience during the medium-experience phase has detrimental effects. Coworkers can fail to adapt to changes, and excessively accumulated experience harms satisfaction. Finally, when users have a longer coworking experience (one year), they become accustomed to the coworking centre. In this case, additional increases in experience are typically accompanied by increased satisfaction. Although this result is difficult to explain, our data clearly indicated that user satisfaction with CWS is not uniform as users gain more experience. In this vein, we can say that the effects of “learning to cowork” do not emerge linearly. After a “honeymoon effect”, it is possible to identify a decline and a recovery of satisfaction.

6. Conclusion

The literature has not sufficiently considered the connection between the personal characteristics of coworkers and their satisfaction with coworking. We addressed this knowledge gap with the initial assumption that personality traits and accumulated coworking experience influence satisfaction with coworking. Our findings showed that the level of satisfaction varies depending on the users’ extroversion, agreeableness, and coworking experience. The open environment of CWS was well-suited to extroverts. However, agreeable individuals were less satisfied with coworking.

6.1 Implications for scholars

Our research broadens the scope of *employee-workplace alignment theory* by confirming that some personality traits are relevant variables for person-environment fit in CWS. Employees with personality characteristics matching the requirements of the CWS environment were more satisfied with this arrangement. Thus, we identified extroversion and agreeableness as predispositions that affect satisfaction as an output of coworking. The nonlinear relationship between the coworking experience and satisfaction with coworking has implications for the vision of coworking as a gradual learning process. Our findings open horizons for future research. For instance, it would be interesting to use other methodologies such as structural equation modelling with a larger sample size. In addition, we could compare our results with those obtained from other EU countries. An analysis of coworkers based on control variables could also complement the findings of the current study.

6.2 Implications for managers

Our research found empirical evidence to support the decisions of coworking managers. Congruence between personality traits and CWS is crucial for attracting motivated people. These centres must tailor their offers to seek new customers. Hosts that are aware of user predispositions can adapt, improve their coworking experience, and deliberately favour particular types of individuals. Conscientiousness, openness, and mental stability did not explain a significant proportion of the variance of satisfaction with coworking. However, members’ satisfaction with coworking spaces increased if he or she is more extroverted. Paradoxically, agreeable individuals may not be satisfied with these enclaves. This study challenges the widely accepted notion that agreeableness is a key personality trait for adjusting to social or group-based environments.

6.3 Implications for society

Modern work environments, such as CWS, are not ideal for everyone as innate predispositions and experience condition the adjustment to these locations. Understanding the factors that contribute to coworkers' satisfaction is essential for coworking managers. Our findings have implications for workers seeking new workplaces that fit their personalities. This work also offers insights for policymakers interested in encouraging innovation and entrepreneurship through CWS.

6.4 Limitations

This study has some limitations. First, it was a cross-sectional analysis, and CWS users were not studied over time. There is also a risk of self-selection as respondents can be convinced coworkers. CWS are heterogeneous in terms of location, spatial setting, amenities, and atmosphere. These characteristics also influence coworkers' satisfaction. In addition, we treated the experience as a function of time, focusing on the quantity of experience without considering quality.

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Corresponding author

Óscar Rodríguez-Ruiz can be contacted at: orr@ccee.ucm.es

Belonging and beliefs: how social influences drive the intention to purchase foods with health claims

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Francisco J. Sarabia-Sánchez
*Centre for Innovation and Business Development,
Universidad Miguel Hernandez de Elche, Elche, Spain*
Inés Küster Boluda and Natalia Vila-Lopez
*Departamento de Comercialización e Investigación de Mercados,
Universitat de Valencia, Valencia, Spain, and*
Francisco Sarabia-Andreu
Universidad Católica San Antonio de Murcia, Murcia, Spain

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Abstract

Purpose – This study examines how social influences (need to belong and fear of missing out) and the perceived credibility of health claims affect the intention to purchase foods with health claims.

Design/methodology/approach – Data were obtained from a web-based survey of 844 Spaniards aged 25 years and older, with sex and age quotas. Real product images with health claims contextualized the purchase intention questions, aiding respondents who often struggle to differentiate health from promotional claims.

Findings – Both personal and social dimensions of fear of missing out (FoMO) influence the desire to belong to a healthy group. The intention to purchase food with health claims is also positively associated with the desire to belong. The results reflect the importance of FoMO and the need to belong in enhancing consumers' tendency to purchase products with health claims. The results also reflect the importance of purchase intention in making health claims perceived as credible.

Originality/value – This study integrates individual aspects (belief in the credibility of health claims) with social aspects (belonging and FoMO) to analyze the intention to purchase foods with health claims. Using authentic product images to aid consumer comprehension adds an innovative dimension, addressing a gap in consumer behavior research.

Keywords Credibility, Purchase intention, Consumer behavior, Health claim, Belonging, FoMO

Paper type Research paper

1. Introduction

The consumption of food claiming to be healthy has increased in recent decades in Western societies, along with increased awareness of healthier eating habits (Khanna, 2022). The wide availability of healthy options in retail and the promotion of active lifestyles further support this shift. Central to healthier eating habits are health claims (HCs), which play a pivotal role in influencing consumer behavior at the point of sale (Steinhauser *et al.*, 2019a; Van Buul and Brouns, 2015). HCs, as a part of food labeling, play a crucial role just before consumers add the food to their shopping cart. Procter & Gamble's "first moment of truth" highlights this critical juncture. Thus, HCs are the last chance for companies to assure consumers of the healthy nature of their products, thereby influencing their perceptions and choices (Ballco and Magistris, 2019).

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While choosing healthy foods may seem rooted in individual decision-making, it is significantly influenced by social contexts and norms (Cruwys *et al.*, 2015; Jeong and Lee, 2021). The consideration of social influences is based on the fact that the desire to consume healthy foods creates an affinity among individuals with the same desire (Reddy and Van Dam, 2020), who can be considered a reference to follow. Moreover, this affinity gives individuals an identifiable lifestyle and history and a specific way of viewing the world (e. g., the Slow Food movement, Healthy Food America, and other groups on social media). Moreover, as food companies are very innovative in healthy products, consumers' choices of these products are intrinsically linked to the need for credible information on such products (Wills *et al.*, 2012). Thus, consumers' desire reliable information about their health effects, and HCs deliver that message. This desire is directly related to purchase intention, as informed individuals are more likely to purchase food they consider beneficial to their well-being (Ali *et al.*, 2018). In addition, this purchase intention is influenced by the need to identify with other individuals/groups that consume healthy foods (Good and Hyman, 2020). Furthermore, the desire to self-identify as a community member with positive eating habits reinforces conscious consumption behavior, motivating healthy eating as a symbol of identity, belonging to a healthy group, and seeking social acceptance. However, this need for identification in a highly innovative and changing environment can lead consumers to fear not being up to date with new healthy products or changes in their nutritional properties. This tendency, known as "fear of missing out" (FoMO) (Alabri, 2022), has been expressed as a negative psychological phenomenon that manifests itself through anxiety and chronic dissatisfaction, interferes with quality of life and psychological well-being, and negatively affects interpersonal relationships (Dadiotis and Roussos, 2024). In fact, FoMO implies a state of anxiety generated by the fear of missing out on positive experiences or because of the desire to belong and the feeling of not wanting to miss out on having or enjoying what other influential people have or enjoy (Gupta and Sharma, 2021). However, the influence of the desire to belong on purchase intention for foods with HCs remains unknown. In reviews on factors influencing purchase intention in retail stores (Castro *et al.*, 2018; Massey *et al.*, 2018), HCs did not appear as drivers of purchase intention, nor did they include the desire to belong and FoMO as possible determinants of purchase intention. In addition, the effect of FoMO in the healthy eating domain has been studied a little (Reisenwith and Fowler, 2023). Therefore, this study explores the impact of Fear of Missing Out (FoMO) on the purchase intentions of products featuring health claims (HCs), taking into account individuals' social need to belong to the community of health-conscious consumers. Additionally, it investigates how the credibility of HCs directly influences purchase intentions and how this relationship may be mediated by the consumers' desire to belong.

2. Conceptual framework and hypotheses

2.1 Social identity theory and healthy eating

Food is a central part of an individual's identity (Burt, 2022) and shapes it from cultural and personal perspectives. On the one hand, food practices are integral to the maintenance of cultural identity, especially in multicultural societies (Reddy and Van Dam, 2020). On the other hand, food choices are expressions of personal identity, influenced by lifestyle and social affiliations (Nezlek and Forestell, 2020). Therefore, healthy eating habits and preferences may reflect and shape individuals' identities and beliefs. Thus, individuals may adopt healthy eating habits based on their expectations of how they identify with other individuals or their reference groups, although social comparison reduces the sense of belonging (Derricks *et al.*, 2021).

In this context, social identity theory can offer a reasonable basis for explaining individuals' preferences for healthy eating (Bartels and Onwezen, 2013). Following this theory, the association between individuals' desires and the need to identify with a specific

reference group can explain preferences for healthy food attributes (Stead *et al.*, 2011). Thus, this theory suggests that individuals classify themselves into groups based on cultural, linguistic, and other similarities, including personal preferences and attitudes (Tajfel and Turner, 1979). This classification helps individuals define their identity concerning the groups to which they belong, reinforces them socially, and influences their behaviors, attitudes, and perceptions (Abrams and Hogg, 2001). This theory has been used to explain healthy eating preferences and behavior. For example, Strachan and Brawley (2008) found that people who strongly identify as healthy eaters tend to react more intensely when that identity is challenged; Robinson *et al.* (2013) concluded that the social context, which can inform nutritional interventions, influences healthy eating behavior, and De Hoog and Pat-El (2024) that social identities are positively associated with healthy food choices.

2.2 Sense of belonging and healthy eating

As suggested by social identity theory, it is essential to consider the individual's sense of identity intimately related to belonging within a group. This belonging is a primary motivation related to the need for social connections to develop an identity (Leary and Cox, 2008). Definitions typically follow a highly applied approach when referring to these groups. Thus, Baumeister and Leary (1995) interpreted belonging as the propensity to form bonds with other people or groups. This propensity has two basic characteristics: the need for positive interactions (or at least non-conflictive interactions) and the perception of a stable and continuous bond. For these authors, this perception is crucial in belonging and goes beyond mere affiliation. Consequently, belonging can be a feeling and conscious decision aimed at a goal (Blackhart *et al.*, 2011). Much of the literature contains studies on belonging to specific social groups (e.g. migrants, Indigenous people and people with disabilities) and food (Reddy and Van Dam, 2020). In summary, a sense of belonging is decisive in several aspects of healthy eating habits. For example, a strong sense of community-belonging is positively associated with healthy eating habits (Hystad and Carpiano, 2010) and better social and psychological functioning, including greater commitment to healthy behaviors (Hagerty *et al.*, 1996). A strong association between feelings of belonging and healthy eating has been reported for specific groups (e.g., older people or individuals with bicultural identity) (Seppänen *et al.*, 2019).

2.3 Sense of belonging and fear of missing out (FoMO)

The sense of belonging is a protective factor for individuals on a personal and social level (Allen *et al.*, 2022). In fact, a low sense of belonging has been related to personal problems (stress, anxiety) and social problems (feelings of loneliness). One of its harmful effects is the phenomenon known as FoMO (Alabri, 2022), which occurs when a strong desire to belong to a group is combined with a feeling of fear of losing or not enjoying what other influential people in the group have or enjoy (Gupta and Sharma, 2021). In this regard, Przybylski *et al.* (2013) defined FoMO as “a pervasive uneasiness that others might be having rewarding experiences from which one is absent” (p. 1841). Subsequently, Zhang *et al.* (2020) considered it as an experience “that can help an individual maintain or enhance her/his private and/or social self” (p. 1622). In sum, FoMO can be understood as a negative feeling derived from not wanting to miss an opportunity, experience, event, or status and the subsequent response regarding interactions with others.

As a psychological issue, FoMO influences physical and mental well-being, social functioning, and personal outcomes (Gupta and Sharma, 2021). FoMO significantly affects food consumption attitudes and behaviors (Hartini and Mardhiyah, 2023), often leading to unhealthy eating patterns driven by social influences. Similarly, FoMO can amplify peer influence on eating habits, pushing individuals to conform to group eating behaviors, which may not be healthy (Milyavskaya *et al.*, 2018). However, FoMO may positively affect young people's motivation in their academic lives (Nursodiq *et al.*, 2020), and, in certain circumstances, it can lead to better social connectedness (Roberts and David, 2020).

Many studies have focused on FoMO in youths and their interaction with social media (Abel *et al.*, 2016). However, Barry and Wong (2020) challenged its generational nature, affirming that it arises at all ages and suggesting, in line with Balta *et al.* (2020) and Zhang *et al.* (2020), that FoMO is more of an individual characteristic than the behavior of specific population cohorts. The latter authors pointed out that FoMO is a two-dimensional construct in which personal and social dimensions can be identified (Reisenwitz and Fowler, 2023). The personal dimension relates to individuals' internal dissatisfaction when they think they are missing out on opportunities or events. People with FoMO tend to compare themselves to others, which can lead to frustration if they believe they are not achieving what others are. The social dimension refers to how interactions and relationships with others influence this fear. In this context, FoMO arises from the desire to belong to a community. Social networks, whether digital platforms or groups of colleagues and friends, amplify this dimension by sharing others' experiences (Jamil *et al.*, 2023), reinforcing the individual's fear of not being part of those moments.

As personal FoMO increases, so does the need to stay informed and participate in what others do, reinforcing the social FoMO. This is because feeling "out of the loop" generates greater dependence on social aspects to validate social belonging. Thus, the personal dimension, marked by internal dissatisfaction, influences the social dimension, increasing participation in interactions to mitigate personal FoMO (Przybylski *et al.*, 2013). The strong association between these two dimensions, coupled with the fact that FoMO is a psychological phenomenon, leads to the following hypothesis:

H1. The personal dimension of FoMO influences the social dimension of FoMO.

2.4 Health claims

HCs are complex to define and arrange into a typology (Hawkes and World Health Organization, 2004), and nutrition claims sometimes overlap (Hodgkins *et al.*, 2019). An HC is any message (text, picture, graph, or symbol) that indicates a relationship between consuming a particular food and lowering the risk of health problems (FDA, 2018) or enhancing growth and development. In some countries, HCs are governed by special regulations, and the requirements for their approval and use can differ across countries (Kušar *et al.*, 2021). They serve three purposes: (1) to highlight the link between consuming a given food and achieving health benefits, (2) to create commercial differentiation concerning other foods that do not make such claims, and (3) to increase the propensity to purchase.

From a consumer point of view, HCs can offer correct information about whether a product is healthy. However, many consumers do not understand HCs and can obtain risky and biased conclusions about the information provided by HCs (Hodgkins *et al.*, 2019). Even in this case, these authors maintained that HCs could correctly guide individuals when searching for certain nutrients or health benefits. For their part, companies use HCs as an additional (and frequently used) element of their marketing strategy because they increase prices, make advertising easier, improve attention at the point of sale, and increase the tendency to purchase (Steinhauser *et al.*, 2019b). Thus, individuals desire to eat healthily (Wiley, 2019), and HCs offer messages that can be useful to enhance their willingness to purchase, leading to a preference for specific brands and creating a perception of quality (Dean *et al.*, 2012).

HCs have communication-related attributes such as credibility, comprehension, focus, and persuasiveness. Some countries require companies to prove that their HCs are truthful. For example, in all European Union countries, a food company can use HC if the average consumer can understand it and the HC is supported by scientific literature (European Parliament and Council of the European Union, 2007). Whether officially recognized or otherwise, truthfulness affects individuals' perceptions (Tarabella and Burchi, 2012) and purchase intention.

2.5 Tendency to purchase depending on the need to belong (BEL)

FoMO can influence people's tendency to buy products that connect them, such as clothing or entertainment. Many buy these products to keep up with the latest trends (e.g., new models of

clothing or new updates or expansions in video games). In the case of food, a connection with the reference group in how a meal is prepared or in new foods appearing on the market. Food and its presentations may provide a sense of belonging and connection to some community or cultural identity (Reddy and Van Dam, 2020). However, it is also possible that individuals will feel they are missing out if they do not have the latest food, which may lead them to develop a purchase intention. The proliferation of social media has exacerbated this phenomenon, as individuals have more access to what other individuals buy or consume. In similar areas, Verbeke *et al.* (2009) found that people who bought products with HCs view them as more trustworthy and express a greater tendency to purchase them again. Meanwhile, Konuk (2019) found that the fair-trade label influences individuals' willingness to buy. Based on these arguments, we propose the following hypotheses:

H2a. The personal dimension of FoMO influences BEL.

H2b. The social dimension of FoMO influences BEL.

There appears to be no literature analyzing the relationship between HC credibility and the tendency to buy foods with HCs while considering the desire to belong to the healthy people group. However, it is known that the sense of belonging significantly influences health and well-being (Raman, 2014). Moreover, it is also known that credible HCs reinforce the sense of belonging to groups that seek physical well-being and health. Therefore, we propose the following hypothesis:

H2c. HC credibility influences BEL.

As H2a and H2c show, we expect that the credibility of food marketing influences HC credibility, and this HC credibility influences BEL. The inclusion and use of HCs in products depends on the companies' commercial policy. Thus, companies use HCs to add value to products (Bimbo, 2017) that engage consumers through more credible products' intrinsic attributes. Therefore, it is possible to consider that the credibility of the HC highlights the influence that credible food marketing can exert on BEL. It is well known that credible HCs reinforce the desire for a sense of belonging in groups that seek well-being and health through food (Raman, 2014). Hence, we posit a novel relationship between credible food marketing and BEL perception.

H2d. The perception of credible food marketing influences BEL mediated by HC credibility.

2.6 Purchase intention for foods with HCs

In general, purchase intention is the individual's tendency to buy a product. This tendency can be "soft," referring to an interest, general disposition, or a mere possibility of purchasing (Dodds *et al.*, 1991). It can also be understood as "hard" when there is an agreement to purchase a product in the future (Spears and Singh, 2004). In this way, a generic purchase intention refers to a conscious assessment of the subjective probability of purchasing a product with specific attributes (in our present case, with HCs). It is a crucial phenomenon of the consumer decision process, understood as the best proxy for behavior, and it has been widely used in marketing literature and business decisions. As a general non-enduring trend, BEL may be related to consumers' intentions to purchase specific foods with HCs. To the best of our knowledge, there is no literature addressing this relationship in the case of food (with or without HCs), although there are examples that deal with other types of products. For instance, Van Ittersum (2001) found a significant relationship between BEL and the intention to buy regional products. Bilal *et al.* (2021) also found a relationship between a sense of belonging and purchase intention in the case of online shopping.

The credibility of a claim can also influence the purchase intention. Lee (2014) reported the existence of this influence, which is strongly mediated by attitudes toward a brand if known by

an individual (but is not mediated if the brand is unfamiliar). Jäger and Weber (2020) found that message credibility mediates the relationship between the arguments in advertising organic food and purchase intention. Based on these arguments, we propose the following hypotheses:

H3a. BEL influences purchase intention.

H3b. HC credibility influences purchase intention.

In general, the intention to purchase healthy food is high if individuals feel that they may miss out on the opportunity to enjoy it or if they feel that they do not enjoy the benefits it brings to others. For this situation to occur, healthy food must have an acceptable price, or its benefit must be trusted, among other conditions (Imtiyaz *et al.*, 2021). Therefore, the following hypothesis posits that the personal and social dimensions of FoMO influence purchase intention, with BEL acting as the mediating variable:

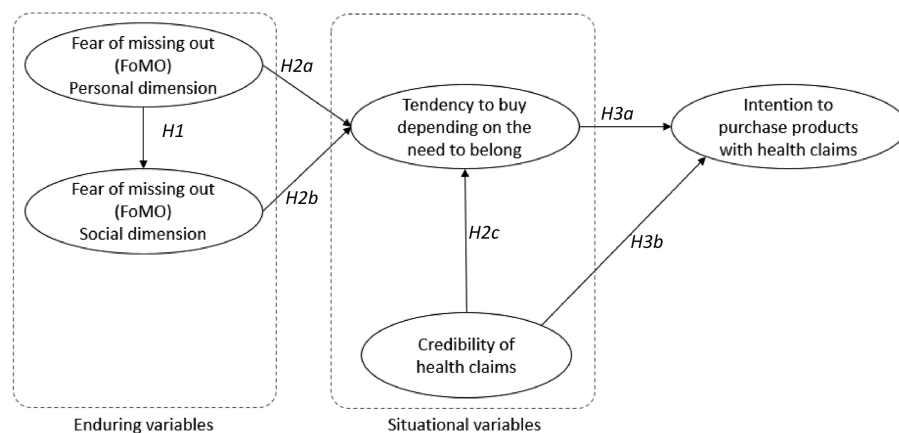
H3c. FoMO indirectly and positively influences purchase intention.

The above hypotheses are summarized in Figure 1, which shows the pivotal difference between enduring and situational variables. Thus, FoMO (personal and social dimensions) is an enduring factor inherent to consumers, providing a stable basis for understanding their behavior. In contrast, situational variables (BEL and HC credibility) are more transitory and influenced by circumstances such as time, type of product, or social context. These variables capture consumers' decision-making and show purchase choices in specific situations.

3. Material and methods

3.1 Participants

Participants were 1,030 residents of Spain, aged 25 years or older, located across 44 of the 50 Spanish provinces. We discarded 105 incomplete questionnaires and 81 outliers (after applying the significance criterion of $p < 0.001$ for the Mahalanobis distance), leaving an effective sample of 844 people. The sample profiles are listed in Table 1. Regarding possible bias in the rate of university education (51.3%), approximately 41% of Spaniards have a university education. To check whether this 10.3% point difference could generate significant



Note(s): For clarity, indirect relationships are not shown

Source(s): Authors' own work

Figure 1. Theoretical framework

Table 1. Sample characteristics ($n = 844$)

Variables		n (%)
Gender	Men	398 (47.2)
	Women	446 (52.8)
Age	25–40 years old	378 (44.8)
	41–60 years old	371 (44.0)
	Over 60 years old	95 (11.3)
Education	Primary education	51 (6.0)
	Compulsory secondary education	92 (10.9)
	Upper secondary education	268 (31.8)
	University	433 (51.3)

Source(s): Authors' own work

biases, we analyzed all variables based on bootstrapping 10,000 samples for corrected and accelerated CI (BCa) with stratified sampling, using the education variable as a stratum. The results showed that the bias was zero for the mean of all variables and was less than 0.005 for each standard deviation. We, therefore, concluded that this difference did not generate biases in the results.

3.2 Procedure

We used a web survey to gather data from participants. For fieldwork (which was conducted for one month), we selected recruiters whose task was to contact potential participants. These recruiters contacted people aged 25 years and over who were regular food shoppers and had no eating problems. Each recruiter followed age and sex quotas, which were required to maintain a minimum number of responses per stratum, thus minimizing age and sex bias. Additionally, for each recruiter, participants were required to reside in a municipality different from the recruiter's residence to minimize the possibility of recruiters contacting relatives or friends within their community. This requirement also prevented the restriction of the sample to a small geographical area, which often occurs with nonrandom sampling. We followed this criterion, as Vehovar *et al.* (2016) suggested, reducing non-coverage bias. Regarding the fieldwork, recruiters contacted potential participants using social networks (WhatsApp, Facebook, Telegram, X -formerly Twitter- and Snapchat). On Facebook, recruiters wrote invitations on their walls and open-group walls. The invitation was forwarded to people who were not relatives of the recruiter for WhatsApp. For other social networks, recruiters asked people to invite other groups.

By ethical standards, the invitation sent to potential participants included information about the study aim, age requirement, voluntary nature of participation, and link to the online questionnaire. Recruiters said participation was anonymous, and there was no financial incentive to participate. Before fieldwork, the Research Integrity and Ethics Committee of the corresponding author's university approved the study (ref. DEE.FSS.02.21). The data are available at <https://doi.org/10.5281/zenodo.14259065>.

3.2.1 Questionnaire. The questionnaire had four blocks. The first was the informed consent, requiring respondents to agree to participate before proceeding. The second block focused on measuring the intention to purchase food with the HCs. To answer these questions, participants had to know what the HC was. In this pre-test, almost half of the pilot sample did not differentiate HCs from promotional claims. This confusion, also reported in the literature (Williams, 2005), forced us to introduce images showing products with HCs, clearly highlighting these HCs. We chose images instead of text because they are easier to understand, process, and retain. Both the market research industry (DeFranzo, 2020) and academic literature (Reynolds-Keefer and Johnson, 2011) indicate that interviewees prefer surveys where the content is short and visual.

In the second block, we asked the participants to examine the images to avoid quick glances without paying attention. The HCs showed were two: a hamburger with the claim “Light beef. Reduced total fat,” and a packet of oat cookies with the claim “Helps lower cholesterol 100% naturally. Supported by the Spanish Heart Foundation,” and a bottle of ketchup with the claim “Less sugar and salt” on the label. All images were extracted from actual products, and we eliminated any reference to the company, brand, or logo to minimize the influence of brand equity.

The questionnaire then included a battery of questions based on the HC in the images. The process followed to select the images, and the proper images are available from the corresponding author upon request. In the third block, we indicated that the respondents’ answers should express their thoughts and feelings without considering the previous questions. Finally, the fourth block included demographics (gender, age group, and educational level) and the item “I don’t care much about my health,” which respondents answered on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Finally, we pre-tested the questionnaire with undergraduate students and people aged 60–75 years. In this pretest, we analyzed respondents’ comprehension and wording of items, the maximum and minimum response times, and the questionnaire flow. We also checked whether the images had an acceptable resolution when displayed on different monitors and the most common smartphones.

3.3 Measures

To measure FoMO, we used the scale of Zhang *et al.* (2020), which includes two dimensions: the personal dimension (FoMO-Personal) with five items and the social dimension (FoMO-Social) with four items, both presented on a 7-point Likert scale. Similarly, to assess the credibility of health claims (CHC), we employed the attitudes toward nutritional information scale from Marietta *et al.* (1999), adapted by simplifying the wording and replacing “nutritional information” with “claim.” This scale was also presented on a 7-point Likert scale for consistency across instruments. The items included statements such as “The information in the health claims is useful” (CHC1), “The information is accurate and correct” (CHC2), “These claims are truthful” (CHC3), “The health claims are true” (CHC4), and “The information is easy to understand” (CHC5). Additionally, to measure the tendency to purchase based on the need to belong (BEL), we adapted the scale from Oberst *et al.* (2017). Items like “I tend to choose foods that improve my health to feel part of the healthy consumer group” (BEL1), “I tend to choose healthy products to share the values of those who buy them” (BEL2), and “I tend to buy healthy foods to feel that I connect with the values of other consumers” (BEL3) were evaluated on the same 7-point Likert scale, ranging from 1 (*mostly disagree*) to 7 (*mostly agree*). Finally, the intention to buy food products with health claims (INT) was measured using the scale proposed by Kozup *et al.* (2003), with items such as “Would you buy these products just because of the health claims they make?” (INT1), “If they did not make these health claims, would you be interested in buying them?” (INT2), and “How likely are you to consider buying ONLY foods because of their health claims?” (INT3), all scored on a 7-point scale from 1 (*definitely not*) to 7 (*definitely*).

3.4 Choice of food images with HCs

We applied the following procedure to select food products with HCs for the questionnaire. First, 63 undergraduate students listed packaged and widely consumed foods. The most cited were sliced bread, cookies, sweets, ready-made pizzas, ketchup, hamburgers, tinned tuna, sugary drinks (soft and energy drinks), and snacks. Only twenty participants mentioned fresh foods like vegetables, fruits, fish, and chicken, typically packaged in blisters. None recalled HCs in the blisters of these fresh foods. Second, the authors chose the three most cited foods: cookies, hamburgers, and ketchup. The selected food included in the questionnaire met two conditions. First, they lacked the terms “bio,” “eco,” “organic,” “vegan,” or “integral” (as these do not represent direct HCs). Second, the textual HCs were not linked to nutritional information and were on the packaging.

4. Results

4.1 Measurement model

An initial analysis with all items of all variables identified a convergence problem with the INT2 item due to their low factor loadings. After discarding this item, the adequacy of the measurement model was confirmed. Because the sample was non-random and Mardias's normalized estimate was $28.83 > 5$, robust estimators were used. The test of model fit was significant (Satorra-Bentler scaled Chi-square = 502.51, degrees of freedom = 125, $p < 0.001$), with a relative chi-square of $4.02 < 5$. The fit indices were good: Bentler-Bonett Normed Fit Index = 0.95, Comparative Fit Index = 0.96, Root Mean-Square Error of Approximation (RMSEA) = 0.060, and 90% CI of RMSEA (0.054, 0.065). We also assessed convergent and discriminant validity. For the first one, we used the statistical significance of the t -values corresponding to the factor loading of each item (all significant) and the standardized factor loadings (all positive and greater than 0.70). We tested for discriminant validity using the Fornell-Larcker criterion and found it was satisfactory. Finally, we calculated the composite reliability indicators and found that all were greater than 0.75. Therefore, the results show that the measurement model is suitable for applying a structural relationship model. Table 2 shows all measurement results.

4.2 Results of the hypothesis testing

Table 3 presents the results for the hypotheses, which may be accepted.

Table 2. Descriptives, reliability, convergent, and discriminant validity of the measuring instruments

Variable	Mean	SD	FL (t-value)	CR	AVE	Correlations			
						F2	F3	F4	F5
(F1) FoMO-Personal	3.81	1.53		0.91	0.68 (0.82)	0.44	0.35	0.15	0.17
FoMO-P1			0.83 (34.46)						
FoMO-P2			0.82 (33.47)						
FoMO-P3			0.84 (36.92)						
FoMO-P4			0.83 (35.36)						
FoMO-P5			0.79 (33.55)						
(F2) FoMO-Social	1.90	1.16		0.93	0.82 (0.91)	1.00	0.61	0.19	0.17
FoMO-S2			0.83 (7.95)						
FoMO-S3			0.92 (9.90)						
FoMO-S4			0.96 (10.13)						
(F3) BEL	2.18	1.30		0.89	0.72 (0.85)		1.00	0.24	0.27
BEL1			0.81 (5.39)						
BEL2			0.88 (4.88)						
BEL3			0.86 (5.41)						
(F4) CHC	3.20	1.32		0.90	0.69 (0.83)			1.00	0.56
CHC1			0.76 (34.27)						
CHC2			0.81 (35.40)						
CHC3			0.88 (34.20)						
CHC4			0.87 (15.86)						
(F5) INT	3.47	1.52		0.78	0.64 (0.80)				1.00
INT1			0.85 (6.76)						
INT3			0.75 (7.62)						

Note(s): SD, Standard deviation; FL, factor loading; CR, Composite reliability
AVE, Average Variance Extracted

The square root of the AVE is shown under each AVE value

INT, Intention to purchase products with health claims; BEL, Tendency to purchase based on the need to belong;

CHC, Credibility of health claims; INT, Intention to purchase

Source(s): Authors' own work

Table 3. Direct effects (standardized solution)

Structural relation	β	rSE	t-value	R^2	Verification
H1: FoMO-Personal $\rightarrow$ FoMO-Social	0.47	0.15	5.04	0.22	Supported
H2a: FoMO-Personal $\rightarrow$ BEL	0.09	0.10	2.58	0.45	Supported
H2b: FoMO-Social $\rightarrow$ BEL	0.62	0.03	10.38		Supported
H2c: CHC $\rightarrow$ BEL	0.07	0.09	2.28		Supported
H3a: BEL $\rightarrow$ INT	0.59	0.07	5.75	0.42	Supported
H3b: CHC $\rightarrow$ INT	0.21	0.24	14.00		Supported

Note(s): BEL, Tendency to purchase based on the need to belong

CHC, Credibility of health claims; INT, Intention to purchase

All t-values are significant at $p < 0.005$; β , Standard coefficient

rSE, Robust standard error; t, t robust test; R^2 , Coefficient of determination

Source(s): Authors' own work

First, the personal dimension of FoMO (FoMO-Personal) influences the social dimension of FoMO (FoMO-Social; H1). The coefficient of determination ($R^2 = 0.22$) for FoMO-Social as the dependent variable is high. These two dimensions correlate ($r = 0.44$, Cohen's $d = 0.98$), which is lower than the value of $r = 0.60$ reported by Zhang *et al.* (2020). Second, both dimensions of FoMO (H2a and H2b) and the credibility of the HC (H2c) influence the tendency to purchase based on a need to belong (BEL). For this case, the proportion of variation for BEL is $R^2 = 0.46$, which is quite high for the consumer behavior area. Finally, consumers' connectivity with other individuals with healthy purchasing behaviors (H3a) and credibility in HCs (H3b) affect the intention to purchase food products with HCs. The model explains 43% of this purchase intention. Moreover, all indirect effects are significant because both dimensions of FoMO affect purchase intention (H3c). Thus, from FoMO-Personal: $\beta = 0.06$, $rSE = 0.05$, $t = 3.079$, $p < 0.01$; and for FoMO-Social: $\beta = 0.09$, $rSE = 0.04$, $t = 3.68$, $p < 0.001$.

5. Discussion

5.1 Theoretical conclusions and implications

Social Identity Theory applied to consumer behavior suggests that identification with social groups influences perceptions, motivations, and decisions. This theory posits that part of the self-concept stems from group membership, which drives behaviors following norms and values. A key implication is that the need for social belonging affects purchasing decisions; those who identify strongly with a health-conscious group tend to choose products that reinforce their group membership. In addition, the credibility of HCs is higher when they come from within the group. Moreover, this theory suggests that the effectiveness of a marketing strategy using HCs may depend on its ability to resonate with the values of specific social groups. Thus, HCs that emphasize shared values within health-conscious communities are likely to be more persuasive. This may also extend to the brand's perception, as consumers may evaluate the brand based on how well it represents or supports their in-group identity.

Our theoretical conclusion is that the literature emphasizes the role of personal identity and belonging to reference groups as contributing factors for healthy eating. It has also been established that a sense of belonging promotes healthy habits, whereas FoMO can negatively affect such habits. However, despite HCs (and their credibility) playing a central role in the purchasing decision, we have not detected that the literature has addressed the role of consumer self-identification and the desired belonging as drivers of the tendency to buy food with HCs. Similarly, we found no studies in the food marketing field that consider FoMO to be an influential factor in purchasing products with HCs. These gaps highlight the originality of our research and its potential contribution to understanding the food choice with HCs from a

new perspective, emphasizing identity and FoMO as significant drivers. However, our study illustrates how social drivers (FoMO and desire to belong) influence the tendency to purchase products with HCs. Positive relationships between these constructs suggest that increases in FoMO or the desire to belong lead to higher purchase intentions for products with HCs. Initially, FoMO was studied in the context of young people's social media behaviors. Recent research shows its relevance in healthy food choices, indicating broader implications (Przybylski *et al.*, 2013). FoMO extends beyond immediate events to affect long-term decisions, including diet. It intertwines with a sense of belonging and personal aspirations linked to reference groups. Marketers can leverage these insights to enhance the appeal of products with HCs by addressing consumers' social needs and aspirations, promoting a sense of inclusion and urgency.

5.2 Managerial conclusions

Social Identity theory points out that the effectiveness of CHs is influenced by their capacity to connect with the values of specific segments. Thus, the persuasiveness of CHs increases when they emphasize shared values in communities concerned about health. This also influences brand perception, as consumers evaluate the brand according to its ability to represent or support their group identity. Thus, food companies have developed consumer-targeted strategies to maximize consumers' purchase intentions based on the development of identities. Thus, companies recognize that (physical or online) point-of-sale shelves, where consumers make specific food choices, are the "first moment of truth" (Araujo, 2013) when directing shoppers toward specific choices. At this point, marketing strategies materialize, with HCs being one of the last messages individuals receive before purchasing. Our results show that the objective of increasing purchase intention for products with HCs can be achieved through strategies based on (1) the desire for belonging and identification, (2) the credibility of HCs, and (3) the use of FoMO in food communication. In the first case, as social identities and affiliations with consumer communities significantly influence decisions to purchase foods associated with healthy lifestyles, appealing to the desire to belong to (or identify with) a healthy community can lead consumers to use HCs as a way to guide the purchase decision by connecting individuals to that community. In the second case, it should be remembered that consumers perceive foods with HCs as healthier, which translates into less information-seeking effort, and HCs as more trustworthy. In addition, consumers have difficulty differentiating between nutrient content and HCs, which can lead to misunderstandings about product benefits. Therefore, food companies must ensure that their HCs are truthful because exaggerations can lead to mistrust among consumers, which reduces their purchase intention. In this sense, improving the credibility of HCs will improve consumers' willingness to buy foods with real health properties. Finally, in the third case, using FoMO in communication actions can be a tool to influence purchase intentions. Thus, a sense of urgency is triggered when advertising messages suggest that certain foods offer benefits that others could be taking advantage of. This approach appeals to the need to seize opportunities, which increases the likelihood that consumers will act quickly to avoid "falling behind" on healthy trends.

5.3 Limitations and future research lines

The first limitation may refer to the common problem of self-selection bias inherent to any survey study. In addition, the web-based survey faced reduced participation from people over 60. Although researchers may define specific participant profiles, only the participants can decide whether to participate. The sampling imbalance for this group of people was due to the significant digital gap in Spain. Older people use the Internet a little, and almost half never use it. Nevertheless, Barry and Wong (2020) reported that FoMO is not generational but independent of age. However, the limitations those authors imposed on their sample (residents aged 47 years or younger) raise questions about whether FoMO is also present in older segments. In many countries, the average age is over 40 years (Japan, most European

countries, and Canada), and older people are more interested in food with information about health attributes (Cavaliere *et al.*, 2015). This line of thinking opens a potential stream of research to test the authors' findings above for different generations (baby boomers and older, Generations X, Y, and Z) and their responses to different types of HCs. If FoMO was found to be an individual trait or generational characteristic, it could provide clues about individuals' nature and perceptual dynamics.

The second limitation may be that the products presented in the survey were unhealthy to contextualize and show the HCs. It was chosen because it is in this type of food where consumers run the most significant risk of finding exaggerated, misleading, inadequate, or false HCs. However, as HCs can appear in functional foods, dietary supplements, nutraceutical products, medical foods, and some beverages promoting health benefits, a second line of work would be to test whether the type of product influences the intention to purchase based on the HC. Finally, our study was conducted in Spain, a country with an advanced Western culture where there is a contradiction between the widespread consumption of junk food and the strong tendency to improve nutrition. Therefore, our results do not apply to other countries with other food traditions and different trends in social relations. A transnational replication of our study could provide insight into the possible generalization of the identified relationships.

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Corresponding author

Francisco J. Sarabia-Sánchez can be contacted at: fransarabia@umh.es

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Prediction of cryptocurrency's price using ensemble machine learning algorithms

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N.S.S. Kiranmai Balijepalli

*Symbiosis Institute of Business Management, Symbiosis International University,
Pune, India, and*

Viswanathan Thangaraj

*Symbiosis Institute of Business Management, Symbiosis International University,
Pune, India and*

*Prin. L. N. Welingkar Institute of Management Development and Research,
Bangalore, India*

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Abstract

Purpose – Cryptocurrency markets are gaining popularity, with over 23,000 cryptocurrencies in 2023 and a total market valuation of 870.81 billion USD in 2023. With its increasing popularity, cryptocurrencies are also susceptible to volatility. Predicting the price with the least fallacy or more accuracy has become the need of the hour as it significantly influences investment decisions.

Design/methodology/approach – This study aims to create a dynamic forecasting model using the ensemble method and test the forecasting accuracy of top 15 cryptocurrencies' prices. Statistical and econometric model prediction accuracy is examined after hyper tuning the parameters. Drawing inferences from the statistical model, an ensemble model using machine learning (ML) algorithms is developed using gradient-boosted regressor (GBR), random forest regressor (RFR), support vector regression (SVR) and multi-layer perceptron (MLP). Validation curves are utilized to optimize model parameters and boost prediction accuracy.

Findings – It is found that when the price movement exhibits autocorrelation, the autoregressive integrated moving average (ARIMA) model and the ensemble model performed better. ARIMA, simple linear regression (SLR), random forest (RF), decision tree (DT), gradient boosting (GB) and multi-model regression (MLR) ensemble models performed well with coins, showing that trends, seasonality and historical price patterns are prominent. Furthermore, the MLR approach produces more accurate predictions for coins with higher volatility and irregular price patterns.

Research limitations/implications – Although the dataset includes crisis period data, anomalies or outliers are yet to be explicitly excluded from the analysis. The models employed in this study still demonstrate high accuracy in predicting cryptocurrency prices despite these outliers, suggesting that the models are robust enough to handle unexpected fluctuations or extreme events in the market. However, the lack of specific analysis on the impact of outliers on model performance is a limitation of the study, as it needs to fully explore the resilience of the forecasting models under adverse market conditions.

Practical implications – The present study contributes to the body of literature on ensemble methods in forecasting crypto price in general, potentially influencing future studies on price forecasting. The study motivates the researchers on empirical testing of our framework on various asset classes. As a result, on the prediction ability of ensemble model, the study will significantly influence the decision-making process of traders and investors. The research benefits the traders and investors to effectively develop a model to forecast cryptocurrency price. The findings highlight the potential of ensemble model in predicting high volatile cryptocurrencies and other financial assets. Investors can design the investment strategies and asset allocation decisions by understanding the relationship between market trends and consumer behavior. Investors can enhance portfolio performance and mitigate risk by incorporating these insights into their decision-making processes. Policymakers can use this information to design more effective regulations and policies promoting economic stability and consumer welfare. The study emphasizes the need for using diversified model to understand the market dynamics and improving trading strategies.



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Originality/value – This research, to the best of our knowledge, is the first to use the above models to develop an ensemble model on the data for which the outliers have not been adjusted, and the model still outperformed the other statistical, econometric, ML and deep learning (DL) models.

Keywords Cryptocurrencies, Forecasting, Price prediction, Analytics, Machine learning, Multi-model regression model

Paper type Research paper

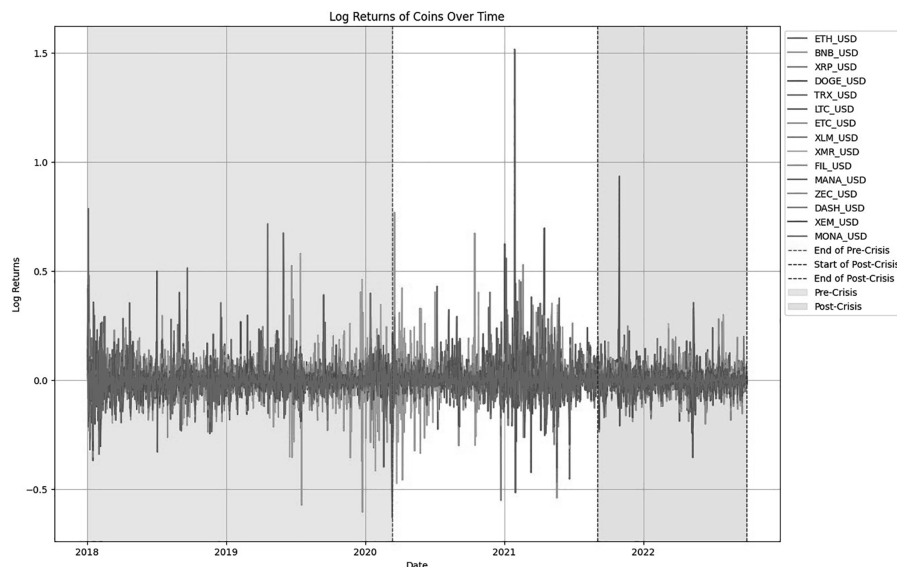
1. Introduction

A cryptocurrency is a cryptographically secured digital currency distributed on a decentralized network using blockchain technology, making them anonymous and untraceable. The advent of cryptocurrencies and blockchain technology has sparked a revolutionary shift in the financial sector (Kayani, 2023; Kayani and Hasan, 2024).

Cryptocurrencies offer substantial returns on investments besides possessing a higher risk factor. A classic example would be the Bitcoin index (in EUR), which stands at a 108.27% compound annual growth rate and a standard deviation of 156.99% between 2011 and 2024. Figure 1 shows the abnormal spike in Bitcoin return during 2021, with significantly higher fluctuations indicating heightened volatility. This calls for accurate forecasting models to combat the large fluctuations in non-stationary cryptocurrencies (Bouteska *et al.*, 2024). Prediction of cryptocurrency prices is also important for several other reasons, such as building trading strategies, risk management, price discovery, market sentiment analysis and business applications.

Fundamentalists and chartists rely on price prediction to make an informed decision. Chartists looking for price patterns and trends can refine their technical analysis based on forecasting. While fundamentalist's primary focus remains on long-term value assessment, the model's predictions could potentially serve as an additional data point for considering short-term market sentiment that might influence their investment decisions (Soltani *et al.*, 2023).

The early-stage researchers employed statistical and econometrics models to forecast the price of cryptocurrencies. To predict Bitcoin's short-term prices, the autoregressive integrated moving average (ARIMA) model was applied by Wirawan *et al.* (2019). The progressive growth



Source(s): Figure by authors

Figure 1. Historical returns of cryptocurrencies

in machine learning (ML) also motivated researchers to compare the forecasting accuracy of various models. Lyu (2022) compared the accuracy of various ML models and found gradient boosting (GB) to be the most efficient in predicting most major cryptocurrencies.

Recent studies on forecasting started applying deep learning (DL) and hybrid models, combining classical models such as the ARIMA model and artificial neural networks (Suhartono *et al.*, 2017). Li *et al.* (2022) found that the hybrid model improved the forecasting accuracy of foreign currency and demonstrated that the hybrid data decomposition model outperforms econometric, ML and deep-learning models. Chen (2023) predicted the Bitcoin price of the next day and found that random forest (RF) gives better accuracy than long short-term memory (LSTM). An extensive literature review revealed limited studies using ensemble methods to predict the prices of multiple cryptocurrencies and hyper-tune the parameters to improve forecasting accuracy (Derbentseva *et al.*, 2021).

Furthermore, the existing literature predominantly focuses mostly on Bitcoin. Empirical research is necessary to test the forecasting models in a broader range of cryptocurrencies that display diverse price dynamics and volatility, which have evolved over the past few years (Pirayonesi and El-Diraby, 2020). ML has the power to identify complex patterns in price movements and overcome the limitations of traditional models to improve forecasting accuracy. In contrast, traditional models like ARIMA may exhibit reliability in some cases (Nakano *et al.*, 2018). Ensemble model combine the output from multiple models, hyper-tune the parameters and improve the forecasting accuracy. A systematic, three-stage approach is followed to create an ensemble model for predicting cryptocurrency prices. First, a dataset of historical prices of the 15 cryptocurrencies selected based on their market capitalization. Then, the base models, random forest regressor (RFR), gradient boosting regressor (GBR), support vector regression (SVR) and MLP regressor, are trained on the training set, optimizing their hyper-parameters. With the base models trained, predictions on the test set are made using each model. Finally, these individual predictions are combined using stacking to create the ensemble model. Root mean squared error (RMSE), mean squared error (MSE), mean absolute error (MAE) and R2 are used to evaluate the ensemble model's performance on the 15 cryptocurrencies.

The study addresses the critical gaps in the existing literature. First, the existing studies have explored the statistical or ML models in silos. The traditional statistical models fail to capture the non-linear and rapid price movement of cryptocurrencies. Further it carries limitations such as hyperparameter tuning and lacks computational efficiency. The standalone ML models suffer from issues such as overfitting or underfitting adversely affecting the forecasting accuracy. This study bridges the gap by applying a robust ensemble machine leveraging the potential of ML to improve forecasting accuracy. Further the existing studies on forecasting, focus mostly on a single cryptocurrency, Bitcoin in general and few others like Ethereum. The broader cryptocurrency market remains largely unresearched. The study provides a methodological framework to empirically test the forecasting accuracy of ensemble model on a broader set of cryptocurrencies. Ensemble models are flexible in capturing non-linear relationships, complex patterns in the data and provide superior forecasting performance as compared to the standalone models. This paper contributes to the existing theories on predictive analytics, providing empirical evidence by creating an ensemble ML model. In addition, it contributes to the body of knowledge on how to leverage bias-variance trade-offs in forecasting. To fill the research gap, the study aims to address the following questions: (1) How to develop an ensemble model to accurately predict the prices of multiple cryptocurrencies? (2) Does the ensemble model outperform the statistical and econometric model in improving forecasting accuracy? (3) Does the ensemble model provide a better estimate of future price on a broader set of multiple cryptocurrencies that differ in return and volatility dynamics?

The rest of the paper is structured as follows. A brief literature review is detailed in Section 2, outlining the previous papers that used various models to predict the price of cryptocurrencies. Section 3 explores the methodology and the ensemble prediction approach of this study, whereas Section 4 presents the empirical findings, including a comparison of the proposed

2. Literature review

Over the last decade, cryptocurrencies have gone up from an obscure asset to a preferred investment due to millennials' popularity, increased risk-taking propensity, perceived profitability, decentralization and acceptance of cryptocurrency as an investment option.

Cryptocurrency price forecasting is considered one of the financial domain's most difficult predictions (Livieris *et al.*, 2021). Challenges, complexity and interpretability of models have been classified as a problem of time series forecasting by most successful researchers (Adegboruwa *et al.*, 2019; Hamayel and Owda, 2021; Lahmiri and Bekiros, 2019; Patel *et al.*, 2020; Tandon *et al.*, 2019; Wirawan *et al.*, 2019).

This literature review examines the existing research studies on cryptocurrency price forecasting and the various possible methodologies for the same. Traditional statistical and econometric models have been considered for the analysis, which goes on to assess promising ML techniques. Finally, the potential of combining these methodologies to create hybrid models is analyzed.

2.1 Existing approaches to cryptocurrency price forecasting

2.1.1 Traditional statistical, econometric and ML models. The early research on cryptocurrency price forecasting relied on traditional econometric and statistical models. Efficient and immediate solutions for time series problems can be achieved through statistical models (Meenu *et al.*, 2020). Econometric approaches that combine statistical and economic principles, according to Alahmari (2019) are crucial to estimating and predicting economic variables relevant to cryptocurrency prices. Time-series analysis often employs the ARIMA model, which, as discussed above, is a widespread technique (El-Bannany *et al.*, 2020). Yet, the statistical and econometric models in forecasting come along with limitations. The statistical models rely on specific assumptions such as the normal distribution of data, the linear relationship between the variables and the stability of parameters over time. Thus, statistical models perform poorly either with noisy data or with changes in the trends and patterns.

Nikou *et al.* (2019) found that the ARIMA model, while suitable for price prediction within specific periods, struggles with capturing sharp price fluctuations. Similarly, Greaves and Au (2015) also observed significant prediction errors with ARIMA, particularly in the cases pertaining to volatile markets. Moreover, statistical and econometric models work within a specific framework, thus limiting the model's ability to handle complexities in real-world data. The presence of non-linear relationships between variables adversely affects the forecasting accuracy.

ML techniques have gained significant traction in cryptocurrency price forecasting as a consequence of advancements in big data technology and artificial intelligence. These techniques analyze complex data patterns and make predictions powerfully (Chevallier *et al.*, 2021; Derbentseva *et al.*, 2021).

2.1.2 Integration of techniques (ensemble models). There is a solid foundation through traditional statistical and econometric models to understand trends and relationships of financial data. However, cryptocurrency markets present the complexity of non-linear patterns that traditional models might not capture. ML techniques have the ability to identify such patterns with ease, only when provided with large datasets and careful tuning to avoid overfitting.

The benefits of statistical models lie in providing a foundational framework and distinguishing patterns and trends. For ML, the same reflects in uncovering the intricacies of complex non-linear relationships within the data. Through a combined approach, it is possible to tackle the limitations of individual models and optimize prediction accuracy (Madan *et al.*, 2015).

Hybrid models that combine traditional and ML approaches can outperform classical ML models in terms of accuracy (Alahmari, 2019). The strengths of both methodologies come together to optimize accuracy in such a hybrid model.

2.1.3 Effects of information shocks on cryptocurrency prices. Wang *et al.* (2020) studied the relationship between economic policy uncertainty (EPU) and Bitcoin prices. Their findings suggest that EPU has a negative impact on Bitcoin prices in the short term. This effect gradually diminishes over time and has no notable long-term effects. Similarly, positive information shocks lead to higher volatility in the short run, while negative shocks have left no significant impact on cryptocurrency prices (Yin *et al.*, 2021)

3. Theoretical framework

Cryptocurrency markets are known for their intense fluctuations and unpredictability. A predictive model which can efficiently navigate price fluctuations is required for effective cryptocurrency price prediction. Comparative studies of statistical models and their strengths and weaknesses are lacking (Lobell and Burke, 2010). ML models are dynamic and can deal with complexities to predict the price with a high degree of accuracy. Researchers used ML models such as DT, GB, SVR and MLP. Contradicting the researchers who supported ML models for price forecasting, Cohn *et al.* (1996) have concluded that statistically-based learning architectures combined with a mixture of Gaussians and locally weighted regression improve forecasting accuracy. Feature engineering and feature extraction using ML models can improve forecasting accuracy.

Ensemble model synthesizes the output from multiple ML models to make an accurate forecast. It works like seeking advice from many sources thus improving the forecasting accuracy. The model improves the forecasting accuracy by merging predictions from multiple models. The learning rate of ensemble model can be effectively improved through optimization and hyperparameter tuning. By combining diverse models, ensemble forecasting accuracy can be improved using features such as maximum vote, stacking, blending, bagging and boosting. The combination of multiple algorithms in an ensemble model makes it capable of outperforming single-base models in predicting cryptocurrency (Yang *et al.*, 2022).

4. Methodology

4.1 Research approach and data source

Primarily differing in their approach to value stability and underlying mechanisms, stablecoins and cryptocurrencies are quite different. Stablecoins are engineered to mitigate price volatility by pegging their worth to a stable asset or fiat currency such as the US dollar or Euro. This ensures their consistency in value. This research paper focuses on the prediction of cryptocurrency prices due to their volatility when compared to stable asset prices. By focusing solely on non-stablecoin cryptocurrencies, our research avoids potential complexities introduced by stablecoins, whose value is pegged to external assets and may exhibit less price volatility compared to other cryptocurrencies.

Daily price data of 15 coins, based on market capitalization, is collected to build the forecasting model starting from January 2018 to September 2022. The coins selected for the study are Ethereum (ETH), Binance (BNB), Ripple (XRP), Dogecoin (DOGE), TRON (TRX), Litecoin (LTC), Ethereum Classic (ETC), Stellar (XLM), Monero (XMR), File coin (FIL), Decentraland (MANA), ZCash (ZEC), Dash (DASH), NEM coin (XEM) and Mona coin (MONA), all priced in USD. Data regarding the prices is obtained from Coinmarketcap as it offers comprehensive coverage and is widely used in cryptocurrency research (Vidal-Tomás, 2022).

The research methodology is divided into four stages. The first stage is to examine the forecasting accuracy of statistical models and refine them further to improve the forecasting accuracy. We evaluate the forecasting accuracy of ARIMA in stage two. In Stage Three, ML algorithms, including GB, DT, RF, SVR and MLP, are employed.

The final stage combines the best-performing ML models to optimize the forecasting accuracy further and build the model. The three models are RF With eXtreme Gradient

Boosting (XGBoost), Ensemble model with RF, GB, DT and multi-model regression (MLR). R-squared, RMSE, MSE and mean absolute error were employed to evaluate the performance of the models.

4.2 Models employed for forecasting

4.2.1 Simple linear regression (SLR). A SLR model is applied to forecast future prices when there is a linear relationship between dependent and independent variables. The equation has the form $Y = a + bX$, where Y is the dependent variable, i.e. the price of cryptocurrencies and X is the independent variable (time), b is the slope of the line and a is the y-intercept.

4.2.2 Auto-regressive integrated moving average (ARIMA). The ARIMA model, a stochastic process, includes sums of autoregressive and moving average components. The model is applicable when there is autocorrelation among the residuals. The model includes three parameters, i.e. p , d and q .

p-auto-regressive component

d-order of differencing

q-moving average component.

ARIMA model specification

$$Y_t' = C + \phi_1 Y_t - 1' + \dots + \phi_p Y_t - p' + \phi_1 t - 1 + \dots + \phi_q t - q + t \quad (1)$$

4.2.3 Random forest (RF). RF, a supervised learning algorithm, is applicable to solving classification and regression problems. The first work on RF goes back to Ho (1995). Breiman (2001) further developed the idea and presented the RF algorithm in 2001. Various DTs are created on randomly selected samples, the forecasted results are produced from each tree and then the best tree is chosen by voting. The key benefits of RF are its generalization capability and minimal sensitivity to hyperparameters (Naing and Htike, 2015). In the prediction of cryptocurrency prices, RF has been used for BTC forecasting (Chevallier *et al.*, 2021) and BTC, ETH and XRP in (Derbentseva *et al.*, 2021).

4.2.4 Decision tree. DT, a type of supervised ML model, made of decision nodes and leaf nodes, resembling a tree-like structure with branches and leaves. The decision node represents features and attributes, and the leaf node represents the outcome. Inducing DT is one of the oldest and most popular techniques for learning discriminatory models, which has been developed independently in the statistical (Breiman, 2017; Kass, 1980) and ML (Hunt *et al.*, 1966; Quinlan, 1983, 1986) communities.

4.2.5 Gradient boosting (GB). GB, an ML technique, is used to solve regression and classification issues. A collection of weak prediction models, often DT, are produced as outcomes (Madeh and El-Diraby, 2021). GB frequently outperforms RF (Madeh and El-Diraby, 2021; Pirayonesi and El-Diraby, 2020), allowing optimization of any differentiable loss function.

The loss function and the base-learner models can be arbitrarily specified on demand. Given a loss function denoted by $\Psi(y, f)$ and/or a custom base-learner $h(x, \theta)$, obtaining a solution to the parameter estimates can be difficult.

4.2.6 Support vector regressor (SVR). SVR is used for regression tasks to minimize forecasting errors. It operates by identifying a hyperplane with maximum margin from the training data. Support vectors, kernel functions and hyperparameter tuning are employed to capture complex relationships and handle outliers. This algorithm can powerfully predict continuous numerical values. Built on support vector machines for classification, SVR enables both linear and non-linear regressions. Examples of SVR usage in forecasting cryptocurrency prices can be found in (Chevallier *et al.*, 2021; Khedr *et al.*, 2021).

4.2.7 Multi-layer perceptron (MLP) regressor. MLP regressor processes input data with multiple layers of interconnected nodes (neurons) to form non-linear transformations.

It employs the backpropagation algorithm to adjust the weights and biases of the network, optimizing the model to minimize the error. Many complicated problems are not linearly separable, so the single hidden layer perceptron, which can only solve linearly separable problems, is not effective (Rosenblatt, 1958). These issues require a solution with multiple hidden layers (Rumelhart *et al.*, 1986). The MPLNN, a feedforward neural network with multiple layers, comprises three layers: an input layer, one or more hidden layers and an output layer.

4.2.8 Ensemble models. Three ensemble models have been created and tested to enhance the accuracy of this study.

4.2.8.1 RF ensembles with XGBoost. GB is used in this approach to train an RF ensemble. The boosting technique is applied to the DTs in RF ensembles by updating the weights of the observations based on the ensemble residuals. Then, each tree in the ensemble is trained to correct the errors of the previous trees. This is done by using the updated weights of the observations. Such an iterative process continues as long as the ensemble's performance continues to improve.

The final ensemble is expected to be more accurate than a simple RF, as the GB algorithm is used to train the DTs.

4.2.8.2 Averaging ensemble model with RF, GB and DT. This method integrated multiple ML model forecasts to increase the forecast's overall accuracy. This ensemble technique is built to individually develop each of the three models, namely RF, GB and DT, which will then return the average of their predictions. Each model may cause errors, so this method can balance them. This practice increases the overall accuracy of the ensemble model's predictions. Each model is trained with a distinct set of algorithms and parameters on the same data set.

4.2.8.3 Multi-model regression model (MLR). This approach employs the RFR, the GB, the SVR and the MLP regressor to form an MLR. Each model's capabilities enhance this ensemble model to increase forecast accuracy. A meta-features data frame is generated by the MLR, which trains a linear regression meta-model using the ensemble of these models. This effectively captures varied patterns and correlations in cryptocurrency data. The MLR technique's success in lowering prediction errors and offering insights into model performance is validated through the RMSE, MSE, MAE and R2 assessment measures.

5. Analysis

5.1 Descriptive statistics

Table 1 shows the descriptive statistics of 15 cryptocurrencies. Generally, cryptocurrencies show high volatility and also create volatility clustering. A perfect normal distribution data series has a skewness value of 0, and kurtosis equals 3. The skewness, kurtosis and Jarque–Bera results indicate that cryptocurrencies' price movements do not follow a normal distribution. This makes it evident that investors face few larger gains and many periods of loss.

5.2 Mean absolute error

Table 2 shows the MAE of cryptocurrency prices. Upon examining the results, it is evident that the performance of the models varies across different coins. Starting with XRP, the RF model exhibits the lowest MAE of 0.019, outperforming other models such as ARIMA, SLR, DT, SVR and MLP. The RF model consistently demonstrates superior accuracy with comparatively lower MAE values than other models for BNB, MONA, XLM, DASH, XMR, FIL and TRX. However, the MLP model shows the lowest MAE values for ETH, LTC, ZEC, MANA and ETC, indicating its effectiveness in predicting the prices. On the other hand, SLR has high MAE values for most coins except for XRP. XRP shows a relatively low MAE compared to other models through SLR. Both RF ensemble with XGBoost and averaging

Table 1. Descriptive statistics

Coins	Skewness	Kurtosis	Jarque-Bera
<i>ETH_USD</i>	1.148557	3.094957	381.8956
<i>BNB_USD</i>	1.073268	2.716866	338.6924
<i>XRP_USD</i>	2.295876	12.24073	7692.837
<i>DOGE_USD</i>	2.087496	7.819337	2937.438
<i>TRX_USD</i>	1.208705	4.660242	621.3699
<i>LTC_USD</i>	1.159686	4.068617	471.173
<i>ETC_USD</i>	1.676378	6.375899	1635.572
<i>XLM_USD</i>	1.186234	4.21978	514.1647
<i>XMR_USD</i>	0.94309	3.44275	271.205
<i>FIL_USD</i>	2.70873	11.43144	7256.654
<i>MANA_USD</i>	2.252884	7.757234	3101.925
<i>ZEC_USD</i>	2.687686	13.10948	9471.696
<i>DASH_USD</i>	3.352199	17.53833	18518.55
<i>XEM_USD</i>	4.245989	27.40811	48253.59
<i>MONA_USD</i>	2.835728	13.97474	11026.09

Note(s): Table showing Descriptive statistics of cryptocurrencies**Source(s):** Table by authors**Table 2.** Mean absolute error

Coin	ARIMA	SLR	RF	DT	GB	SVR	MLP	RF with XGBoost	Avg RF, GB and DT
<i>XRP</i>	98.288	0.264	0.019	0.024	0.021	0.108	0.183	0.05579	0.008
<i>BNB</i>	13.192	97.665	4.61	5.671	5.696	60.99	111.3	213.3256	44.659
<i>MONA</i>	0.031	0.713	0.054	0.069	0.062	0.312	0.579	25.63429	5.134
<i>XLM</i>	0.009	0.113	0.008	0.009	0.008	0.059	0.129	20.20679	4.259
<i>DASH</i>	0.003	95.75	5.879	7.211	6.531	56.31	84	0.01516	0.004
<i>ETH</i>	5.454	739	38.614	46.389	41.215	724.5	775.9	41.7622	6.805
<i>XMR</i>	2.068	65.669	4.916	6.257	5.879	35.54	61.33	0.01283	0.002
<i>FIL</i>	0.01	18.503	1.1	1.346	1.167	9.257	19.05	0.11622	0.023
<i>LTC</i>	8.742	51.08	3.8	4.499	4.229	35.34	50.07	3.88621	1.086
<i>DOGE</i>	2.294	0.06	0.004	0.004	0.004	0.07	0.077	24.22042	5.544
<i>TRX</i>	0.835	0.02	0.002	0.002	0.002	0.069	0.067	0.37456	0.062
<i>XEM</i>	6.395	0.111	0.006	0.008	0.007	0.062	0.065	23.80469	5.818
<i>ZEC</i>	6.212	68.536	4.934	5.842	5.572	35.45	59.54	0.04309	0.009
<i>MANA</i>	0.006	0.505	0.026	0.033	0.031	0.254	0.558	0.08772	0.029
<i>ETC</i>	0.038	13.167	1.035	1.162	0.975	7.478	11.62	6.77117	1.212

Note(s): Table showing the Mean Absolute Error of cryptocurrencies**Source(s):** Table by authors

ensemble of RF, GB and DT show low MAE demonstrating that the model performs well for most cryptocurrencies.

5.3 Mean squared error

According to Table 3 on the MSE of cryptocurrency prices, the results vary in accordance with the performance of models across different coins. First, the RF model outperforms other models such as ARIMA, SLR, DT, GB, RF ensemble with XGBoost and averaging ensemble of RF, GB and DT for XRP, demonstrating the lowest MSE of 0.002. However, it is essential to note that it is unusual for the MLP model to show a negative MSE value for XRP. This might indicate an issue with the model or the data. The RF model consistently exhibits the lowest

Table 3. Mean squared error

Coin	ARIMA	SLR	RF	DT	GB	SVR	MLP	RF with XGBoost	Avg RF, GB and DT
<i>XRP</i>	18931	0.105	0.002	0.003	0.002	0.58	-1.67	0.0077	0.000
<i>BNB</i>	393.7	15799	117.392	197.296	213.091	0.09	-0.91	126782.8	6882.085
<i>MONA</i>	0.003	0.933	0.014	0.03	0.018	0.75	0.02	2553.567	140.136
<i>XLAM</i>	0	0.019	0	0	0	0.62	-10.21	959.3232	61.044
<i>DASH</i>	0	14219	161.275	239.256	156.187	-4.5	-24.59	0.00127	0.000
<i>ETH</i>	99.239	815760.5	5419.305	8791.746	6711	-23.35	-0.79	3470.993	186.544
<i>XMR</i>	16.705	6763.324	77.521	142.697	117.923	-0.23	-1.27	0.0003	0.000
<i>FIL</i>	0	878.676	7.574	12.603	9.638	-1.23	-3.53	0.02645	0.002
<i>LTC</i>	191.46	4001.806	53.799	79.782	69.582	-2.23	-3.27	67.33126	14.105
<i>DOGE</i>	17.443	0.009	0	0	0	0.4	-52.48	1185.888	91.333
<i>TRX</i>	1.592	0.001	0	0	0	-593	-2.07	0.26202	0.017
<i>XEM</i>	108.51	0.021	0	0.001	0	0.67	-0.03	1243.139	112.427
<i>ZEC</i>	126.38	7103.623	97.882	139.455	112.793	-1.23	-11.31	0.00409	0.000
<i>MANA</i>	0	0.564	0.005	0.008	0.008	0.44	-5.23	0.03888	0.006
<i>ETC</i>	0.007	329.031	14.379	15.213	12.707	-0.93	-3.74	235.6092	9.808

Note(s): Table showing mean squared error of cryptocurrencies

Source(s): Table by authors

MSE values for BNB, MONA, XLM, DASH, XMR, FIL and TRX, indicating its superior accuracy when compared to other models. For ETH, LTC, ZEC, MANA and ETC, the MLP model, conversely, showcases the lowest MSE values among the models considered and stands out as the most accurate. It is worth mentioning that the SLR model shows a relatively low MSE value for XRP and performs poorly for most coins, resulting in a significant rise in MSE values compared to other models.

5.4 Root mean squared error

Table 4 results derive variations in the performance of models among different coins. The RF model outperforms other models such as ARIMA, SLR, DT, GB, SVR and MLP and achieves the lowest RMSE for XRP at 0.052. However, it is essential to note that the SLR model presents a relatively low RMSE for XRP. The RF model consistently exhibits the lowest RMSE values for BNB, MONA, XLM, DASH, XMR, FIL, TRX and ZEC, indicating its superior accuracy compared to other models. For ETH, LTC, MANA and ETC, the MLP model conversely stands out as the most accurate. It showcases the lowest RMSE values among the models considered. The ARIMA model shows relatively high RMSE values across the board, while the SVR model performs moderately well for most coins. Additionally, except for XRP and TRX, where it performs relatively better, the SLR model exhibits higher RMSE values for most coins. RF ensemble with XGBoost and Averaging ensemble of RF, GB and DT has relatively low RMSE demonstrating that the model performs well for most cryptocurrencies.

5.5 R-squared

The results of Table 5 show that the RF, DT and GB models have strong predictive power, due to high *R*-squared values across most coins. Their ability to account for a considerable proportion of the fluctuations in cryptocurrency prices is evident in these models. The ARIMA model has limited explanatory capability for cryptocurrency price movements, as it exhibits comparatively lower *R*-squared values for all coins. Some coins have relatively higher *R*-squared values through the SLR model, while others have significantly negative values.

Table 4. Root mean squared error

Coin	ARIMA	SLR	RF	DT	GB	SVR	MLP	RF with XGBoost	Avg RF, GB and DT
<i>XRP</i>	137.59	0.323	0.052	0.043	0.041	0.171	0.274	0.08777	0.020
<i>BNB</i>	19.842	125.7	14.046	14.598	10.835	109.593	136.629	356.0657	82.958
<i>MONA</i>	0.054	0.966	0.173	0.135	0.118	0.475	0.695	50.53283	11.838
<i>XLM</i>	0.02	0.137	0.021	0.017	0.016	0.075	0.151	30.97294	7.813
<i>DASH</i>	0.004	119.25	15.468	12.497	12.699	100.591	145.217	0.03559	0.015
<i>ETH</i>	9.962	903.2	93.764	81.922	73.616	1212.689	925.488	58.91513	13.658
<i>XMR</i>	4.087	82.239	11.946	10.859	8.805	56.477	85.682	0.01724	0.004
<i>FIL</i>	0.019	29.642	3.55	3.105	2.752	22.931	29.521	0.16264	0.044
<i>LTC</i>	13.837	63.26	8.932	8.342	7.335	49.155	69.146	8.20556	3.756
<i>DOGE</i>	4.177	0.094	0.015	0.014	0.016	0.085	0.106	34.43673	9.557
<i>TRX</i>	1.262	0.026	0.004	0.004	0.003	0.074	0.072	0.51188	0.129
<i>XEM</i>	10.417	0.143	0.024	0.02	0.019	0.079	0.103	35.25817	10.603
<i>ZEC</i>	11.242	84.283	11.809	10.62	9.894	59.686	97.813	0.06396	0.018
<i>MANA</i>	0.01	0.751	0.089	0.088	0.073	0.506	0.806	0.19719	0.080
<i>ETC</i>	0.084	18.139	3.9	3.565	3.792	15.187	17.31	15.34957	3.132

Note(s): Table showing root mean squared error of cryptocurrencies

Source(s): Table by authors

Table 5. *R*-Squared

Coin	ARIMA	SLR	RF	DT	GB	SVR	MLP	RF with XG Boost	Avg RF, GB and DT
<i>XRP</i>	0	−356.35	0.98	0.98	0.98	0.58	−1.67	0.25	0.980
<i>BNB</i>	0.03	0.14	0.99	0.99	1	0.09	−0.91	0.91	1.000
<i>MONA</i>	0.03	−1.44	0.98	0.97	0.99	0.75	0.02	0.92	1.000
<i>XLM</i>	0.01	−1029.32	0.98	0.98	0.99	0.62	−10.21	0.67	0.980
<i>DASH</i>	0.13	−1.55	0.99	0.98	0.99	−4.5	−24.59	0.87	0.980
<i>ETH</i>	0	−0.26	1	0.99	1	−23.35	−0.79	0.7	0.990
<i>XMR</i>	0.01	−15.39	0.98	0.98	0.99	−0.23	−1.27	0.45	0.980
<i>FIL</i>	0.01	−6.3	0.99	0.99	0.99	−1.23	−3.53	0.62	0.980
<i>LTC</i>	0.01	−71.37	0.98	0.98	0.99	−2.23	−3.27	0.78	0.960
<i>DOGE</i>	0.08	−1.89	0.98	0.98	0.98	0.4	−52.48	0.79	0.990
<i>TRX</i>	0.99	−3.05	0.99	0.98	0.99	−593.2	−2.07	0.64	0.980
<i>XEM</i>	0.01	−5.6	0.98	0.97	0.98	0.67	−0.03	0.75	0.980
<i>ZEC</i>	0.01	−5.44	0.98	0.98	0.99	−1.23	−11.31	0.7	0.980
<i>MANA</i>	0.05	−0.92	0.99	0.99	0.99	0.44	−5.23	0.95	0.990
<i>ETC</i>	0.02	−4.2	0.97	0.96	0.96	−0.93	−3.74	0.68	0.990

Note(s): Table showing *R* Squared of cryptocurrencies

Source(s): Table by authors

Hence, the results are mixed. It is important to note that the SLR model performs worse than a horizontal line (mean) in fitting the data when *R*-squared values are negative. This implies that the relationships between those specific coins' dependent and independent variables cannot be captured adequately by the SLR model. There is varied performance across different coins with the MLP model as well. It achieves high *R*-squared values for some coins, such as BNB and ETH, and presents negative *R*-squared values for others. This suggests that for those particular coins, the MLP model may not effectively capture the underlying patterns in cryptocurrency prices. For RF ensemble with XGBoost and averaging ensemble model with RF, GB and DT show reasonably high *R*² values indicate that the model can explain a considerable percentage of the data variation. However, when certain cryptocurrencies, such as XRP, have lower *R*² values for RF ensemble with XGBoost, it is inferred that the model cannot explain a large variation in the data for this coin. Thus, this model's prediction accuracy is quite poor for this currency. The averaging ensemble model with RF, GB and DT model has *R*² values are typically near one, indicating that the model can accurately predict the target variable.

5.6 Multi-model regression (MLR) model

Table 6 and Figure 2 shows the forecasting results of MLR for pre and post-COVID crisis. The results show that the model consistently achieves exceptional performance across all coins. Extremely low values of MAE, MSE and RMSE indicate its high accuracy in predicting cryptocurrency prices covering pre and post-crisis. Additionally, it can be concluded that the model can perfectly explain the variance in cryptocurrency prices, indicating its strong explanatory power, given that the *R*² value of all coins is 1.00. The significant performance of the MLR in accurately forecasting cryptocurrency prices across different coins, as the table highlights, is overall indicative of its effectiveness.

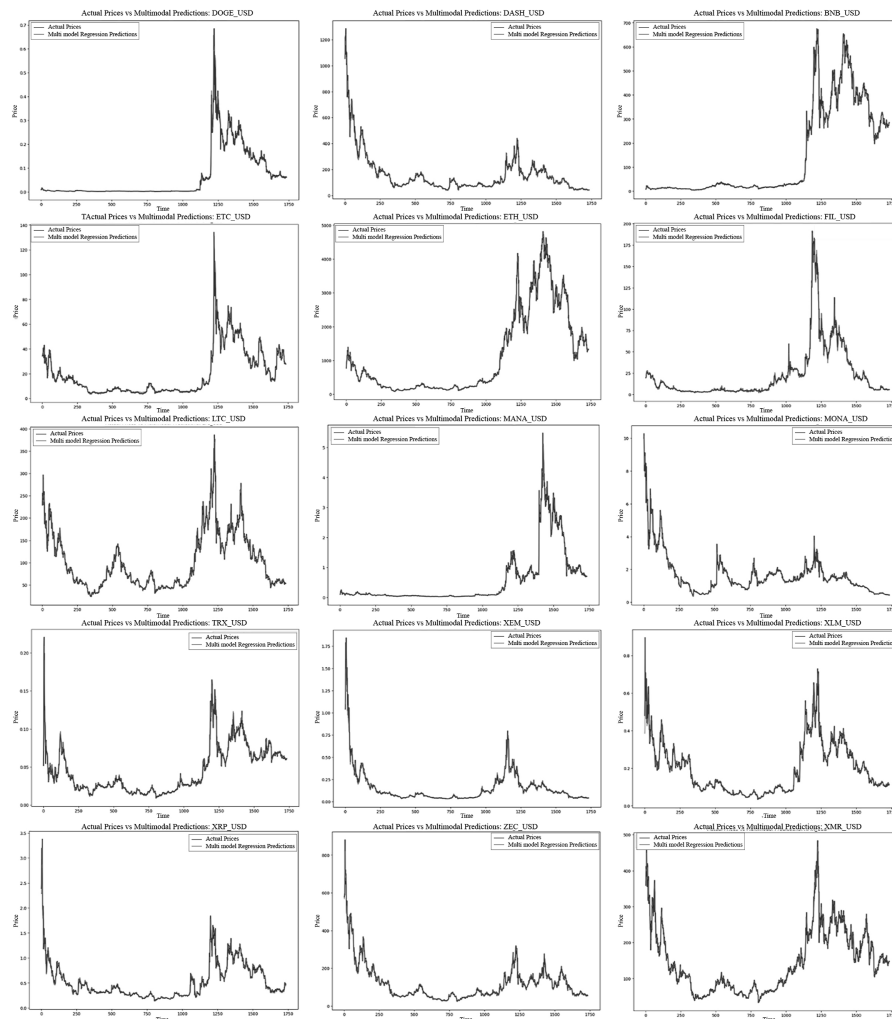
6. Findings

The descriptive statistics analysis, helped understand the nature of cryptocurrency price distributions. Cryptocurrencies are known for their high volatility and the presence of volatility clustering, as noted in the literature review. Aligning with findings from the previous

Table 6. Multi-model regression model

Coin	Pre MAE	Pre MSE	Pre RMSE	Pre R2	Post MAE	Post MSE	Post RMSE	Post R2	Con MAE	Con MSE	Con RMSE	Con R2
XRP	0.02	0.001	0.035	0.991	0.007	0.000	0.010	0.999	1.035	8.828	2.971	1
BNB	0.252	0.151	0.388	0.997	3.267	20.167	4.491	0.998	0.198	0.381	0.617	1
MONA	0.069	0.014	0.119	0.995	0.006	0.000	0.011	0.999	0.001	0	0.003	1
XLM	0.008	0	0.015	0.987	0.002	0.000	0.003	0.999	0.002	0	0.004	0.99
DASH	7.662	198.404	14.086	0.995	1.173	3.345	1.829	0.999	0	0	0	1
ETH	7.223	181.374	13.468	0.997	24.651	1107.4	33.277	0.999	0.334	0.439	0.663	1
XMR	3.372	34.607	5.883	0.995	1.950	7.281	2.698	0.997	0.295	0.266	0.516	0.99
FIL	0.19	0.108	0.329	0.996	0.375	0.432	0.657	0.999	0	0	0.002	1
LTC	2.371	13.674	3.698	0.994	1.231	3.650	1.910	0.999	0.124	0.095	0.308	1
DOGE	0	0	0	0.991	0.001	0.000	0.002	0.999	0.067	0.041	0.203	1
TRX	0.001	0	0.003	0.978	0.001	0.000	0.001	0.996	0.005	0	0.012	1
XEM	0.013	0.001	0.029	0.987	0.001	0.000	0.002	0.999	0.425	0.626	0.791	1
ZEC	5.533	118.976	10.908	0.993	1.525	5.479	2.341	0.998	0.786	1.722	1.312	1
MANA	0.002	0	0.004	0.989	0.031	0.003	0.052	0.998	0.001	0	0.003	1
ETC	0.263	0.364	0.603	0.994	0.370	0.300	0.550	1.000	0.004	0	0.009	1

Note(s): Table showing multi-model regression model for all cryptocurrencies
Source(s): Table by authors



Source(s): Figure by authors

Figure 2. Figure showing the multi-modal regression model performance for all cryptocurrencies

research, the skewness and kurtosis values indicate deviations from a normal distribution (Nikou *et al.*, 2019). This supports the need for robust forecasting models capable of handling such volatile and skewed data.

ARIMA, SLR, RF, DT, GB and MLR ensemble models performed well with coins such as XLM, FIL, MANA, DASH, XMR and ZEC. These models adequately reflect the above coins' trends, seasonality and historical price patterns. Furthermore, MLR demonstrates its advantages when applied to coins like BNB and MONA. SLR has performed well for cryptocurrencies that have significant market capitalization, strong liquidity and price movements that have historically been consistent, like XRP, TRX and DOGE. The MLR ensemble approach produces more accurate predictions for coins with higher volatility and irregular price patterns, such as ETH and ETC, by combining ML models to remove errors.

It is worth noting that the intricacies of each coin's behavior may not be captured as these are broad observations. Macroeconomic, attractiveness and demand and supply variables are all factors that can impact a model's efficacy. The literature review expresses concern regarding cryptocurrency price forecasting challenges, echoed by the findings, which demonstrate that different models perform variably across different cryptocurrencies. The analysis of the RF ensembles with XGBoost and averaging ensemble model with RF, GB and DT demonstrates the effectiveness of ensemble models combining multiple models for improved forecasting accuracy. The results support that ensemble models can enhance predictive performance. They often outperformed individual models across various cryptocurrencies in the current study.

7. Conclusion

Cryptocurrency price forecasting carries a significant influence on investment decisions. The present study makes contribution to the theoretical and practical implications on cryptocurrency investments. On the theoretical side, the study advances the conceptual framework on building predictive models by demonstrating the efficiency of ensemble model in forecasting. It shows a new dimension to predictive analytics by empirically validating the accuracy of multiple algorithms pre-COVID and post-COVID period. On the practical side, it offers a valuable forecasting tool to the traders and investors in making informed decision. The novelty of the research is in its attempt to empirically test the forecasting ability of ensemble model across time span and its comparison with econometric model on a broad-based set of cryptocurrencies. Consistent with the expectations, ensemble models created by combining RF, XGBoost, gradient boosting and decision tree (DT) reduce the variance in predicting errors indicating the forecasting accuracy. Interestingly, it is found that when the price movement exhibits autocorrelation, the ARIMA model is best applicable. Compared to other ML models applied in isolation the ensemble model performed better.

7.1 Practical implications

The present study contributes to the body of literature on ensemble methods in forecasting crypto price in general, potentially influencing future studies on price forecasting. The study motivates the researchers on empirical testing of our framework on various asset classes. As a result, on the prediction ability of ensemble model, the study will significantly influence the decision-making process of traders and investors. The research benefits the traders and investors to effectively develop a model to forecast cryptocurrency price. The findings highlight the potential of ensemble model in predicting high volatile cryptocurrencies and other financial assets. Investors can design the investment strategies and asset allocation decisions by understanding the relationship between market trends and consumer behavior. Investors can enhance portfolio performance and mitigate risk by incorporating these insights into their decision-making processes. Policymakers can use this information to design more effective regulations and policies promoting economic stability and consumer welfare. The study emphasizes the need for using diversified model to understand the market dynamics and improving trading strategies.

7.2 Limitations

Although the dataset includes crisis period data, anomalies or outliers are yet to be explicitly excluded from the analysis. The models employed in this study still demonstrate high accuracy in predicting cryptocurrency prices despite these outliers, suggesting that the models are robust enough to handle unexpected fluctuations or extreme events in the market. However, the lack of specific analysis on the impact of outliers on model performance is a limitation of the study, as it needs to fully explore the resilience of the forecasting models under adverse market conditions.

7.3 Future research

Cryptocurrency markets can be influenced by investor sentiment, which can be reflected in price movements. By analyzing these price movements, investors might gain insights into overall market sentiment. However, exploring this link further is certainly an area for future research. While our study focuses on price prediction using the ensemble model, we acknowledge the need for further exploration to definitively link price movements to specific investor behaviors. Complementary techniques, such as sentiment analysis of social media data or transaction volume analysis, could be valuable tools for future research in this area.

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About the authors

N.S.S. Kiranmai Balijepalli is Research Scholar at the Symbiosis Institute of Business Management, a constituent of Symbiosis International (Deemed) University in Bengaluru, India. Her research focuses on the intersection of technology and finance, utilizing machine learning techniques to predict future cryptocurrency prices and detect market manipulations. Kiranmai aims to advance the understanding and development of predictive models and analytical tools in the dynamic field of cryptocurrency. She has published her work in international journals and presented papers at international conferences, contributing significantly to the academic and professional discourse on cryptocurrency markets. N.S.S. Kiranmai Balijepalli is the corresponding author and can be contacted at: kiranmai@sibm.edu.in

Dr Viswanathan Thangaraj is Associate Professor at the Symbiosis Institute of Business Management, a constituent of Symbiosis International (Deemed) University in Bengaluru, India. Holding a Doctorate Degree, he is also a corporate trainer specializing in Finance and Data Science. Dr. Thangaraj's areas of expertise include data science, ML, artificial intelligence, financial econometrics, financial analytics and corporate finance. He has published several research papers in international journals and presented his work at conferences in India, Singapore, Malaysia and Thailand. His research focuses on integrating technology and finance through advanced analytical techniques.

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Commitment to quality service in hospitality: role of human resources practices, turnover intention, organizational engagement, and adaptability

Md Karim Rabiul

*College of Business, Al Yamamah University, Riyadh, Saudi Arabia and
 Faculty of Hospitality and Tourism, Prince of Songkla University, Phuket, Thailand*

Marianna Sigala

*Newcastle Business School, The University of Newcastle, Newcastle, Australia and
 Department of Service Sector Management, Sheffield Hallam University,
 Sheffield, UK, and*

Rashed Al Karim

School of Business Administration, East Delta University, Chittagong, Bangladesh

Abstract

Purpose – This study examines the mediating role of organizational engagement in the link between human resources management (HRM) practices and commitment to quality services (CQS). It also investigates the moderating effect of turnover intention on the link between HRM practices and organizational engagement, and the moderating effect of employee adaptability on the link between organizational engagement and CQS.

Design/methodology/approach – Customer contact employees ($N = 593$) in Bangladeshi hotels were recruited using a convenient sampling method. Partial least squares structural equation modeling (PLS-SEM) was applied to test the hypotheses.

Findings – Organizational engagement significantly mediates the relationship between HRM practices and CQS. Turnover intention negatively and employee adaptability positively moderates the proposed relationships.

Practical implications – Hospitality managers may use the findings to enhance quality customer services by implementing appropriate HRM practices, reducing turnover, and increasing adaptability and organizational engagement.

Originality/value – The findings contribute to social exchange theory, theory of planned behavior, and job demand-resources theories by explaining the mediating role of organizational engagement and moderating role of turnover intention and employee adaptability which are yet to be discovered.

Keywords Commitment to quality service, HRM practices, Turnover intention, Organizational engagement, Employee adaptability

Paper type Research paper

Introduction

Customer contact employees and the quality of their services are the cornerstones of success in the hospitality industry (Nguyen *et al.*, 2023; Shum *et al.*, 2024). Hence, hospitality firms invest heavily in human resources management (HRM) to enhance their employees' quality of service (Papademetriou *et al.*, 2024; Rabiul *et al.*, 2022). A number of studies (Hessari *et al.*,



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2024; Nerves and Van Dam, 2024) have the direct outcomes of HRM practices in the hospitality industry. Likewise, numerous studies (Davras and Davras, 2024; Rabiul *et al.*, 2021a) have been conducted to investigate the mechanisms that elucidate the connection between HRM practices and hospitality employees' service-oriented behaviour, such as psychological safety and meaningfulness and employee satisfaction.

Although several previous studies have contributed to understanding HRM practices and their impacts on employee behaviours directly and indirectly through different mediating mechanisms (Davras and Manap Davras, 2024; Hessari *et al.*, 2024; Nerves and Van Dam, 2024; Rabiul *et al.*, 2021a), our review of the literature has identified three notable gaps.

First, specifically, previous studies have not tested organizational engagement as a mediator between HRM practices and employees' commitment to quality services (CQS). Organizational engagement is a necessary employee positive behaviour defined as "an individual's role, responsibility, and tasks associated with membership in an organization" (Saks, 2017, p. 79). We applied social exchange theory (SET) to explain the mediation (Cropanzano *et al.*, 2017). Nevertheless, many studies used SET to understand HRM practices (Davras and Davras, 2024; Fan *et al.*, 2024; Kilroy *et al.*, 2024) but ignored organizational engagement in the process of SET. SET refers to a reciprocal exchange process, such as employees feeling obliged to return to the organization as they benefit from it. In other words, employees benefit from HRM practices and return to the organizations through organizational engagement.

Our assumption not only depends on the SET propositions but also on practical evidence. For example, organizational engagement is positively associated with employee satisfaction, enhances commitment and service behaviour, reduces turnover intention, and produces a general sense of belongingness to the organization (Saks, 2006). Therefore, we examine that HRM practices enhance organizational engagement through a social exchange process, thus leading to CQS.

Second, many studies have examined factors that enhance the quality of employees' services in the hospitality industry, such as leadership style, human resource practices, and highly engaged, efficacious, and adaptive employees (Kloutsiniotis *et al.*, 2023; Rabiul *et al.*, 2021b, 2022) and depend on boundary conditions (Rabiul *et al.*, 2022). Hence, CQS may not be explained fully by applying SET, which connects HRM practices and organizational engagement; it may further require a theory of planned behaviour (TPB) and job demands-resources (JD-R) theory. In other words, the SET, TPB, and JD-R theories, as proposed in the model, are required to understand employee service quality.

For instance, employees might repay through the exchange process, but their intentions might have significant impacts. Some employees may think of leaving (i.e. intention to leave) the organization, avoiding their exchange process. Even if the express process is favorable, the individual has a different intention, leading to poor quality service as the individual decides to leave. Precisely, TPB suggests that individuals' actions in certain work roles depend on their attitude (positive or negative) and motivation (high or low) (Ajzen, 1991). In other words, they may come to enjoy a hospitality job for a while or get experience. Thus, their motivation is lower than that of those who actually need a job to live their lives. Therefore, we test the moderating effect of turnover intention on the association between HRM practices and organizational engagement-when turnover is high, the effect HRM practices on organizational engagement is weaker, and when turnover is low, it is stronger.

Third, some people may not be as adaptable as is required for the work (Hessari *et al.*, 2024; Silva and Pinto, 2024). In this regard, although the exchange process and intention are positive, the failure to adapt to the situation may cause quality service. This is well suggested by JD-R theory, for example, when people feel they have more resources than they need and/or are confident in their ability to handle stress, they may put forth more effort and be more active in their professional duties (Demerouti and Bakker, 2023). Hence, the third aim of this study is to scrutinize the moderating effect of employee adaptability on the association between organizational engagement and CQS in such a way that when employee adaptability is high, the relationship is stronger, and when it is low, it is weaker.

The following are the contributions of the present study. First, the findings contribute to SET by explaining the mediating role of organizational engagement. Second, it adds value to TPB, in that turnover intention is a boundary condition for the relationship between HRM practices and organizational engagement. Third, higher adaptability and organizational engagement lead to higher CQS, thus contributing to JD-R theory. Fourth, it adds to the literature on underdevelopment, particularly in the hospitality industry in developing countries in Asia.

Literature review and hypothesis development

Social exchange theory (SET), theory of planned behaviour (TPB) and job demands-resources (JD-R) theory

SET, which stands for Social Exchange Theory, denotes an exchange process that is reciprocal and involves economic and socioemotional resources (Cropanzano *et al.*, 2017). In this context, organizations provide benefits to employees through HRM practices. As a result, employees reciprocate or feel obliged to respond in kind and repay their organization, such as through organizational engagement.

Ajzen (1991) emphasized that “a central factor in the theory of planned behaviour [TPB] is the individual’s intention to perform a given behaviour” (p. 181). This intention, influenced by subjective norms, behavioural control, and attitude, plays a pivotal role in shaping an individual’s behavior. For instance, an employee’s intention to provide quality service can be significantly influenced by social pressure or the perceived ease of performing the task.

The JD-R theory describes the two elements which are job resources and job demands (Demerouti and Bakker, 2023). Job resources refer to an individual’s ability to perform tasks, such as how effectively an employee can adapt to a situation. On the contrary, job demands are the work-related demands that create a barrier to the task roles, such as a lack of ability to adapt to the situation.

Definition of the variables

HRM Practices. HRM practices refer to the human resources (HR) tools that companies use to increase employees’ knowledge, skills, abilities, and motivation to develop strong organizational commitment and ensure their safety (Elsayed *et al.*, 2024; Ngo *et al.*, 2024). No single set of HR procedures is appropriate for all businesses, including hotels (Benítez-Núñez *et al.*, 2024; Davras and Davras, 2024; Oyelude *et al.*, 2024). This study concentrates on HR practices that hotels can use to gain a competitive advantage by enhancing employees’ skills, knowledge, and abilities, and motivating them to be more committed to serving customers (Elsayed *et al.*, 2024; Ngo *et al.*, 2024). Particularly, eight HR tools vital for employee growth and CQS: appraisal, career advancement, employee participation, job security, recruitment, rewards and recognition, teamwork, and training and development.

Organizational Engagement. This study focuses on organizational engagement, which refers to the individual’s “role, responsibility, and tasks associated with membership in an organization” (Saks, 2017, p. 79). *Turnover Intention.* Turnover intention refers to job-related withdrawal or intention to resign and search for alternative employment in another organization (Colarelli, 1984). *Employee Adaptability.* Hartline and Ferrell (1996) defined adaptability “as a continuum ranging from conformity to an established script, in which employees approach each customer the same way, to service personalization, in which employees must adapt to serve individual customers” (p. 55). In other words, it refers to employees’ ability to adjust their behavior and interpersonal situations to serve customers following established social standards, attitudes, and practices. *Commitment to Quality Services.* This study defines CQS as “the relative intensity of an employee’s dedication or commitment to providing quality service to the firm’s guests” (Clark *et al.*, 2009, p. 216). CQS describes how an individual shows concern for meeting customer needs and providing

high-quality service in a distinct and direct manner (Peccei and Rosenthal, 1997; Rabiul *et al.*, 2021b).

HRM practices and organizational engagement

According to SET, agreements are made through a sequence of interactions between parties that are mutually dependent on one another (Cropanzano *et al.*, 2017). Through the exchange process, both parties follow certain rules of engagement. Norms of exchange typically include standards of reciprocity or repayment, whereby one party's behaviour triggers another party's response or actions (Fan *et al.*, 2024). For instance, when people receive financial and emotional support from their organization, they feel obligated to give the organization something in return (Cropanzano *et al.*, 2017). Employers who show that they care about their staff by implementing HRM practices may receive stronger organizational engagement responses from employees (Han *et al.*, 2020). If businesses offer their staff members perks through HRM practices, staff members will be more organizationally engaged as a result (Han *et al.*, 2020).

An appropriate appraisal system in an organization can encourage employees' intrinsic motivation to engage more in the organization. Clear career advancement pathways in an organization can add meaning to work, leading to more organizational activities (Han *et al.*, 2020). Prospects for career advancement make employees more dedicated, optimistic, and fulfilled at work (Islam *et al.*, 2024). Another crucial sign of organizational engagement in employees is their participation in decision-making processes (Islam *et al.*, 2024). When a company provides a clear promotion trajectory, employees' organizational engagement and motivation increase.

Job security and an appropriate recruitment process could contribute to both intrinsic and extrinsic motivation, and encourage employees to perform and engage in more organizational activities (Anthony *et al.*, 2023). Similarly, when employees receive rewards and recognize their work- and non-work-related roles, they may engage in more organizational activities (Wang *et al.*, 2024). By generating a comfortable work environment by facilitating HRM practices (i.e. teamwork), employees feel psychosocially safe and experience their work as meaningful (Rabiul *et al.*, 2021a), and this generates greater participation in organizational activities. Further, training and development can assist employees in improving their knowledge, skills, and abilities to perform tasks and build their careers (Anthony *et al.*, 2023; Islam *et al.*, 2024).

In all the facilities above, employees are likely to gain from their organization's HRM practices. They may have a significant positive influence on employee behaviours, highlighting the potential for improvement and growth. The employees feel required to respond by engaging in additional organizational tasks, which is consistent with SET (Cropanzano *et al.*, 2017; Fan *et al.*, 2024). Organizations provide economic and socioemotional resources to employees, such as career investment, appropriate appraisal, decision-making participation, job security, proper recruitment, fair reward and recognition, teamwork development, and training and career development, making them more likely to repay through the exchange process. Thus, we propose:

H1. HRM practices have a significant positive impact on organizational engagement.

Organizational engagement and CQS

Organizational engagement, the outcome of Social Exchange Theory (SET), is a reciprocal process. When both parties (the employer and employee) honour their rules of exchange (Kilroy *et al.*, 2024), it leads to a mutually beneficial relationship. HRM practices, in line with SET, play a crucial role in this process. They provide employees with economic and socioemotional resources from the organization, thereby increasing the likelihood of higher organizational engagement. Practical studies have shown that when people are

organizationally engaged, they develop a loyal and trusted relationship with the employer, resulting in positive attitudes and intentions toward the company (Sultana and Johari, 2024). Therefore, we posit that organizational engagement is the social exchange outcome of HRM practices; consequently, employees reciprocate with the organization by providing high-quality services to customers (Cropanzano *et al.*, 2017; Kilroy *et al.*, 2024).

Practical evidence supports this: Individual employees continue to reciprocate by offering high-quality customer services, reflecting their active role as members of the organization (Saks, 2006). Furthermore, greater organizational involvement creates a sense of belonging, which leads to positive outcomes. Saks (2006) found that organizational engagement is positively related to positive commitment and behavioural outcomes, demonstrating the mutual benefits of organizational engagement for both the employee and the organization. Thus, we propose:

- H2.* Organizational engagement has a significant positive impact on commitment to quality services.

Mediating role of organizational engagement

We followed Saks (2006), to explain the mediating role of organizational engagement using SET. According to SET, an equilibrium exchange in reciprocal relationships between two parties (employee and employer) occurs when the company provides facilities (HRM practices) to employees, employees feel obligated to repay the company through organizational engagement, leads to CQS. The rules of exchange typically include reciprocity or repayment rules that require one party to respond to an action by another party (Fan *et al.*, 2024; Sultana and Johari, 2024). When employees receive socioemotional and financial resources (e.g. including career investment, appropriate appraisal, decision-making participation, job security, proper recruitment system, fair reward and recognition, developing teamwork, and facilitating training and career development) from their organization, they are more likely to show positive behaviour by being psychologically present as a member of the organization and providing high-quality services to customers. Thus:

- H3.* Organizational engagement mediates the link between HRM practices and commitment to quality services.

Moderating role of turnover intention

TPB postulates that individual behaviours and attitudes toward a work organization (organizational engagement) depend on individual intention (Ajzen, 1991). If an employee plans to leave their present organization and is not committed to their present job, regardless of the circumstances, they will not physically or psychologically engage in the organization (Ferdian *et al.*, 2023; Islam *et al.*, 2024).

In contrast, employees will be psychologically present in their organization if they plan to stay. Thus, drawing on TPB, we speculate that the link between HRM practices and organizational engagement is contingent on individual behaviour. In other words, if an employee has a higher turnover intention, the association between HRM practices and organizational engagement will be weaker, and the same link will be stronger when turnover is lower. Our assumption is solely hypothetical because employees' intentions depend on many factors, such as economic, social, socioemotional, political, cultural and many more factors (Ma *et al.*, 2023). Thus, we offer:

- H4.* Turnover intention moderates the relationship between HRM practices and organizational engagement such that the relationship becomes weaker when employees have high turnover intention and stronger when turnover intention is low.

Moderating role of employee adaptability

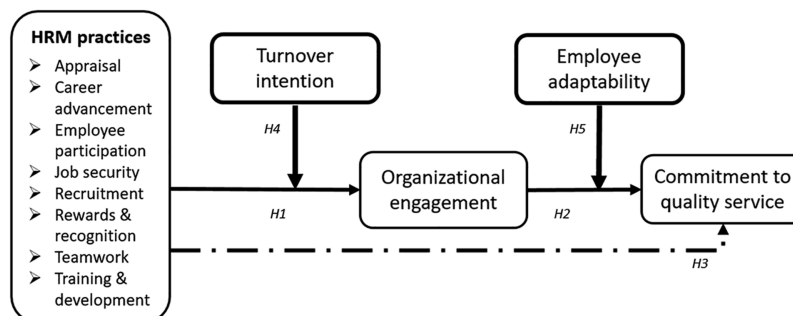
Adaptability refers to employees' ability to adjust their behavior and interpersonal situations to serve customers following established social standards, attitudes, and practices (Hartline and Ferrell, 1996; Neves and Van Dam, 2024).

Our exploration of adaptability as a moderator is underpinned by the JD-R theory, a robust framework that illuminates the role of job resources. These resources, whether intrinsic or extrinsic, are the "physical, social, or organizational aspects of a job that serve the functional purpose of enabling employees to achieve work" (Han *et al.*, 2020, p. 3). Consider the case of individuals who thrive in the hospitality industry, investing their resources fully to adapt to any situation (Silva and Pinto, 2024). This intrinsic motivation becomes a resource for them to adapt. Consequently, employee adaptability emerges as a resource that can foster a positive attitude towards customer service (Silva and Pinto, 2024). People may exert more effort and become more deeply involved in assisting clients if they believe they have access to more resources than they require or are confident in their capacity to handle stress (Rabiul *et al.*, 2024). On the contrary, a lack of resources or a lower level of adaptability may generate emotional exhaustion, mental stress, strain, demotivation, and disengagement from serving customers (Demerouti and Bakker, 2023). A lack of adaptability might happen due to high job demands (Anh, 2024). However, we did not focus on job demands in our study.

Consistent with JD-R theory, employees with higher levels of adaptability cope with any job situation and are motivated to serve customers (Neves and Van Dam, 2024; Rabiul *et al.*, 2022). In contrast, employees with lower levels of adaptability are more likely to be demotivated due to strain, anxiety, and uncertainty (Demerouti and Bakker, 2023). Particularly, employees may repay through higher organizational engagement due to HRM practices facilities. However, employees may have higher or lower adaptability. Therefore, as SET does not explain CQS completely, so we added the JD-R theory with employee adaptability to provide more explanatory power to this relation. Thus:

- H5. Employee adaptability moderates the connection between organizational engagement and commitment to quality services such that the connection becomes stronger with high levels of employee adaptability and weaker with low levels of employee adaptability.

The framework is presented in Figure 1.



Source(s): Authors' own work

Figure 1. Research framework

Method*Sample and population*

We could not obtain a full list of hotels based on ratings, so we consulted different online sources (e.g. booking.com, Agoda, and TripAdvisor) to identify popular hotels by their online ratings. Dhaka, had the most hotels ($N = 142$), followed by tourist city, Cox's Bazar ($N = 49$), and Sylhet ($N = 32$) and the port city of Chittogram ($N = 31$). Hence, this study collected data from hotels in the cities where most hotels are situated. We contacted Bangladesh Parjatan Corporation and Ministry of Tourism and Aviation for star-rating information. After contacting them and searching their website, we could not get information. Therefore, we relied on information from different websites as mentioned above, managers of certain hotels, and researchers' knowledge to clarify the hotel types.

Measurement

The ten items (out of 13) used to measure *HRM practices* were adapted from den Hartog *et al.* (2013) and Jensen *et al.* (2011). Rabiul *et al.* (2021a) and Den Hartog *et al.* (2013) used these items and found them reliable. Items included: "I feel my job is secure in this hotel."

The six items used to measure *organizational engagement* were adapted from Saks (2006) and found to be reliable (Rabiul *et al.*, 2021a). The following is a representative item: "I am highly engaged in this organization." *Turnover intention* was measured using the three items developed by Colarelli (1984). Item included: "I am planning to search for a new job during the next 12 months" This scale was found to be highly reliable (Colarelli, 1984; Hartline and Ferrell, 1996).

Employee adaptability was measured using eight items (out of ten) adapted from Hartline and Ferrell (1996). The following is a representative item: "Every customer requires a unique approach." This scale was validated by Xie *et al.* (2019) in a hospital setting. The nine items used to measure *commitment to quality services* (CQS) were developed by Clark *et al.* (2009). The scale was initially developed by Hartline and Ferrell (1996). Rabiul *et al.* (2021b) found it reliable and valid in the hospitality industry. Items included: "I really care about the quality of my organization's services."

Participants responded on a seven-point scale, where answers ranged from "strongly disagree" to "strongly agree," depending on how much they agreed or disagreed with each statement. Any negative items were reverse scored.

Content validity, translation, and pre-test

After selecting well-established measures, the items were given to two assistant professors with PhDs at a public university in Bangladesh to test for content validity. After considering their feedback, two items (out of 10) from *employee adaptability* and three items (out of 13) from *HRM practices* were removed. Ten items for HRM practices and eight for employee adaptability were used in the final study. Minor modifications were made to the wording of the items. After validating the items, the researchers translated them into Bengali. Two lecturers in hospitality management at private universities in Bangladesh checked the bilingual (Bengali and English) versions of the questionnaire. Modifications were made to the Bengali version based on their suggestions. A pre-test was performed on 14 hotel employees to increase the questionnaire's effectiveness and clarity. No issues were identified, and all the items were used in the final survey.

Data collection

After contacting hotel managers, we decided to distribute the questionnaires (Bengali and English versions together) by applying a purposive and convenient sampling method (e.g. Rabiul *et al.*, 2022) as most hotel managers did not agree to officially distribute the survey to their employees. However, human resource managers unofficially assisted us in distributing

and collecting the questionnaires by introducing representatives to hotels' employees. As we had to cover many areas, we recruited alumni and colleagues to distribute and collect the completed questionnaires. As the population was unknown because there was no official list of hotel employees, which state that 384 is a good sample size for an unknown population (see Rabiul *et al.*, 2021a).

For sampling variety, survey questionnaires were conveniently distributed to customer contact employees in every department (food and beverages [F&B], front office, housekeeping, concierge, marketing, and reservations). Each participant received a questionnaire in an open envelope along with a pencil. The participants were requested to seal the envelope after completing the questionnaire. They were guaranteed anonymity and voluntary participation. No personal information was collected, and participants could withdraw from the survey at any time. After distributing 850 survey questionnaires, 654 responses were received from 47 hotels. After removing outliers and missing ones, 593 responses were used for the data analysis.

Data treatment

We checked for missing data using software and removed items following earlier studies. We also ensured that there was no multicollinearity among the variables. Outliers were deleted from the dataset by observing variance inflation factor (VIF) and checking for multivariate outliers (i.e. Benitez *et al.*, 2020). We used Harman's single-factor test to assess common method bias (CMB). Bias was unlikely as a single factor only explained 28.74% of 62.13, which was less than the threshold of value of 50% (i.e. Rabiul *et al.*, 2024).

Demographic profile. Table 1 represents demographic information. Male employees dominated the sample (72%), which was surprising, because Rabiul (2023) reported a rate of less than 20%. Many participants were from the front offices and the F&B departments. Among the participants, 48.1% held a bachelor's degree and more than 42% had a diploma or higher secondary (HSC) and secondary school (SSC) certificates.

Table 2 shows that HRM practices had the highest mean of 4.58, and adaptability and HRM practices had the highest correlation coefficient ($r = 0.735$).

Analysis

Convergent and divergent validity

Measurement model evaluation or convergent validity was checked by running the algorithm in Smart-PLS. Specifically, we checked the indicator loading for every item, composite reliability (CR), and average variance extracted (AVE). The results are summarized in Table 3.

All the items complied with the minimum criteria (i.e. loadings above 0.60, AVE above 0.50, and CR above 0.70) (Benitez *et al.*, 2020). For variable divergence, heterotrait-monotrait ratio of correlations (HTMT) analysis in Table 4 confirmed that the ratio was below 0.85, as suggested by Benitez *et al.* (2020). Thus, convergent and divergent validity was ascertained to test the hypotheses.

Hypothesized results and model quality

We controlled for demographic variables (i.e. experience, age, gender, and marital status) as they could influence employees' behaviors. To test the hypotheses, bootstrapping with a 10,000 resample and a product indicator approach was applied. To illustrate this, the complete model was run simultaneously with all the variables (Nitzl *et al.*, 2016). The results are summarized in Table 5. As Nitzl *et al.* (2016) have suggested, all the hypotheses were supported with *p*-values, *t*-values, and bias-corrected confidence intervals (BBCI). For example, the results showed that turnover intention negatively and significantly moderates the association between HRM practices and organizational engagement.

Table 1. Demographic profile

Demographic	Categories	Frequency	Percent
Gender	Female	165	27.8
	Male	428	72.2
Marital status	Single	353	59.5
	Married	214	36.1
	Separated/divorced	26	4.4
Departments	Front office	246	41.5
	Food and Beverage	185	31.2
	Sales and Marketing	69	11.6
	Housekeeping	33	5.6
	security/others	60	10.1
Education	SSC or below	28	4.7
	HSC or Diplomas	224	37.8
	BA/Hons or equivalent	285	48.1
	Masters or postgraduate	56	9.4
Age	Up to 21	49	8.3
	22–26 years old	212	35.8
	27–31 years old	221	37.3
	32 years and above	111	18.7
Experience	Up to 2 years	154	26.0
	3–5 years	316	53.3
	6 years and above	123	20.7
Cities	<i>Dhaka</i>	154	26.0
	<i>Cox's Bazar</i>	256	43.2
	<i>Chottogram</i>	74	12.5
	<i>Sylhet</i>	109	18.4
Types of hotel	2 stars	103	17.4
	3 stars	164	27.7
	4 starts	152	25.6
	5 stars	174	29.3

Source(s): Authors' own work**Table 2.** Descriptive statistics

Variables	Mean	SD	1	2	3	4	5
1. HRM practice	4.584	1.017	–				
2. Organizational engagement	4.524	1.078	0.401**	–			
3. Turnover intention	4.369	1.028	0.285**	0.372**	–		
4. Adaptability	4.520	0.992	0.368**	0.735**	0.348**	–	
5. Commitment to quality service (CQS)	4.046	0.797	0.180**	0.368**	0.228**	0.282**	–

Note(s): **2-tailed significant correlation at 0.01**Source(s):** Authors' own work

R^2 (coefficient of determination), one of the criteria used to check the model's goodness of fit; the values were 30.8 and 13.3% for organizational engagement and CQS, respectively. Another criterion was Q^2 (predicative relevance), which was 0.183 and 0.069 for organizational engagement and CQS, respectively. The results indicated that the model had medium predictive relevance as it was more than 0.02 (Benitez *et al.*, 2020). Standardized root mean squared residual (SRMR) is another criterion, although it does not guarantee a perfect model fit. In this study, the SRMR value of 0.077 was lower than the suggested value of 0.08, and thus confirmed the model's fit (Benitez *et al.*, 2020).

Table 3. Indicator loading, composite reliability (CR), average variance extracted (AVE)

Variables	Highest and lowest loading	CR	AVE
Adaptability	0.810–0.0684	0.913	0.568
Commitment to quality service (CQS)	0.789–0.627	0.908	0.524
HRM practices	0.773–0.634	0.912	0.511
Organizational engagement	0.809–0.703	0.900	0.601
Turnover intention	0.820–0.801	0.852	0.657

Source(s): Authors' own work

Table 4. Heterotrait-Monotrait ratio (HTMT)

Variables	1	2	3	4	5
1. Adaptability	=				
2. Commitment to quality service (CQS)	0.320	=			
3. HRM practices	0.418	0.207	=		
4. Organizational engagement	0.840	0.416	0.462	=	
5. Turnover intention	0.430	0.279	0.351	0.469	=

Source(s): Authors' own work

Table 5. Direct, mediation, and moderation hypotheses

No	Hypothesized paths	β	<i>t</i> -values	95% BCCI		<i>p</i> -values
				LL	UL	
H1	HRM practices → organizational engagement	0.346	9.020	0.265	0.417	0.000
H2	Organizational engagement → CQS	0.368	6.937	0.263	0.469	0.000
H3	HRM practices → organizational engagement → CQS	0.127	5.252	0.083	0.178	0.000
H4	HRM practices*turnover intention → organizational engagement	−0.168	3.865	−0.248	−0.079	0.000
H5	Organizational engagement*employee adaptability → CQS	0.132	4.134	0.071	0.195	0.000

Note(s): CQS = commitment to quality service; bias-corrected confidence interval = BCCI; UL = upper level; LL = lower level

Source(s): Authors' own work

Results and discussion

HRM practices are positively linked to organizational engagement (H1). Consistent with SET: Employees feel obliged to reciprocate to the company by demonstrating better organizational engagement (Fan *et al.*, 2024; Kilroy *et al.*, 2024). HRM advantages boost employee commitment, performance, contentment, psychological ownership, and enthusiasm (Dorta-Afonso *et al.*, 2023; Peethambaran and Naim, 2024). Proper HRM may increase employee trust (Sultana and Johari, 2024). Psychological safety and job meaning may also boost organizational engagement (Rabiul *et al.*, 2021a). Organizational involvement may also depend on employees' psychological well-being (Ngo *et al.*, 2024). Proper appraisal and reward systems can boost intrinsic and extrinsic motivation (Kloutsiniotis, 2023). In other words, career investment, appropriate appraisal, decision-making participation, job security,

proper recruitment system, fair reward and recognition, developing teamwork, and facilitating training and career development provided the hospitality organization could influence employees in many different ways along with social exchange process (Davras and Davras, 2024; Fan *et al.*, 2024; Kilroy *et al.*, 2024).

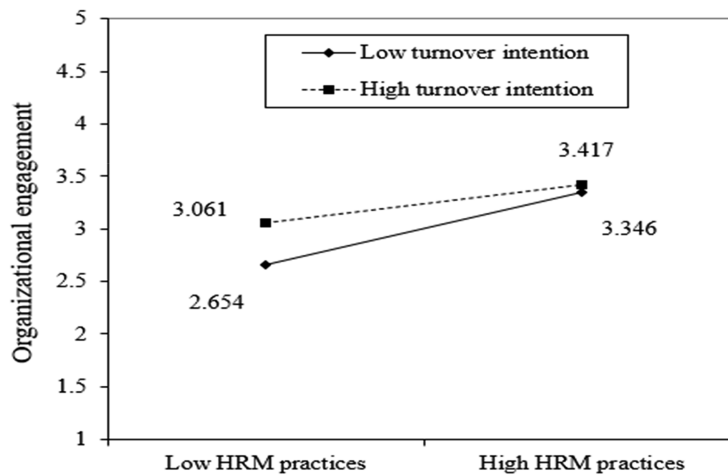
Organizational engagement positively impacts CQS (H2), confirming that when employees feel obliged to reciprocate, they are more committed to serving customers (Saks, 2006). Findings demonstrate that organizational engagement is a significant mediator between HRM practices and CQS (H3), further confirming SET, which states that employees become organizationally engaged and show greater CQS to customers through HRM practices. This reiterates the crucial role of HRM practices in facilitating organizational engagement and thereby influencing CQS. This is because employees experience and perceive organizational efforts to relate and engage with employees as more “authentic” organizational practices by showing an interest in their well-being. In exchange, based on the social exchange process (Cropanzano *et al.*, 2017), employees would like to reciprocate and give back this organizational “care” as “care” to the organization’s customers.

Nevertheless, our assumption is that the social exchange process requires employees to show higher organizational engagement and serve customers as a result of appropriate HRM practices. For instance, when people receive financial and emotional support from their organization, they feel obligated to reciprocate (Cropanzano *et al.*, 2017). In other words, HR tools facilitate further organizational engagement, which leads to positive employee outcomes (Kilroy *et al.*, 2024; Saks, 2017). In the Bangladeshi context, some scholars have shown that HR tools facilitate trust and commitment (Sultana and Johari, 2024), thus engendering positive employee outcomes. Bangladeshi people are emotionally responsive (Rabiul *et al.*, 2023); therefore, facilities such as HRM practices from hotels will make employees emotionally obliged to reciprocate (Cropanzano *et al.*, 2017; Fan *et al.*, 2024). In addition to the exchange process, there could be many other factors, such as lower stress, higher satisfaction, well-being, economic and socioemotional situations, psychological contract, and many more individual factors (Benítez-Núñez *et al.*, 2024; Davras and Davras, 2024; Elsayed *et al.*, 2024).

Regarding the moderating role of turnover intention (Figure 2), the findings show that employee turnover intention significantly and negatively moderates (weakens) the association between HRM practices and organizational engagement (H4). For employees with a higher intention to resign, the positive relationship between HRM practices and organizational engagement is reversed (in Figure 2 the lines deviate to the left and are not parallel). This finding confirms the applicability of TPB theory, which states that with higher turnover intention, the impact of HRM practices on organizational engagement will be weaker. This is not surprising in the context of Bangladeshi hotel, because several studies have confirmed that employees perceive higher turnover as likely causing negative outcomes.

Figure 3 shows the moderation effect of employee adaptability. Employee adaptability significantly and positively moderates the relationship between organizational engagement and CQS (H5).

Employees with higher adaptability levels can significantly strengthen their organizational engagement and CQS. This finding is consistent with the JD-R theory, which states that the effect of organizational engagement on CQS is enhanced when employees have more resources (higher adaptability). When customers perceive flexibility and perspective-taking behaviour in an employee, they are more willing to share their ideas and information with the employee, with the potential to increase the quality of service (Hartline and Ferrell, 1996). Indeed, adaptability is a crucial factor for employees in organizations, with the potential to significantly enhance organizational engagement and influence performance at work in any context, either positively or negatively based on individual adaptability (Neves and Van Dam, 2024; Silva and Pinto, 2024).



Source(s): Figure by authors

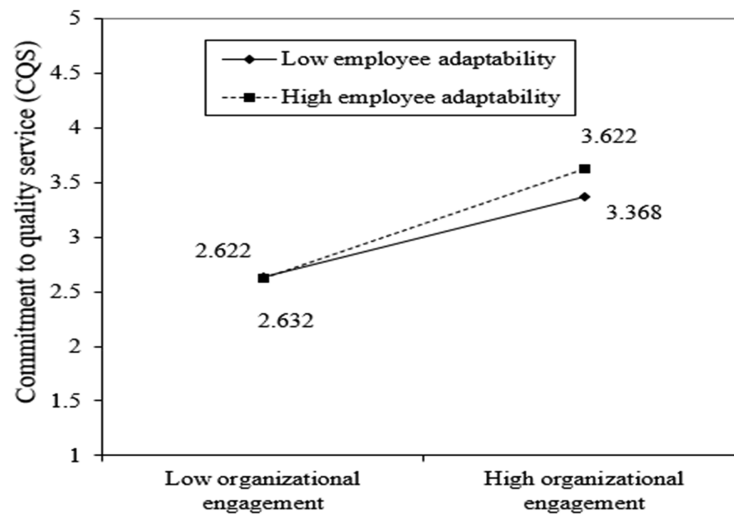
Figure 2. Moderation effects of turnover intention

Theoretical contributions

First, we were unaware of how HRM practices enhance CQS through an exchange process, which is building employee organizational engagement. Notably, from a social exchange process perspective, HRM practices that focus on building greater engagement between organizations and employees, which in turn can more effectively incentivize and direct employee behaviours, have not been investigated by earlier studies. This study adds to our understanding of the importance of internal quality (i.e. HR practices for organizational engagement) by using SET to explain and confirm the role of organizational engagement as the underlying mechanism facilitating and boosting more excellent employee outcomes or CQS.

Second, very few studies (Rabiul *et al.*, 2021a; Baker, 2024; Mao *et al.*, 2024) in the hospitality industry have investigated the consequences of organizational engagement. By collecting data from hotel employees, this study adds to this research stream by providing firsthand evidence of the role of organizational engagement in boosting CQS. To examine the role of organizational commitment on employees' service quality behavior, this study confirms the applicability of SET, which in turn explains how internal HR practices are converted into employees' service quality behavior toward customers as a result of a social exchange process of "take and give" between organizations and employees.

Third, while SET suggests that employees stay longer to reciprocate the organizations, we propose an alternative explanation using the TPB theory. We argue that the individual's mindset, not just the exchange process, is a crucial factor in their decision to stay with the organization. In this context, what the employee receives from the organization is not the determining factor. Instead, it is the individual's mindset that influences their decision to stay or leave, a perspective that the TPB theory sheds light on. For example, TPB suggests that turnover intention is a significant boundary factor of individuals' positive or negative behaviours (Ajzen, 1991). To elaborate further, if employees intend to resign from an organization, they will refrain from participating in organizational activities regardless of the facilities offered by the organization, including HRM practices. However, previous studies have not clarified whether turnover intention weakens the connection between HRM practices



Source(s): Figure by authors

Figure 3. Moderation role of employee adaptability

and organizational engagement. This study's findings show that turnover intention is a boundary condition that negatively moderates the connection between HRM practices and organizational engagement (see H4). These factors significantly differentiate our study from previous studies, thereby contributing to the literature.

Fourth, the SET and TPB theories together are not sufficient to explain CQS. For example, individuals may not just work with an exchange process and mindset; it also depends on their adaptability. JD-R theory (Demerouti and Bakker, 2023) states that once employees have access to more resources to cope with service settings, they will exhibit better CQS. Therefore, we add employee adaptability to the model, which is a resource for individuals. Our results (see H5) confirm that individuals with higher service adaptability show a significantly greater association between organizational engagement and CQS. This finding is novel because, although the influence of SET was previously known, its reliance on individual resources had not been previously identified. Thus, our study adds value to the literature on CQS by combining SET and JD-R theories and provides practical insights for improving CQS in organizational settings.

Fifth, this study also makes a contextual contribution by expanding the literature on hospitality in developing countries by focusing on the hospitality industry in Bangladesh, where such research is scarce. Few studies have examined the impact of HRM practices on various employee and organizational outcomes in the Bangladeshi banking sector (Sultana and Johari, 2024).

Practical contributions

Managers should consider providing appropriate HR tools (i.e. job security, career growth opportunities, rewards, and appraisals) to achieve organizational engagement. Managers in the hospitality industry and other organizations can enhance employees' organizational activities by investigating their needs and expectations so that they can demonstrate psychological presence as members of the organization and offer high-quality services. Hospitality managers should focus on developing a policy and implementing it appropriately to facilitate HR tools and ensure greater organizational engagement among their employees.

To implement HRM practices, hospitality organizations are suggested to evaluate their own strategy and follow the rules and regulations of the country. For example, organizations should follow the country's rules and regulations. The appraisal system should be designed to ensure justice and fairness, making managers feel just and equitable in their decisions. Decision-making should not be done alone by managers; employees should actively participate in it. Career growth is another crucial factor for any employee. Hoteliers should invest and provide opportunities for employees. Hoteliers should invest in training and development for the employees; otherwise, higher turnover could severely affect the organizations. Teamwork should create a friendly environment. Managers, employees, and hotel owners should work together to implement HRM practices.

The study's outcomes also highlight the importance of organizationally engaged employees, which is positively associated with employees' CQS. Therefore, it is imperative for hospitality managers to ensure employees' organizational engagement. Organizationally engaged employees are resources for hoteliers that produce greater employee outcomes, such as lower turnover intention, greater commitment, CQS, and a sense of belongingness to the organization (Saks, 2006). Organizational engagement may be increased through fair practices, appropriate leadership, safety in the workplace, and meaningfulness.

Managers and hoteliers should investigate ways to reduce turnover intention and keep talented employees to avoid negative organizational activities that may impact the reputation of the organization in general. One effective strategy is to facilitate a high-performance work system, which has the potential to significantly boost employee morale and productivity. Minimizing contractual agreements, reducing ostracism, and creating a better work environment are also important factors in improving employee retention. It is crucial to identify whether employees are committed to staying or have other intentions. For instance, if employees are primarily seeking to gain experience in the hotel industry before moving on, it may be challenging to retain them. Similarly, if they feel their job is meaningless in the exchange process, where organizations do not return what they invest, then organizations should invest money and energy to keep them.

Furthermore, employee adaptability to serve customers is considered a resource that enhances the association between organizational engagement and employee CQS. Indeed, adaptability could be one of the most effective means to enhance workplace morale and improve employee and organizational outcomes because adaptable employees communicate better with customers, which leads to more personalized service (Hartline and Ferrell, 1996). Hence, hospitality and other service organizations should investigate ways to increase employee adaptability to serve individual customers in any situation.

Hoteliers can facilitate a flexible work environment, provide a comfortable workplace design, and ensure their employees have a balanced work-life by establishing programs and practices that emphasize adaptability. Contradictions may occur in the workplace because of supervisor-subordinate relationships; thus, practising flexible attitudes between supervisors and subordinates is important. Specific training interventions could improve employees' capacity to perform and enhance employees' adaptability at work. For instance, interpersonal adaptation skills, emotional capacity to deal with the work, and service-oriented skills can be improved through training programs. Organizational strategies and cultures can also improve behavioural attitudes. Thus, managers should consider a work culture that is appropriate for all employees.

Limitations of the present study and future research recommendations

The limitations of this study should be addressed in future studies. We only recruited participants from star-rated hotels in two of Bangladesh's four large cities. Employee behavior (e.g. intention to quit) may differ in other parts of Bangladesh because of the current job situation (a higher unemployment rate). Future research should collect data from hotels in

other cities. Future research could apply simple random sampling by collecting employee lists to address the limitations of convenient sampling techniques.

Contextual factors always matter, because jobs in the hospitality industry are vulnerable and not prestigious compared to banking, information technology (IT), and teaching jobs in Bangladesh. A similar model may produce different results in these sectors, indicating the need for future research in these contexts. Future research may improve the model by introducing motivational variables (work engagement) and examining whether organizational or work engagement produces different outcomes.

Future studies should investigate other types of adaptability, such as group, political, and social adaptability. Moreover, employees in different contexts may demonstrate varying levels of adaptability. Hence, a comparison of employee adaptability in different hospitality countries could provide further insights. Future studies should also investigate psychological factors. Last, although the data analysis suggested no common method bias, future scholars should collect customer data to evaluate employees' CQS to obtain insightful results.

Conclusion

Organizational engagement does not only occur through the social exchange process or SET, but also depends on individual behavior or TPB theory. Furthermore, higher adaptable employees show higher CQS with organizational engagement, and higher intention to leave the organization shows lower organizational engagement with HRM practices. These findings suggest that HRM practices and higher adaptability can be optimized to enhance organizational engagement and CQS, and turnover intention needs to be mitigated.

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Further reading

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About the authors

Md Karim Rabiul’s first publication appeared in the *International Journal of Hospitality Management*. Since then, he contributed to 36 publications in esteemed journals, spanning various indexes: Web of Science (SSCI = 17; ESCI = 19), and Scopus (Q1 = 19; Q2 = 15; Q3 = 2). Additionally, he serves on the Editorial Advisory Board for the *International Journal of Contemporary Hospitality Management* and *Journal of Hospitality and Tourism Insights*. As a reviewer, he provides insights for numerous Q1 journals, including the *Journal of Business Research*, *Annals of Tourism Research*, *International Journal of Hospitality Management*, *International Journal of Contemporary Hospitality Management*, and *Journal of Hospitality Marketing and Management*. Md Karim Rabiul is the corresponding author and can be contacted at: mdkrabiul@gmail.com

Marianna Sigala is Professor at *The University of Newcastle*, Australia. Her academic credentials are combined with her professional experience in the tourism industry. Her interests include services and experience management, Information and Communication Technologies (ICT) in tourism and services, as well as wine tourism. She is a widely published and multi-awarded authority with great participation in international research projects. She is the co-editor of the *Journal of Service Theory and Practice*, and the Editor-In-Chief of the *Journal of Hospitality and Tourism Management*.

Dr Rashed Al Karim is an associate professor in business management. After completing MBA from the United Kingdom, he has completed Ph.D. in tourism management from University Utara Malaysia. He has several publications in prestigious journals such as the *International Journal of Entrepreneurial Research*, in the *International Journal of Hospitality Management*, *Journal of Hospitality and Tourism Management*, *Journal of Quality Assurance in Hospitality and Tourism*. Dr Karim is also reviewers for many prestigious journals of emerald, Taylor Francis, etc.

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Cooking unforgettable experiences: sensory marketing in slow food restaurants

Mariana Alves Santos

EIDO, Universidade de Vigo, Vigo, Spain

Ana Dopico-Parada

*Department of Business Organization and Marketing, Universidade de Vigo,
Pontevedra, Spain, and*

Pablo Cabanelas

*Department of Business Organization and Marketing, ECOBAS,
Universidade de Vigo, OdC, Vigo, Spain*

Abstract

Purpose – This study aims to investigate the impact of gastronomic sensory experiences on customer intention to revisit. The paper analyses if sensory perception is positively related to experiential value and attempts to verify if customer satisfaction is positively related to post-purchase behaviour.

Design/methodology/approach – The paper adopts a quantitative approach through structural equation modelling for analysing the data collected from 416 respondents in Portugal, a country well-known for its gastronomy.

Findings – Sensory perception positively impacts the experiential value in its functional and emotional dimensions. Furthermore, immediate customer satisfaction induces positive post-purchase behaviour regarding slow food restaurants.

Practical implications – This study provides practical guidelines for managers to monitor customer satisfaction by applying sensory marketing techniques. Furthermore, slow food advocates for environmentally sustainable practices, social welfare and the preservation of biodiversity and local culinary traditions.

Originality/value – Slow Food restaurants must remain authentic and sustainable to develop a traditional gastronomic experience. Sensory marketing is a marketing practice that uses senses to improve customers' emotions and dining experiences. Although there are studies applied to the restaurant sector, there are hardly any applied to slow food.

Keywords Multisensory marketing, Customer experience, Experiential value, Post purchase behaviour, Slow food, Sustainability

Paper type Research paper

1. Introduction

The business environment has changed dramatically in modern markets, and this transformation affects the overall efficiency and competitiveness of companies (Isaac *et al.*, 2023). Customers are exposed to multiple stimuli provided by the respective brands to attract and retain them (Nayeem *et al.*, 2019); e.g. several modernist chefs have paid more attention to food or drinks aromas in enhancing their guests' multisensory dining experiences (Spence, 2022). This exposure to experiences has become an alternative to differentiate products and brands from competitors (Nayeem *et al.*, 2019), and to build customer loyalty (Andreini *et al.*, 2019).



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Youssef and Spence (2023) called it the “experience economy”, and it is a response to those customers who value the power of experiences.

In a service industry like the restaurant industry, managers have an extra advantage in experience marketing because the industry’s nature allows a dialogue to be established with customers, providing personal experiences directly (Amin and Tarun, 2019). For instance, marketing practices has seen a clear shift towards a more experiential relationship with customers, and many brands are trying to harness the power of experiential events; this change has led to a growing interest in delivering immersive, multisensory experiences (Youssef and Spence, 2023). However, few experiences can awaken all senses as restaurants do. Although most service industries employ one or more of the five senses, restaurants can employ all five senses or multi-senses (Kumar *et al.*, 2020). So, restaurants are moving from being food provisioners to places where visitors can experience new stimuli to increase their satisfaction. Despite this idea being particularly important in slow food restaurants, which aim to challenge the fast-paced life we are immersed in, there are still few studies applied to this niche, when customer satisfaction largely depends on memorable, pleasurable, attentive, and sometimes extraordinary experiences in this industry. Therefore, the challenge for marketers and researchers is to identify which experiences can leave the most favourable impression on customers and encourage them to develop a positive attitude and behaviour towards the brand (Amin and Tarun, 2019).

This research intends to be a signpost for the restaurant sector by highlighting the noticeable lack of research focused on applying sensory marketing principles in Slow Food restaurants. Despite the existing body of literature addressing various aspects of the service industry, few studies have specifically targeted the application of these marketing principles within the Slow Food movement; this oversight reveals an area ripe for exploration and potential innovation (Chang and Cheng, 2023; Isaac *et al.*, 2023; Silaban *et al.*, 2023). By bridging this gap, we aim not only to enrich academic discourse but also to furnish practitioners with insights that can catalyse transformative changes within the restaurant landscape. In this sense, the paper results serve as a valuable guide for managers of Slow Food restaurants, who share the philosophy of promoting a more intentional and mindful approach to food, thereby contributing to a healthier planet and community. By focusing on offering high-quality meals prepared with fresh, locally sourced, and sustainably produced ingredients, Slow Food restaurants can attract environmentally conscious consumers, enhancing their satisfaction and loyalty. Furthermore, the Slow Food dining experience emphasizes the enjoyment of flavours, the company of others, and an appreciation for the craftsmanship behind each dish, contrasting sharply with the fast-food experience, which prioritizes convenience and speed (Petrini, 2013). Our findings can assist managers in attracting this mindful consumer base while reinforcing their commitment to quality, sustainability, and the uniqueness of the culinary experience, ultimately resulting in positive impacts for both their businesses and the community.

In alignment with this pursuit, this paper aims to understand the impact of gastronomic sensory experiences (including vision, hearing, taste, smell and touch), on the consumer’s intention to revisit, as it can become a differential strategy that needs more scientific testing. This objective is also complemented by two sub-objectives: first, the paper analyses if sensory perception is positively related with experiential value, and second, it assesses if customer satisfaction with the experience is positively related with post-purchase behaviour.

2. Literature review

2.1 Slow food

In 1986, Carlo Petrini created the Slow Food concept aimed at neutralizing fast-food chains or simply resisting the “McDonaldization” of food (Petrini and Pollan, 2001). Defenders of this concept refute many aspects of the modern capitalist economy and promote a multidisciplinary approach to sustainable food production and consumption through more balanced and slower

rhythms of life (Dias *et al.*, 2021). Overall, the philosophy behind Slow Food is that eating is an agricultural act in which informed consumers make better decisions and become co-producers of good food. It defends the right to consume healthy food while respecting the planet, conserving regional, traditional and artisanal cuisines, techniques and products, maintaining food heritage, promoting fair trade, and protecting biodiversity always in harmony with ecosystems and with gastronomic pleasure in mind (Petrini, 2013).

In this regard, corporate and customer awareness has seen an upsurge in ecological and sustainability practices. This trend is particularly evident within the broader hospitality industry, where restaurants are taking significant strides in adopting sustainability initiatives (Hu *et al.*, 2010). The food industry is increasingly adopting practices related to sustainability in gastronomy, e.g. through eco-gastronomy, a close concept to Slow Food philosophy, which establishes connections between the dish and the planet. This concept fosters an attitude not only capable of preserving the taste of food, but also considering the cultivation and valorisation of local products (Freixa and Chaves, 2015).

The Slow Food movement conceptualizes food through three interconnected principles: good, clean, and fair (Petrini, 2005). “Good” is undoubtedly a very subjective characteristic; it means pleasant, quality, tasty and healthy food. “Clean” encompasses the notion of production that does not harm the environment. “Fair” symbolizes equity for consumers and producers; affordable prices for customers and good working and remuneration conditions for producers (Slow Food, 2023a). However, despite its growing visibility around the world, with Slow Food being present in 160 countries, contributions from the academic and scientific community to understand its multiple impacts are still modest (Dias *et al.*, 2021).

2.2 Overview of multisensory marketing

Multisensory marketing represents a shift from conventional marketing activities, reliant on needs, information retrieval, and product evaluation, to a marketing strategy centred on enhancing experiences (Isaac *et al.*, 2023). It is a business practice rooted in experiences, possible by the five sensory modalities: taste, smell, hearing, vision and touch (Fong *et al.*, 2023). Some of the most successful organizations use the five senses in creating their brand image, and new technological developments and research has appeared in literature to help organizations create an experience suited to their business and customers (Khandelwal *et al.*, 2020). Research in the field of sensory marketing suggests that products can be evaluated or judged based on their appearance, feel, smell, taste and sound, which further influences customer behaviour and indirectly affects purchasing intentions (Wörfel *et al.*, 2022).

Lindstrom (2005) explains that sometimes, unconsciously, we store our values, feelings, and emotions in memory banks. It is then possible to metaphorically compare that memory to something like a standard video, that is, a kind of recording made up of an image track and a sound track; however, for humans this has at least five tracks, image, sound, smell, taste and touch. These five tracks contain an unimaginable quantity of data with a direct influence on emotions and everything they imply. Thus, sensory marketing produces a message that evoke customers through senses when they think about products or services (McCole, 2004; Schmitt, 1999; Yuan and Wu, 2008).

2.2.1 Sight marketing. Vision is considered the most common sense when choosing goods or services and crucial for customer identification with the brand (Hultén, 2011), becoming the most studied modality (Wörfel *et al.*, 2022). The domain of vision causes a need to experience products and services, as human opinion is quickly conditioned by what is seen (Hultén, 2013). The visual sense is used in various ways and dominates other senses in the customer’s purchasing decision (Pawaskar and Goel, 2014).

Visual stimulus encompasses the brand’s image strategy, and can be worked through colour, graphics, fonts, packaging and its visual identity (Hultén, 2013). Colour is considered the most important element of the visual sense, as it is used to evoke emotion, express personality, and stimulate brand association (Nagarjuna and Sudhakar, 2015). In the food and

beverage sector, the influence of colours is readily apparent and distinctly defined. Therefore, selecting the right colour scheme is crucial in enticing customers to a restaurant, ensuring their comfort throughout the dining experience, and encouraging them to return for more (Chemah *et al.*, 2019).

2.2.2 Sound marketing. When we hear a word, we attribute meaning to it, we even try to perceive the physical characteristics of the source of the sound – either animate (human, cat) or inanimate (box, robot) (Krishna, 2012). As Lindstrom (2012) points out, it is the use of the perception that the customer has through hearing that leads a brand to develop an eminent image. Sound is very effective in getting the customer to create new images and thoughts, confirming that listening has a percentage of 41% in brand building.

It was proven that music had the purpose of inducing certain attitudes and behaviours in customers, such as awakening the purchase (Milliman, 1982). For instance, customers can stay longer and even spend more than expected in a store if they like the music (Bitner, 1992). Thus, sound can provide multiple sensory experiences to everyone, through different forms of sound expression such as the voice or even a simple jingle (Pawaskar and Goel, 2014). Then, it is advisable for restaurateurs to dedicate time to curate a music playlist that aligns with their restaurant's identity, considering genre, artists, and release years (Chemah *et al.*, 2019). Similarly, the location of the kitchen significantly impacts the restaurant's ambiance, as cooking sounds enhance the dining experience; it would be unfavourable to separate the kitchen from the dining area (Chakravarty, 2017).

2.2.3 Smell marketing. The sense of smell is also essential for living an experience and is a determining factor in human decision-making. Brands began to use smell as an activator of relationships, emotions, and feelings with their customers, since smell does not present advertising saturation and has direct communication with memory and is still a new concept as a sensory marketing application for most companies (Grisales and Claudia, 2019). Smell is the only sense that we cannot turn off; people can close their eyes, cover their ears, not touch anything, and not put anything in their mouth, but smell remains an essential element of the air we breathe (Kotler, 2010). The feelings created by fragrances, whether pleasant or not, are associated with creativity, culture, learning, emotion, and psychology (Wright, 2006). Furthermore, odours can also be used to produce lasting customer memories and relationships with brand loyal customers. We can remember aromas with 65% perfection after just three months, while the visual memory of a photograph drops to around 50%; on average, a human can remember about 10,000 scents (Batey, 2010).

One of the most renowned strategies in olfactory marketing within the food industry involves employing artificial scents to entice customers. A notable example is Starbucks Coffee's decision to roast coffee beans in-store instead of relying on external suppliers. This practice diffuses the aroma of freshly roasted beans throughout the environment, enhancing the sensory experience for patrons (Medina, 2017). The concept of slow food takes a different approach, it emphasizes natural aromas from the careful preparation of authentic dishes, using fresh ingredients and traditional methods (Slow Food, 2023a).

2.2.4 Taste marketing. The perception of flavour is perhaps the most multisensory of our everyday experiences. The latest research by psychologists and cognitive neuroscientists increasingly reveals the complex multisensory interactions that give rise to the taste experiences we all know and love, demonstrating how they depend on the integration of signals from all human senses (Spence, 2015). The use of taste in brands' sensory experiences is achieved through its association with other senses, since taste is one of the senses that stands out most emotionally in cohabitation with other senses (Rupini and Nandagopal, 2015).

However, taste is the most difficult sense to incorporate for most brands, and consequently, and it becomes the least explored sense in sensorial branding (Lindstrom, 2012). However, Gobé (2002) associates the acts of eating and drinking with happy emotions and positive memories, which is why branding should not neglect taste. The sense of taste contributes to the construction of an incomparable brand image, thus being an effective method for differentiation from competitors (Lindstrom, 2012). For example, the characteristics of

flavours are among the most important differentiating factor for restaurants. Some of the dishes can be designed based on much-loved traditional dishes, thus evoking childhood memories in the minds of customers, the portions can be followed by “from-farm-to-fork stories” including the origin of the ingredients and preparation methods to increase credibility and authenticity (Chemah *et al.*, 2019). In this sense, in slow food restaurants, flavour is particularly significant, as the dishes are celebrated for their authentic and unique taste that reflects local culture and tradition (Slow Food, 2023a).

2.2.5 Touch marketing. As it is the oldest and most primitive, touch is the sense with the greatest contribution to our survival and evolution (Praddep, 2010). In the event of a failure of the other senses, the solution would be touch (Lindstrom, 2012). Tactile perception is a different sense, as it is not located in a specific area of the body. The skin is the largest organ of humans, and we can “feel” any part of the body through the skin, whether through the hands, fingers, legs, head, face, chest, and so on (Wright, 2006). When customers touch products, their attitude and behaviour is positively affected (Peck and Wiggins, 2006). Brands use the tactile sense because it translates the physical component of the human being, linking information and sensation about a given product to both a tactile and psychological experience. After touching a certain product, customers become more likely to buy it (Rupini and Nandagopal, 2015).

In the restaurant sector, to enhance customer experience and foster a sense of welcome, restaurateurs should prioritize offering personalized and passionate dining experiences. One effective strategy could involve waiters and/or chefs engaging with customers on a more personal level, such as through handshakes, during their visit. This gesture not only promotes a warm atmosphere but also has the potential to encourage impulse buying, spur unplanned purchases, and increase the likelihood of patrons becoming regular customers (Chemah *et al.*, 2019).

2.3 Experiential value

The concept of experiential value is composed of emotional and functional values (Ihtiyar *et al.*, 2018; Nadiri and Gunay, 2013; Yuan and Wu, 2008). Functional value is defined as the perceived utility gained from the ability of an alternative to perform functionally, utilitarianly, or physically (Sheth *et al.*, 1991). A service acquires functional value through the possession of important functional, utilitarian, or physical attributes; that is, it can be measured in a profile of choice attributes. From another perspective, functional value can be described as the cognitive or financial reward that the customers gain from the product or service (Yuan and Wu, 2008). On the other hand, emotional value is defined as the perceived utility acquired from the ability of an alternative to arouse feelings or affective states (Sheth *et al.*, 1991). A service acquires emotional value when it is associated with certain feelings or when it precipitates or perpetuates these feelings, thus, emotional value can be measured in a profile of feelings associated with the alternative (Sheth *et al.*, 1991). It refers to the feelings and emotional reactions that customers obtain during and after the experience (Yuan and Wu, 2008).

2.3.1 Relationship between experiential value and multisensory marketing. Regarding experience in the context of the product, Schmitt (1999) approaches experiential marketing through five different types of strategic experiential modules: sensory, affective, thinking, behaviour, and relational. The application of an interdisciplinary approach to experiential marketing allows a better understanding of the complicated nature of consumers’ desires, motivations, and needs (Akel, 2022).

Although there is considerable discussion about consumption and its physical/metaphysical aspects, experience cannot be ignored when developing a comprehensive understanding of consumption, particularly in today’s markets. The current customer profile requires an assessment of consumption as a complete experience, with emotional and functional drivers of consumption. Therefore, the goal of experiential marketing is to focus on customer experiences (Ihtiyar *et al.*, 2018).

Several studies show a relationship between experiential value and experiential marketing (Ihtiyar *et al.*, 2018; Nadiri and Gunay, 2013; Pham and Huang, 2015; Salomão and Santos, 2022; Yuan and Wu, 2008). When delving deeper into the topic of experiential marketing, it should offer emotional and functional value to the customer (Schmitt, 1999); furthermore, this argument is overlapped with each type of experiential marketing experience from a product perspective. In this context, Berry *et al.* (2002) added that an experience can bring emotional and functional values to customers.

Several empirical studies applied in coffee shops and fast-food restaurants have proven a positive association between experiential marketing and experiential value (Ihtiyar *et al.*, 2018; Nadiri and Gunay, 2013; Salomão and Santos, 2022). However, the centre of interest for this research is to prove the relationship between the sensory module and the experiential value. Therefore, the following hypotheses were proposed to examine the relationships between sensory perception and experiential value:

H1. Sensory perception is positively related to emotional value.

H2. Sensory perception is positively related to functional value.

2.4 Customer satisfaction

In today's increasingly competitive restaurant business, management must prioritize customer satisfaction within their strategic approach to outperform competitors (Suchánek and Králová, 2019). Enhancing customers' motivation to return necessitates constant efforts from restaurant management to foster the overall positive customer experience (Chun and Nyam-Ochir, 2020). Satisfaction thus plays a crucial role in shaping customer behaviour and influencing managerial decisions within the food service industry (DiPietro and Levitt, 2017). Thus, customers' satisfaction could be understood as the overall assessment of their experience in the restaurant in terms of price, food quality, and service (Lo *et al.*, 2024).

In most sectors, satisfaction is dependent on how customers perceive whether the service experience met, fell short of, or exceeded their expectations (Ashworth and Bourassa, 2020). When execution falls short of what is desired, the organization weakens its corporate image. Customers become satisfied when execution meets or even exceeds their desires and the organization is seen as a complement to customer satisfaction levels, as satisfied customers become loyal customers and are the most important source of promotion of an organization (Warde, 2017). In other words, satisfaction is seen as the reaction of customers to the product they expect, and the comparison between the performance of brands with expectations (Lemon and Verhoef, 2016).

2.4.1 Relationship between customer satisfaction and experiential value. An aspect related to customer satisfaction is precisely its connection with experiential value. There are several studies that have proven that experiential value directly and positively affects customer satisfaction (Ihtiyar *et al.*, 2018; Pham and Huang, 2015; Van Dat and Tran, 2020), which means that customers with high experiential value tend to give positive satisfaction ratings. As a result, two hypotheses were deployed:

H3. Emotional value is positively related to customer satisfaction.

H4. Functional value is positively related to customer satisfaction.

2.4.2 Relationship between customer satisfaction and post-purchase behaviour. Post-purchase behaviour is the phase in which the level of customer satisfaction or dissatisfaction is analysed after the product or service has been used (Kotler, 1998). Therefore, it is argued that this step is vital because it evaluates all the effort credited by the organization and marketing professionals in each product and can also produce evaluations that positively or negatively affect a company, often in a way that cannot be changed. As a result, organizations must try to

understand if their customers are not satisfied so that appropriate measures can be applied to improve their services and increase their sales (Bojanic and Reid, 2010).

There are numerous studies that have analysed how customer satisfaction can have an impact on post-purchase behaviour (Hasan *et al.*, 2021; Ihtiyar *et al.*, 2018; Ma *et al.*, 2022; Mili and Soto, 2023). In this context, the post-purchase behaviour is measured in some studies by the following variables, which we will analyse, i.e. word of mouth (WOM), intention to revisit (IRV), and intention to pay more (IPM).

Word of mouth communication is a process in the form of providing recommendations both individually and in groups for a product or service and aims to provide personal information (Keller and Kotler, 2012). Additionally, customers will enthusiastically encourage people within their social circle to adopt a behaviour when their experience is beneficial or pleasant. Thus, WOM refers to positive or negative customer reviews and (re)purchase behaviour of other individuals (Ihtiyar *et al.*, 2018).

Purchase intention indicates the degree of perceptual persuasion necessary for an individual to repurchase from a given supplier of goods/services and, therefore, this behaviour reflects future transaction behaviours. Intentions are the greatest interpreters of individual behaviour, as they allow each individual to incorporate all applicable factors that may influence them (Ihtiyar *et al.*, 2018). When customers realize that they made a good choice and that the product met their needs and desires, with the service they expected, this leads to a positive impact on their future purchase intention. Any dissatisfaction in any of the determinants of customer satisfaction can reduce their future purchase intention (Nadiri and Gunay, 2013).

Additionally, an alternative way to examine customers' behavioural intentions is to focus on their intention to pay more as a post-purchase path (IPM). This concept is defined as the maximum price that a customer intends to pay and relates to positive or negative customer reviews and affects an organization's profitability (Byrd *et al.*, 2016).

Although recent findings support the notion that there is a positive relationship between customer satisfaction and post-purchase behaviour, only limited studies have been conducted in specific markets and industries, for example, the hospitality and tourism industry (Ihtiyar *et al.*, 2018). Thus, three hypotheses were developed to test the relationship between customer satisfaction and post-purchase behaviour:

H5. Customer satisfaction in slow food restaurants has a positive effect on WOM.

H6. Customer satisfaction in slow food restaurants has a positive effect on IRV.

H7. Customer satisfaction in slow food restaurants has a positive effect on IPM.

3. Methodology

3.1 Research context

This research deals with slow food restaurants in Portugal. Despite Slow Food restaurants being present in various regions of Portugal, they are most common in six, namely, Alentejo, Algarve, Alto Minho, Lisbon, Porto, and Arcos de Valdevez (Slow Food, 2023b). The restaurant industry plays a significant role in Portugal's economy, contributing to job creation, tourism, and GDP results. Thus, tourism consumption in the Portuguese economy was equivalent to 15.8% of GDP (9.8% in 2021), with the restaurant sector being one of the main contributors to tourism GDP (INE, 2023).

3.2 Data collection and sampling

In September 2023, a survey was conducted among customers aged 18 and over in Portuguese Slow Food restaurants. The restaurants were selected for having official affiliation with the Slow Food movement, a minimum of two years of operation, and menus focused on local and

seasonal ingredients. The questionnaire, administered over a three-month period, included two parts: the first incorporated statements measuring various constructs with a seven-point Likert scale (from 1 = strongly disagree to 7 = strongly agree), while the second part gathered demographic information. Customers were invited to participate in the survey immediately after their dining experience.

Participant anonymity was ensured to minimize response biases and reduce social desirability bias; neutral, non-leading language was used to avoid acquiescence and halo effects; balanced Likert scales with clear distinctions between options have helped mitigate central tendency and extreme response biases; and respondents were asked specifically about their most recent visit to a Slow Food restaurant. Furthermore, following Podsakoff *et al.* (2003), we assessed common method variance at both the exploratory and confirmatory levels because the data for both the predictor and criterion variables were gathered by a single person. Results indicate that method biases were not an issue.

The research was disseminated online through a snowball approach across all districts of Portugal. To ensure that data collection represented real and recent experiences, filter questions were applied so that only individuals residing in Portugal who consumed meals in Portuguese Slow Food restaurants and were aged 18 or over. After eliminating questionnaires that did not fit the target population and filter criteria, the final sample resulted in 416 people. Using the G*Power 3.1.9.2 software, sample power was validated (F test > linear multiple regression: fixed model, R^2 deviation from zero) with the following parameters: $\alpha = 0.05$; $f^2 = 0.10$, number of predictors = 6. The software identified a sample power ($1 - \beta$) result of 0.99981, translating into less than 0.01% chance of having a type 2 error in this study (Cohen, 2013). The next step was data analysis through Structural Equation Modelling (SEM), using the Partial Least Squares method in the SmartPLS4 software.

Regarding the sociodemographic profile of participants, although there are more female than male respondents, a balance between genders was found, given that the Portuguese population is slightly made up of more women than men (Pordata, 2023). On the other hand, the three age bands with the greatest weight were from 26–35, 36–45, and 46–55 years old. Additionally, most respondents had a degree or at least had completed secondary education and were working. Further details can be found in Appendix 1.

3.3 Item specification

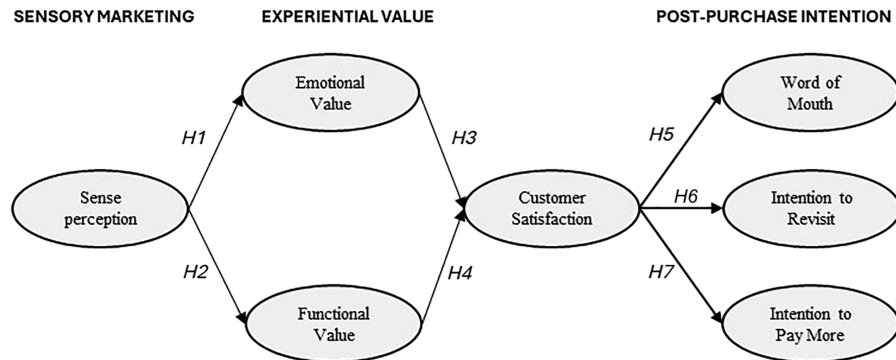
For the items that assessed sensory perception (10 statements, previously used by Nadiri and Gunay, 2013; Schmitt, 1999; Yuan and Wu, 2008), experiential value (6 statements, applied by Mathwick *et al.*, 2001; Nadiri and Gunay, 2013; Sweeney and Soutar, 2001; Yuan and Wu, 2008), customer satisfaction (2 statements from Nadiri and Gunay, 2013; Oliver and Swan, 1989; Yuan and Wu, 2008), Word of Mouth (3 statements, previously used by Nadiri and Gunay, 2013; Zeithaml *et al.*, 1996), intention to revisit (2 statements, applied by Nadiri and Gunay, 2013; Zeithaml *et al.*, 1996) and finally the intention to pay more (2 statements, coming from Ihtiyar *et al.*, 2018; Zeithaml *et al.*, 1996) a Likert scale was applied. This choice is aligned with previous research using the items mentioned above.

All variables went through the process of translation and back-translation from English to Portuguese to ensure full understanding by interviewees. Before publishing the research, a pre-test was carried out, in which ten individuals were interviewed after completing the questionnaire, evaluating whether their understanding converged with the original meaning of the items. There were no reports of inconsistencies related to the original statements, thus establishing the face validity of the instrument.

4. Analysis of results

4.1 Measurement model assessment

Figure 1 reflects how items relate to the research model. The relationships between the construct and its measurement instruments (indicators or items) can be reflective or formative.



Source(s): Authors' own creation

Figure 1. Structural model

In marketing research, reflective indicators are the most common (Diamantopoulos and Winklhofer, 2001). Scales from the model applied in this investigation are reflective, as the components that constitute the variables are interrelated, and the shared information enables the measurement of the construct (Diamantopoulos *et al.*, 2003).

Appendix 2 includes factor loadings, essential to enhance the accuracy and validity of the factors identified in the factor analysis. Those items with a factor loading below 0.7 should be eliminated (Hair *et al.*, 2017), thus ensuring that only the most relevant and reliable ones are included in the analysis. For sensory perception, it was necessary to eliminate items S1, S5 and S8 due to their low factor loading; the remaining were maintained.

Table 1 shows the analysis of convergent validity, internal consistency, and discriminant validity (Fornell and Larcker, 1981). As all AVE values were greater than 0.5, it can be confirmed the convergent validity (Henseler *et al.*, 2009). Additionally, results confirmed the internal consistency of the analysis because all composite reliability (CR) values were greater than 0.7 (Hair *et al.*, 2017). On the other hand, all Cronbach alpha values were considered good

Table 1. Convergent validity, internal consistency and discriminant validity

Constructs	AC	CR (rho_a)	CR (rho_c)	AVE	1	2	3	4	5	6	7
Intention to pay more	0.928	0.930	0.965	0.932	0.966						
Intention to revisit	0.789	0.834	0.903	0.823	0.769	0.907					
Customer satisfaction	0.960	0.961	0.974	0.926	0.688	0.704	0.963				
Sensory perception	0.807	0.818	0.859	0.512	0.553	0.417	0.606	0.685			
Emotional value	0.953	0.953	0.970	0.914	0.667	0.645	0.824	0.680	0.956		
Functional value	0.833	0.933	0.893	0.737	0.451	0.447	0.512	0.344	0.490	0.859	
Word of mouth	0.929	0.932	0.955	0.876	0.687	0.730	0.896	0.580	0.803	0.536	0.936

Source(s): Authors' own creation

or very good (Hair *et al.*, 2017). Finally, all the square roots of the AVEs were greater than the correlations of the constructs, therefore, the results confirmed that there is discriminant validity (Fornell and Larcker, 1981).

The analysis of the PLS algorithm found that when excluding items with factor loadings below the reference values, it was noticed that the SRMR presented was 0.083. Although this value is not less than 0.08, it was close to it (Henseler *et al.*, 2016a, b). In turn, the value of the NFI indicator was greater than 0.09, showing a good fit of the model (Lohmöller, 1989). Finally, the RMS Theta indicator was below 0.12, also showing a good fit of the model (Henseler *et al.*, 2014). Regarding the VIF values (Table 2), all hypotheses revealed a value lower than 5, showing acceptable values (Hair *et al.*, 2019); it demonstrates the absence of multicollinearity.

Table 2 includes the structural model results. The evaluation of the degree of explanation of the variance of emotional value, R^2 0.463, allowed us to conclude that sense perception explained 46.3% of the variance in emotional value, considered a weak effect (Hair *et al.*, 2019). The R^2 for functional value was 0.119, that is, sensory perception explained 11.9% of the variance in functional value, considered a very weak effect (Hair *et al.*, 2019). When evaluating the degree of explanation of the variance of customer satisfaction (R^2 0.695), it is possible to conclude that the two latent variables tested, emotional value and functional value, explained 65.6% of the variance in customer satisfaction, suggesting a moderate effect (Hair *et al.*, 2019).

Regarding post-purchase intention, the degree of explanation of WOM (R^2 = 0.803) allowed us to conclude that the latent variable customer satisfaction explained 80.3% of the WOM variance; considered a substantial effect (Hair *et al.*, 2019). When studying the intention to revisit (R^2 0.496), it can be said that the latent variable customer satisfaction explained 49.6% of the variance of the intention to revisit, a moderate effect (Hair *et al.*, 2019). Finally, when evaluating the degree of explanation of the variance of intention to pay more (R^2 = 0.474), it can be concluded that the latent variable customer satisfaction explained 47.4% of the variance of the intention to pay more; a moderate effect (Hair *et al.*, 2019).

To complete the analysis of Table 2, the calculation was carried out in Bootstrapping's SmartPLS4 to evaluate the structural coefficients and their respective *p*-values. As *p*-values were lower than 0.005, all hypotheses were accepted.

5. Discussion

The first specific objective was to analyse whether sensory perception is related to experiential value. Hypotheses 1 and 2 demonstrated that sensory perception positively influences

Table 2. Structural model results

Hypotheses	VIF	Standard deviation	<i>p</i> -value	Conclusion
Effect on emotional value (R^2 0,463)	1.000	0.0033	0.000	Supported
H1. Sensory perception → Emotional value				
Effect on functional value (R^2 0,119)	1.000	0.062	0.000	Supported
H2. Sensory perception → Functional value				
Effect on customer satisfaction (R^2 0.695)	1.315	0.047	0.000	Supported
H3. Emotional value → Customer satisfaction				
Effect on customer satisfaction (R^2 0.695)	1.315	0.060	0.0018	Supported
H4. Functional value → Customer satisfaction				
Effect on WOM (R^2 0, 803)	1.000	0.024	0.000	Supported
H5. Customer satisfaction → Word of mouth				
Effect on intention to revisit (R^2 0, 496)	1.000	0.056	0.000	Supported
H6. Customer satisfaction → Intention to revisit				
Effect on intention to pay more (R^2 0.474)	1.000	0.046	0.000	Supported
H7. Customer Satisfaction → Intention to pay more				

Source(s): Authors' own creation

experiential value in both its functional and emotional dimensions among slow food customers. This finding aligns with Schmitt (1999) and Yuan and Wu (2008), which emphasize the role of sensory stimuli in enhancing customer experiences through multi-sensory engagement. For example, the visual stimuli during food presentation in dishes in an elaborate way makes the difference; aesthetically pleasing visuals significantly enhance perceived quality, boosting experiential value (Wörfel *et al.*, 2022). The confirmation of Hypothesis 1 is consistent with previous findings in coffee shops and fast-food settings (e.g. Nadiri and Gunay, 2013; Salomão and Santos, 2022). However, it was contradictory with other studies that suggests that context plays a more significant role in these outcomes (Ihtiyar *et al.*, 2018; Yuan and Wu, 2008), indicating a need for further exploration. Similarly, while our findings for Hypothesis 2 align with existing literature (Ihtiyar *et al.*, 2018; Salomão and Santos, 2022), discrepancies were observed in coffee shop studies (Nadiri and Gunay, 2013; Pham and Huang, 2015), it underscores the complex nature of sensory marketing and its variable effectiveness across different environments.

In addressing the second specific objective—assessing the relationship between customer satisfaction and post-purchase behaviour – Hypotheses 3 and 4 confirmed that experiential value positively correlates with consumer satisfaction. This supports McCole's (2004) assertion that emotional engagement is vital for fostering customer loyalty, which is, in turn, facilitated by sensory marketing that activates consumers' perceptions and directly influences their emotions through products and services. Furthermore, Hypotheses 5, 6, and 7 demonstrated that immediate customer satisfaction leads to positive post-purchase behaviour. Our findings echo previous studies, which similarly conclude that enhanced experiential value leads to greater satisfaction and loyalty (Ihtiyar *et al.*, 2018; Nadiri and Gunay, 2013; Pham and Huang, 2015; Salomão and Santos, 2022; Yuan and Wu, 2008).

5.1 Theoretical implications

Many studies have been conducted to delve deeper into customer perception, including sensory perception, across various contexts and sectors. This research focuses on the underexplored realm of Slow Food restaurants, aiming to understand how different stimuli impact customer perceptions and behaviours in this specific setting. By applying a tailored theoretical framework, the study investigates the relationship between sensory marketing practices, immediate customer satisfaction, and post-purchase behaviour in the context of Slow Food dining. This approach is supported by previous studies (Ihtiyar *et al.*, 2018; Nadiri and Gunay, 2013; Salomão and Santos, 2022; Yuan and Wu, 2008), but it distinctly addresses the nuances of the Slow Food movement, highlighting its unique attributes.

Thus, this research reinforces the theory that sensory marketing practices result in immediate customer satisfaction through experiential value, which in turn leads to positive post-purchase behaviour. Moreover, it emphasizes that in Slow Food restaurants, this immediate customer satisfaction is particularly influential in fostering increased brand loyalty, repeat purchases, and positive word-of-mouth recommendations. These findings underscore the crucial role that sensory experiences play in shaping customer perceptions, preferences, and actions specifically within the Slow Food context.

Furthermore, this investigation makes a significant contribution to the marketing literature by offering new insights derived from applying the theoretical model deployed to Slow Food restaurants. This not only enriches the existing body of knowledge but also opens new avenues for future research in this area, encouraging further exploration of the interplay between sensory marketing and consumer behaviour within the unique context of Slow Food dining. By highlighting these specific dynamics, this study sets the stage for deeper understanding and potential applications in related fields.

5.2 Managerial or social implications

From a managerial standpoint, this research serves as a valuable tool in formulating actionable strategies for managers to effectively gauge and enhance customer satisfaction using sensory

marketing tactics. Notably in Portugal, where rich cultural traditions intersect with modern business practices, some managers remain unfamiliar with the notion of sensory marketing. Consequently, they may lack a comprehensive understanding of the profound implications this marketing approach holds for their industry.

What's intriguing is that Portugal, with its vibrant culinary scene and centuries-old artisanal traditions, offers a unique backdrop for exploring sensory marketing's potential. Yet, despite this rich sensory heritage, some managers are yet to harness its power in the realm of business. It is recommended that these managers abstain from presuming that consumer decisions are solely driven by the utilitarian aspects of a product, such as its quality and price. This presumption, as evidenced by this study, is not entirely accurate. Instead, customers often respond deeply to sensory stimuli, whether it is the aroma of freshly brewed coffee or the tactile experience of testing out a new gadget. For instance, Slow Food restaurant managers could enhance the dining experience by incorporating the aromas of local herbs and spices into their restaurants, or by using texture-rich materials in their table settings that evoke the feel of traditional dining. By tapping into these sensory triggers, businesses can create more immersive and memorable experiences for their customers, ultimately fostering greater loyalty and satisfaction.

Beyond, focusing on the social level, Slow Food advocates for environmentally sustainable practices, social welfare, and the preservation of biodiversity and local culinary traditions; thus, the implementation of sustainable food practices contributes to the correct economic growth of this sector. For example, managers could engage customers through sensory experiences by hosting tasting events that highlight local production, allowing consumers to see, smell, and taste the unique flavours of their region. This not only showcases the sensory richness of local cuisine but also emphasizes the importance of sustainability in their dining choices, also demonstrating cooperation with their business ecosystem. This study could have a positive impact on society by encouraging non-slow food restaurant managers to also apply more sustainable eating practices as they realize that current consumers are increasingly supporting the definition of a more sustainable and ecologically conscious future (Ismail *et al.*, 2023).

5.3 Limitations and suggestions

A limitation of this study was that an item associated with the auditory sense had to be excluded; therefore, in the next study it is advisable to include more than one item per sense to keep in the analysis all senses affecting sensory marketing. Since sensory perception is part of one of the five experiential modules of experiential marketing, future research should study how the remaining perceptions (affective, thoughts, behaviours and relational) can also be important for restaurants. Additionally, while this study was conducted in Portugal, findings may be extrapolated to other countries with similar contexts, i.e. Spain and Italy, where rich cultural traditions intersect with modern business practices. In these nations, restaurateurs may face similar challenges regarding their familiarity with sensory marketing. Therefore, the implications and advantages of this marketing methodology could be relevant and applicable to industries operating under analogous cultural and economic conditions.

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Table A1. Participants demographics (absolute and percentage)

Variable	Options	N	%
Gender	Female	220	52.8
	Male	196	47.1
	None of the options above represent my gender	0	0
Age range	18–25	45	10.8
	26–35	124	29.8
	36–45	98	23.6
	46–55	93	22.4
	56–65	44	10.4
	More than 65	12	2.9
Education	Elementary school	23	5.5
	Middle school	42	10.1
	High school	141	33.9
	Bachelor's degree	151	36.3
	Postgraduate	1	0.2
	Master's degree	53	12.7
Professional situation	Doctorate	5	1.2
	Employee	330	79.3
	Self-employed	57	13.7
	Unemployed	3	0.7
	Student	14	3.4
	Retired	12	2.9
Gross annual income	≤5.000 euros	17	4.1
	Between 5.001 and 10.000 euros	12	2.9
	Between 10.001 and 13.500 euros	15	3.6
	Between 13.501 and 19.000 euros	54	13.1
	Between 19.001 and 27.500 euros	86	20.7
	Between 27.501 and 32.500 euros	85	20.4
	Between 32.501 and 40.000 euros	76	18.3
	Between 40.001 and 50.000 euros	33	7.9
	Between 50.001 and 100.000 euros	25	6.0
	≥100.000 euros	7	1.7
District	N/A	6	1.4
	Aveiro	17	4.1
	Beja	10	2.4
	Braga	15	3.6
	Bragança	5	1.2
	Castelo Branco	5	1.2
	Coimbra	5	1.2
	Évora	10	2.4
	Faro	16	3.8
	Guarda	5	1.2
	Leiria	5	1.2
	Lisboa	154	37
	Portalegre	6	1.4
	Porto	108	26
	Região Autónoma dos Açores	10	2.4
	Região Autónoma da Madeira	13	3.1
	Santarém	8	1.9
	Setúbal	9	2.2
	Viana do Castelo	4	1
	Vila Real	5	1.2
	Viseu	6	1.4

Source(s): Authors' own creation

Table A2. Items and factor loadings

Item	Factor loading
S1- Materials associated with the service (such as pamphlets/statements, menus) are visually appealing and getting attention	0.415
S2- The internal and external decoration was attractive and attention getting	0.662
S3- The establishment emanated a pleasant and interesting smell	0.658
S4- The tastes of the products matched my expectation	0.658
S5- The flavours of the products were typically regional/local and difficult to find in other restaurants outside this region	0.477
S6- The products offered for eating were fresh	0.655
S7- The containers in which the products were delivered were clean and practical	0.688
S8- The auditory (music) system offered relaxing and pleasant atmosphere	0.476
S9- The furniture in the establishment was comfortable	0.795
S10- The texture of the establishment's furniture was pleasant	0.794
VE1- I enjoy being in this establishment	0.962
VE2- This establishment makes me feel good	0.969
VE3- This establishment makes me revisit it	0.937
VF1- The products offered by the establishment are reasonably priced	0.916
VF2- In this establishment I receive a good price/quality proposal for the products.	0.913
VF3- This establishment is economical	0.741
SAT1- I am satisfied with my decision to get some products/visit here	0.954
SAT2- Taking everything into consideration, I really liked this restaurant	0.973
SAT3- Taking everything into account, the establishment's service meets my expectations	0.961
WOM1- I will say positive things about this restaurant to other people	0.952
WOM2- I will encourage friends and relatives to visit this restaurant	0.915
WOM3- I will recommend it to someone who seeks my advice	0.940
IR1- I consider this restaurant as my first option	0.880
IR2- I intend to continue eating at this restaurant soon	0.934
IP1- I will continue to buy products from this restaurant, even if the prices increase slightly	0.964
IP2- I don't mind paying more for the benefits I currently receive from this restaurant	0.968

Note(s): Italic numbers indicate those items deleted as their factor loading are below 0.7 (Hair *et al.*, 2017)

Source(s): Authors' own creation

About the authors

Mariana Alves Santos is currently pursuing a doctoral degree in Economic Analysis and Business Strategy at the University of Vigo (Spain). Her current research interests encompass the fields of marketing, consumer behaviour, and corporate strategy. Recently, she debuted with a publication that delved into these areas of interest, and since then, she has expressed her intention to develop and participate in further research.

Ana Dopico-Parada is Associate Professor of marketing at the Faculty of Communication at the University of Vigo. She has published articles in journals such as *Journal of Retailing and Consumer Services*, *Revista de Administração de Empresas* or *Foods*. She has participated in various public research projects and published papers in international conference.

Pablo Cabanelas is Assistant Professor of Marketing at the University of Vigo (Spain) and Adjunct Director of ECOBAS. He also belongs to the UNAM and UdG (México) faculty in the post-graduate studies. His current research interests are value creation, customer experience and relationship marketing. He acts as Associate Editor in *European Research on Management and Business Economics* and *Journal of Business and Industrial Marketing*. His research has been published in different journals such as *Industrial Marketing Management*, *Journal of Business Research* or *International Marketing Review*, among others. Pablo Cabanelas is the corresponding author and can be contacted at: pcabanelas@uvigo.gal

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Integrating sustainability into brand valuation models: an integrative literature review

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Gabriela Salinas

Department of Marketing, Complutense University of Madrid, Madrid, Spain, and

Carmen Abril

Complutense University of Madrid, Madrid, Spain

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Abstract

Purpose – Given the mixed findings in the literature regarding the impact of sustainability on brand value, this study aims to clarify the debate by analyzing and synthesizing existing research. We focus on the metrics used to assess both sustainability and brand value, as well as the mediators and moderators that shape this relationship.

Design/methodology/approach – This study employs both a systematic literature review and a bibliometric analysis, drawing on publications indexed in the Web of Science Core Collection™ (WoS), Scopus and ScienceDirect. The search process adheres to the SPAR-4-SLR protocol and PRISMA guidelines. A total of 39 articles were retrieved and analyzed using the VOSviewer software for bibliometric analysis.

Findings – Sustainability efforts impact brand value through two primary pathways: consumer and corporate. In studying the consumer path, most academics have overlooked the role of consumer perceptions in brand value creation. We emphasize the need to integrate both consumer and corporate metrics into brand valuation models to fully capture the effects of sustainability efforts on brand value.

Originality/value – This is the first study to adopt a systematic literature review and bibliometric analysis to explore the impact of sustainability on brand value. It offers a critical overview of the different measurement approaches used in the literature and provides important managerial implications, such as the need to reflect both corporate and consumer metrics to fully capture the effects of sustainability on brand value. The study also proposes a comprehensive agenda for future research.

Keywords Brand valuation, Brand value, Financial-based brand equity, Sustainability, Interbrand, Brand Finance

Paper type Literature review

1. Introduction

A growing body of academic literature highlights the increasing relevance of intangible assets in value creation, signaling a shift in the sources of competitiveness from tangible to intangible assets, such as brands (Intara and Suwansin, 2024; Masulis *et al.*, 2023). Globally, intangible assets now account for 50% of Enterprise Value (Brand Finance, 2023). Among these intangible assets, brand value—defined as the financial (monetary) worth of a brand and estimated as the present value of expected brand cash flows (Salinas, 2009)—can represent up to 40% of total Enterprise Value (Leite, 2022). This highlights the crucial role brands play in generating business value in today's economy. Given their significant contribution to shareholder value, safeguarding and optimizing brand value has become a strategic priority for marketers.

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At the same time, sustainability—defined as the integration of environmental, social, and governance (ESG) practices into business operations to meet present needs without compromising future generations (Brundland, 1987)—has emerged as a key driver of consumer demand (Eitelwein and Paquet, 2021). Consumers increasingly expect companies to act sustainably and contribute positively to society (Rathee and Milfeld, 2023). As a result, sustainability has become a critical consideration for marketing executives in brand management decisions, particularly for new product development and innovation (Kemper and Ballantine, 2019; Lin *et al.*, 2021; Rahman, 2023).

At the intersection of these two challenges—preserving brand value and fostering sustainable growth—marketers are increasingly tasked with integrating sustainability into brand strategies and tactics while demonstrating the tangible impact of such efforts. This is where brand valuation—the process of estimating a brand's financial value based on consumer perceptions, competitive position and projected revenues (Salinas, 2009)—becomes vital. It helps marketers build a business case for sustainability investments by quantifying their impact on value creation in financial terms (Brand Finance, 2024; Calder, 2020).

To achieve this, managers must understand how sustainability efforts influence two fundamental variables in brand valuation: profitability and risk. These factors are key drivers of the economic value of any asset, including brands (Damodaran, 1996).

This need to measure the financial impact of sustainability efforts may explain the exponential growth of the literature exploring the association between brand valuation and sustainability, with 67% of the studies in this review published in the last five years.

However, despite the growing body of research on the subject, the impact of sustainability on brand value remains unclear, with studies showing contradictory results (see Table 1).

1.1 Theoretical framework

Given the ambivalent results in this field, understanding the underlying mechanisms through which sustainability shapes brand value has been identified as a critical issue in the literature (Zou *et al.*, 2024).

One reason for this disparity may lie in the different sustainability metrics used by researchers in this field. Most studies rely on Environmental, Social and Governance (ESG) indices as proxies for sustainability efforts undertaken by firms (Alcaide González *et al.*, 2020; Melo and Galan, 2011; Pope and Kim, 2021). ESG practices are generally viewed as long-term corporate investments (Qi *et al.*, 2021; Wang *et al.*, 2024; Zou *et al.*, 2024), and therefore, these indices measure performance of such investments at the corporate level, with higher and more effective investments in ESG activities leading to better scores (Berg *et al.*, 2022).

However, focusing solely on ESG scores disregards the significant influence that customers' perceptions of sustainability have on brand value creation, depriving managers of key insights into when and why sustainability efforts impact brand value and how marketing programs can be optimized to increase brand value.

According to the Brand Value Chain Theory (Keller and Lehmann, 2003), brand value is created through a series of stages where brand-building investments—such as sustainability initiatives—influence customer perceptions, and ultimately, financial brand value. This framework is particularly useful for understanding that for sustainability investments to translate into brand value creation, they must be effectively communicated to customers, fostering their awareness and positive perceptions of these efforts (Acuti *et al.*, 2022).

Despite this, research has largely neglected the mediating influence of customer sustainability perceptions, prompting scholars to call for further investigation into this crucial mechanism (Kinnunen *et al.*, 2022; Nguyen *et al.*, 2015).

This paper addresses these concerns by developing a framework, grounded in the Brand Value Chain Theory, that synthesizes the effects of sustainability efforts on brand value, identifying appropriate metrics to assess the relationship and contributing to the development of the field proposing new research avenues.

Table 1. Contradicting results in selected empiric articles studying the link sustainability-brand value

Type of relationship	Author and year	Theoretical framework	Methodology	Sample details	Period	Mechanisms, moderators or mediators	Brand value source	How the study measured sustainability	Investment	Source
Positive	Melo and Galan (2011)	Instrumental stakeholder theory	Panel regression	US, cross-industry	2001–2003	Not explored	Interbrand		X	KLD
	Torres <i>et al.</i> (2012)	Stakeholder and signaling theory	Panel regression	57 brands, US, EU, Asia	2002–2008	Not explored	Interbrand		X	Sustainalytics
	Bouvain <i>et al.</i> (2013)	Not explicitly mentioned	Panel regression	84 bank brands in Asia and the US	2012	Not explored	Brand Finance		X	CSRHUB
	Hartoto and Salas (2017)	Instrumental stakeholder theory	Panel regression	47 brands, manufacturing sector, US	2000–2014	Not explored	Interbrand		X	KLD
	Alcaide <i>et al.</i> (2020)	Not explicitly mentioned	Multivariate linear regression by OLS	13 IT brands, US, Asia	2000–2017	Not explored	Interbrand, Brand Finance, Kantar		X	Green Ranking, CSR Reprtrak, Finance Yahoo Sustainability, Global 100 most sustainable corporations
	Loh and Tan (2020)	Legitimacy theory	Linear regression	90 firms, 180 observations, cross-industry, Singapore	2016–2018	Not explored	Brand Finance		X	Scored by authors based on public company reports
	El Zein <i>et al.</i> (2020)	Not explicitly mentioned	Panel regression	1,100 financial brands, US, EU	2013–2017	Not explored	Estimated by author based on Damodaran's model		X	Sustainalytics
	Lin <i>et al.</i> (2021)	Resource-based view	Generalized method of moments	164 firms, automotive, global	2011–2018	Marketing and innovation capabilities positively moderate the relationship	Goodwill estimated by authors		X	CSRHUB
	Pope and Kim (2021)	Stakeholder theory, institutional theory	Panel regression	618 firms, cross-industry, global	2007–2013	Brand architecture type (impact stronger for masterbrand type of structure)	Brand Finance		X	ASSET4 (now Refinitiv), DJSI, ETHICAL, FTSE4GOOD, G100
										(continued)

To this end, we propose a series of research questions that we will answer throughout this paper:

- RQ1. What are the key themes, factors, and measurement methods used in the literature to study the impact of sustainability investments on brand value?
- RQ2. What factors moderate or mediate the relationship between sustainability efforts and brand value?
- RQ3. What future research avenues emerge from this review?

To achieve these objectives, we follow four steps. First, we systematically select relevant studies employing the SPAR-4-SLR protocol (Paul *et al.*, 2021). Second, we conduct a bibliometric analysis using the VOSViewer software, adhering to established academic bibliometric protocols (Donthu *et al.*, 2021). Third, we synthesize and critically review the findings derived from these analyses. Finally, we offer recommendations and outline a comprehensive agenda for further research.

Our research contributes to the literature by offering a comprehensive synthesis of how sustainability efforts impact brand value, along with mechanisms explaining different outcomes. We offer recommendations to improve the metrics and approaches used to measure this impact. Additionally, we introduce a novel explanation of the two pathways—corporate and consumer—through which sustainability influences brand value, emphasizing the importance of considering both paths in brand valuation.

The paper is structured as follows: we begin by outlining our methodology. Next, we present and discuss the results, featuring a bibliometric analysis and a conceptual integrative framework for the studies. Finally, we provide suggestions for future research based on our findings.

2. Method

Our research methodology combines bibliometric analysis to uncover key themes and trends within the broader landscape, along with the SPAR-4-SLR protocol to ensure a systematic, transparent and comprehensive review.

The SPAR-4-SLR protocol (Paul *et al.*, 2021) involves three steps: assembling the relevant literature, organizing and tabulating the papers, and assessing trends and emerging themes.

To gather the relevant literature, we began by extracting the data from the Web of Science (WoS) Core Collection Social Sciences Citation Index (SSCI), Scopus and ScienceDirect databases.

Given the multidisciplinary nature of the field, there is a myriad of terms used to refer to brand value, encompassing legal (trademarks), financial (brand valuation) and marketing aspects (brand value, financial-based brand equity) (Egan, 1998). Similarly, sustainability is referred to in various ways in academic literature, including terms like Corporate Social Responsibility (CSR) (Bouvain *et al.*, 2013; Melo and Galan, 2011; Pope and Kim, 2021; Torres *et al.*, 2012), sustainability (Harjoto and Salas, 2017; Loh and Tan, 2020; Nguyen *et al.*, 2015), and ESG (Al-Issa *et al.*, 2022; Lee *et al.*, 2022; Lee and Suh, 2022; Zou *et al.*, 2024).

Therefore, to ensure the inclusion of all relevant studies, we used a broad set of search keywords, employing the Boolean OR to capture all possible keyword combinations. The search string used was: (“brand valuation” OR “financial brand value” OR “financial-based brand equity” OR “trademark valuation” OR “brand equity valuation” OR “Valuation of brands”) AND (“sustainability” OR “CSR” OR “ESG” OR “Corporate Social Responsibility”).

After identifying the keywords for the search phase, we defined two inclusion criteria: (1) document type (journal papers) and (2) language (English), with no restriction on publication year to get a long view of the evolution of the brand valuation-sustainability literature. We

included empirical and non-empirical articles, given their value in shaping theoretical insights and providing diverse perspectives. The search, conducted on August 31, 2024, returned 379 articles.

After this initial search phase, we eliminated 69 duplicates, reducing our dataset to 310 articles. We proceeded to read the 310 titles and abstracts, excluding 205 articles that did not discuss brand value in financial terms, reducing our dataset to 105 articles. Further exclusions included 11 studies where full text was unavailable, leaving us with 94 articles. A full-text review of these 94 articles led to the elimination of 61 articles that did not explore the relationship between sustainability and brand value, as well as one article that did not provide a clear definition or specify the sources of brand value. This resulted in a final corpus of 32 articles extracted from databases.

Through citation searching, a process commonly known as snowballing (Wohlin *et al.*, 2022), we identified 7 additional studies which met our inclusion criteria, bringing the final dataset to 39 articles.

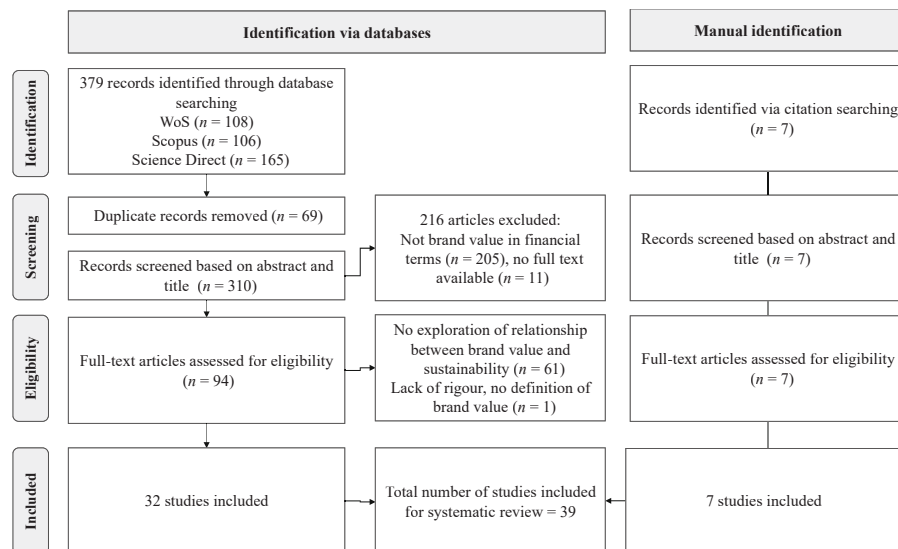
Figure 1 shows the overall search strategy and refinement process.

Once we obtained the final corpus of articles, we organized them in an Excel table with fields, including authors' names, publication year, title, source, objectives, results, employed methodology, limitations and suggested further research.

This organization enabled us to proceed to the third step of the protocol, i.e. systematically assess and identify key trends and emerging themes. In this final stage, we incorporated bibliometric analysis to enhance the identification of recurring themes, and emerging areas of interest. The combined approach allowed for a more comprehensive understanding of the literature, which is discussed in detail in Sections 3 and 4.

3. Results from the bibliometric analysis

The bibliometric analysis reveals the key themes and patterns within the literature, explored through two methods: co-occurrence of keywords and bibliographic coupling. Together, these



Source(s): Authors' own work

Figure 1. Search process depicted through a PRISMA flow diagram

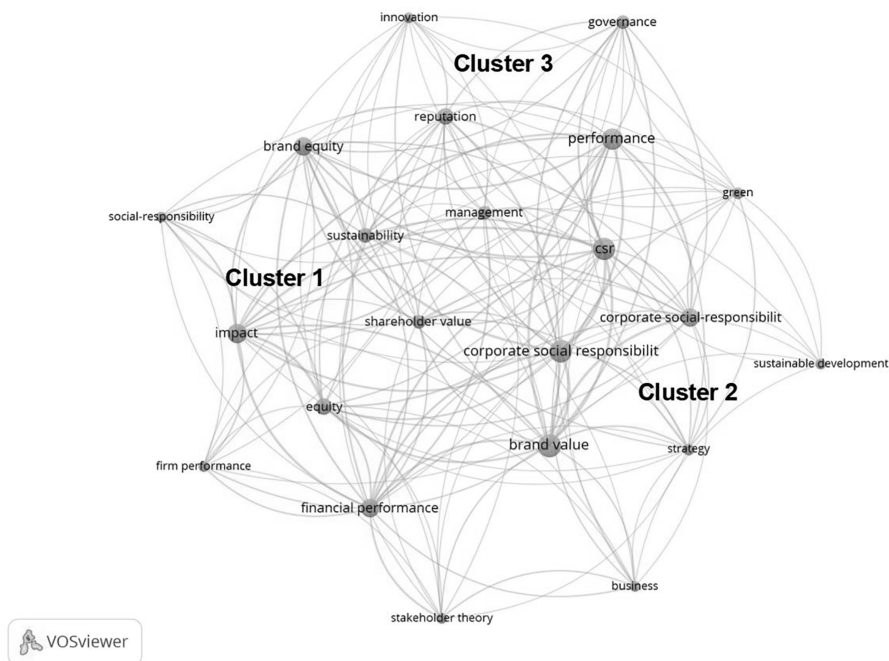
analyses provide insights into how sustainability and brand value are interrelated across different research streams and highlight gaps in the current understanding.

3.1 Co-occurrence analysis

Using VOSviewer, we conducted a co-occurrence analysis of keywords to identify the core themes in the literature, grouping 22 frequently appearing keywords into three distinct clusters, as shown in Figure 2.

These clusters provide a thematic overview of how sustainability interacts with brand value:

- (1) *Cluster 1* focuses on two primary pathways through which sustainability affects brand value: the consumer pathway, where sustainability influences brand value by shaping consumer perceptions (Cowan and Guzman, 2020; Nguyen *et al.*, 2015), and the corporate pathway, which connects sustainability to financial performance and shareholder value, key concerns for corporate stakeholders such as investors (Kim *et al.*, 2021; Pope and Kim, 2021). This dual focus aligns with stakeholder theory and reflects the need to integrate both, corporate and consumer sustainability metrics into brand valuation models.
- (2) *Cluster 2* emphasizes the strategic role of sustainability in creating long-term brand value and contributing to societal sustainable development (Wang *et al.*, 2024; Zhang and Liu, 2023). This cluster suggests that sustainability-driven strategies can create brand value not just through direct economic benefits, but by aligning brands with global sustainability objectives, which can bolster brand reputation and market positioning.



Source(s): Authors' own work

Figure 2. Co-occurrence of keywords

- (3) *Cluster 3* highlights the importance of *corporate governance and risk management* in leveraging sustainability to protect brand value. This cluster stresses internal functions, such as compliance, that contribute to minimizing reputational risks through sustainable practices (Ke *et al.*, 2023; Lin *et al.*, 2021).

These clusters reveal the multifaceted ways sustainability intersects with brand value, from consumer perceptions to corporate governance. These findings underscore the importance a holistic approach to measuring the impact of sustainability on brand value, suggesting that both consumer and corporate metrics should be integrated into brand valuation models to capture its full influence.

3.2 Bibliographic coupling

To further identify key research areas and gaps, we conducted the bibliographic coupling analysis, shown in Figure 3, which revealed five clusters.

Cluster 1, which is the largest, explores the mechanisms underlying the sustainability-brand value relationship, focusing on factors like brand architecture (Pope and Kim, 2021), media coverage and size of the firm (Zou *et al.*, 2024), analyst ratings (Ma *et al.*, 2023) and digitalization level of the firm (Wang *et al.*, 2024). This cluster underscores the role of sustainability as a signal that enhances brand value through reputation (Cowan and Guzman, 2020; Lee *et al.*, 2022).

Cluster 2 narrows the focus to industry- and region-specific studies, particularly in sectors like finance (Bouvain *et al.*, 2013; El Zein *et al.*, 2020) and specific countries (Chiang *et al.*, 2022; Loh and Tan, 2020), revealing the contextual nuances of how sustainability impacts brand value across different environments.

The remaining clusters provide broader perspectives on the overall relationship between sustainability efforts and brand value (Harjoto and Salas, 2017; Kim *et al.*, 2021; Melo and

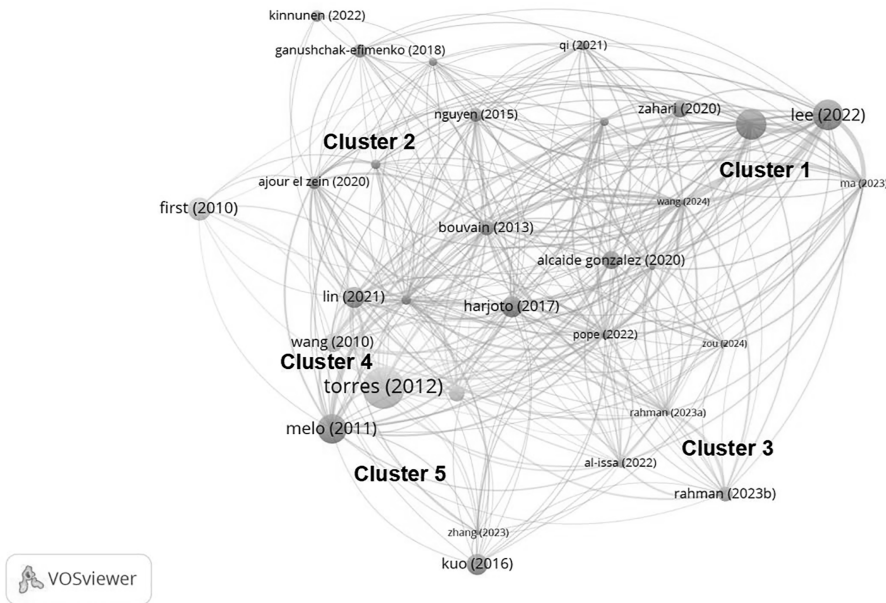


Figure 3. Bibliographic coupling

Galan, 2011; Zhang and Liu, 2023). These studies explore the general mechanisms by which sustainability influences brand value but often focus on isolated factors, suggesting a need for more integrative frameworks. Most rely on ESG indices like KLD as proxies for sustainability and Interbrand's ranking for brand value.

The clusters also reveal distinct chronological trends, with Cluster 1 reflecting a shift in focus towards mechanisms and firm-level dynamics as sustainability gains prominence approaching 2030.

3.3 Integrated analysis of co-occurrence and bibliographic coupling

The co-occurrence and bibliometric coupling analyses converge on the need for a comprehensive understanding of how sustainability impacts brand value from both consumer and corporate perspectives, with measurement tools requiring particular attention.

The integration of both analyses reveals several overarching patterns. First, consumer perceptions and corporate-level factors emerge as central to understanding the sustainability-brand value relationship, as reflected in Cluster 1 of both analyses.

Second, sustainability's strategic role in shaping brand value, particularly through the lens of reputation, is emphasized in co-occurrence Cluster 2 and bibliographic coupling Cluster 1.

Third, governance and risk management emerge as crucial factors, highlighted in co-occurrence Cluster 3 and bibliographic Cluster 3, underscoring the importance of corporate metrics in mitigating risks and protecting brand value.

Finally, the analyses collectively suggest that while the literature has extensively explored corporate- and consumer-level sustainability metrics to understanding its impact brand value, there is a need to bridge these perspectives through a holistic framework that integrates both. Existing studies often treat these dimensions separately, highlighting a critical gap in the literature: the absence of comprehensive models that capture the full range of sustainability's effects on brand value across different stakeholder groups and operational levels.

In Section 4, we build on these findings to propose an integrative review that synthesizes these insights into a more cohesive understanding of the sustainability-brand value relationship.

4. Integrative review and critical analysis

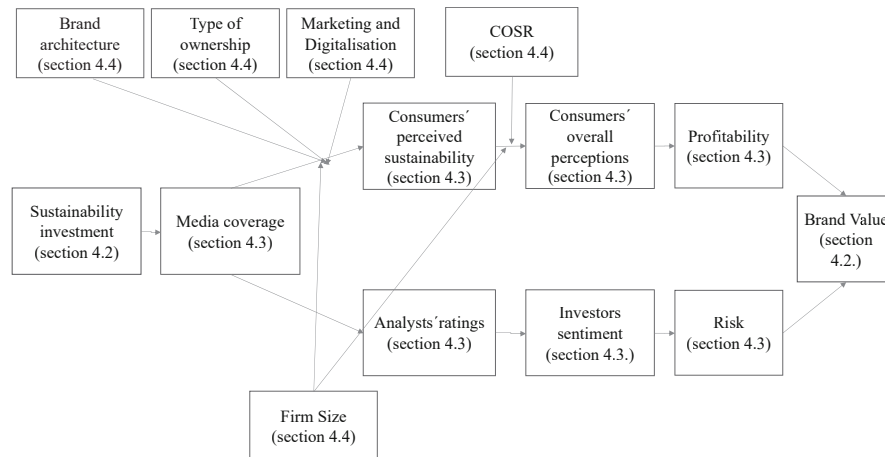
We first synthesize recurring themes and key topics from the selected literature, addressing the fragmented and varied findings from scholars studying the link between brand value and sustainability (Section 4.1). This is followed by an examination and critical analysis of factors that may explain the variation in results, such as the different metrics used to measure both, sustainability and brand value (Section 4.2). We then explore the mechanisms underlying this relationship, focusing on mediators (Section 4.3) and moderators (Section 4.4).

Figure 4 presents an integrated framework that summarizes our analysis and highlights the mechanisms through which sustainability efforts impact brand value. This framework draws on the Brand Value Chain model developed by Keller and Lehmann (2003), but expands it to include not only the consumer path but also a corporate path to brand value creation.

4.1 Overall brand value-sustainability association: analysis of contradicting outcomes

We identified four groups of authors researching the sustainability-brand value link (see Table 1). The first group used existing ESG and brand value rankings as proxies for both variables, consistently finding a positive correlation between them (Alcaide González *et al.*, 2020; Chiang *et al.*, 2022; Harjoto and Salas, 2017; Loh and Tan, 2020; Melo and Galan, 2011; Pope and Kim, 2021; Torres *et al.*, 2012; Wang, 2010; El Zein *et al.*, 2020).

The second group found that the impact of sustainability on brand value was not a simple linear relationship but exhibited other patterns. Qi *et al.* (2021) discovered an inverted U-type relationship, where initial investments in sustainability boost reputation and brand value.



Source(s): Authors' own work

Figure 4. An integrated framework of the mechanisms by which sustainability investment impacts brand value

However, further investment in sustainability implies a suboptimal allocation of budget in which other promotional activities will not be supported with enough investment, and therefore, brand value will decrease. Conversely, Wang *et al.* (2024) found a U-shaped relationship. The authors explain that although investments in sustainability are a reputation signal to consumers that has long-term positive effects on brand value, at the beginning this requires investments which detracts from other value-adding activities such as R&D or advertising, initially destroying brand value. After a while, the accumulated and continued investment starts to compound, and the reputation signal becomes stronger, bringing in benefits that exceed the investment, and therefore, building brand value.

The third group found no significant relationship between sustainability efforts and brand value, attributing this to ineffective communication of sustainability efforts to consumers (First and Khatriwal, 2010).

The fourth group found a negative relationship between perceived sustainability and brand value (Nguyen *et al.*, 2015). This finding may stem from two factors: first, this is the first study exploring on the role consumers perceptions of sustainability play in brand value creation, and second, most brands in their sample (67%) belonged to utilitarian categories. Research suggests that in such categories, where functionality is key, sustainability may be seen as a liability, with consumers viewing sustainable products as potentially lower in quality compared with their non-sustainable counterparts (Luchs *et al.*, 2010). This is due to a consumer compensatory inference process by which they assume that company resources are being diverted from quality.

4.2 Metrics used to measure brand value and sustainability

In Section 4.1, we presented the differing findings from the studies included in our literature review. In this section, we explore whether measurement approaches to sustainability and brand value contribute to these discrepancies.

Most studies used well-known rankings, such as Interbrand, Brand Finance, Kantar or World Brand Lab, as sources for brand value. Notably, the two studies that found non-linear relationships both relied on World Brand Lab, focused on the Chinese market, suggesting a potential influence of its brand valuation methodology in the results.

For sustainability, most scholars relied on ESG indices (such as KLD, Sustainalytics, CSRHub or Hexun). While these indices assess sustainability efforts at corporate level, brand

value is estimated at product level. This methodological mismatch poses challenges, especially when the corporate name differs from the product name (Pope and Kim, 2021). For instance, a corporation may excel in sustainability at the corporate level but positioning individual products as sustainable can sometimes negatively affect brand value, particularly in utilitarian categories (Luchs *et al.*, 2010). In fact, while most studies using ESG indices found a positive relationship between sustainability and brand value, the only study measuring the impact of sustainability perceptions on brand value (Nguyen *et al.*, 2015) found a negative association. This suggests that, in the consumer path, consumer perceptions of sustainability may matter more than actual efforts to increase brand value (Cowan and Guzman, 2020). But this mechanism has been overlooked in the literature.

4.3 Mediators: what factors explain the impact of sustainability efforts on brand value?

The literature identifies seven key mediating factors in the relationship between sustainability investments and brand value: media coverage, consumers' perceived sustainability, overall consumer perceptions, profitability, analyst ratings, investor sentiment and risk. These factors mediate two distinct paths in the sustainability-brand value relationship: the consumer path, which focuses on how sustainability influences consumers and drives profitability, and the corporate path, which primarily affects analysts and investors, thereby influencing risk.

Media coverage plays a central role in both pathways by amplifying a firm's sustainability efforts and extending the effects of sustainability beyond corporate reporting to external audiences, influencing both financial and consumer markets (Zou *et al.*, 2024). After this point, both paths diverge, each following a unique trajectory.

In the *consumer path*, media coverage raises visibility and recognition of the company's sustainability actions, which positively influences overall consumer perceptions (Cowan and Guzman, 2020; Ma *et al.*, 2023). However, the extent of this impact may vary depending on the product category: it tends to be more favorable for hedonic categories (e.g. designer handbags) but can be negative for utilitarian categories (e.g. cleaning products) (Luchs *et al.*, 2010). These shifts in consumer perceptions, whether positive or negative, affect profitability (Zou *et al.*, 2024), ultimately influencing brand value.

In the *corporate path*, media coverage enhances brand value through better analysts' ratings, which subsequently boost investor sentiment (Ma *et al.*, 2023). Positive analyst ratings enhance investors' confidence in the firm's long-term prospects, particularly in how well the firm integrates ESG practices. This favorable investor sentiment serves as a risk-mitigation mechanism, reducing the firm's exposure to stock volatility and protecting the brand from negative market reactions (Zou *et al.*, 2024).

In summary, the *consumer path* connects sustainability efforts to profitability by shaping consumer perceptions, while the *corporate path* links sustainability with risk mitigation, as integrating ESG practices can enhance analyst ratings and investor sentiment. These two pathways reflect the fundamental drivers of brand valuation—profitability and risk—highlighting how sustainability can either enhance brand value through greater profitability or protect it by reducing financial risk.

For marketing managers, these findings provide two distinct yet complementary ways to justify sustainability initiatives: (1) through improved consumer perceptions and increased profitability in product markets, or (2) through enhanced investor perceptions and risk mitigation in financial markets. Even if consumers do not immediately embrace a sustainable innovation—potentially impacting short-term profitability negatively—these efforts can still positively influence investors and analysts by reducing perceived risks.

4.4 Moderators: what factors either mitigate or strengthen the relationship between sustainability efforts and brand value?

The literature identifies five key moderators that shape the impact of sustainability investments on brand value. These factors either strengthen or weaken the relationship,

providing marketers with insights into when and why sustainability efforts succeed or fall short:

- (1) *Firm size* plays a critical role in moderating the relationship between sustainability efforts and brand value. For larger firms, the mediating effect of media coverage is stronger, as they naturally attract more public attention (Zou *et al.*, 2024). Consumers also tend to assume that larger firms possess the resources to invest in sustainability without compromising product quality (Kim *et al.*, 2021), which weakens the “sustainability liability” effect.
- (2) *Ownership type*: Family-owned businesses tend to benefit more from sustainability efforts than non-family businesses, likely due to their stronger ties to stakeholders and local communities (Chiang *et al.*, 2022).
- (3) *Brand architecture* moderates the association between sustainability investment and brand value, such that it is stronger for branded house architectures (where the corporate and product brands share the same name, e.g. Deloitte), and weaker for house of brands architectures (where the corporate and product brands have different names, e.g. P&G and Unilever) (Pope and Kim, 2021). This is explained by the spillover effect of the corporate sustainability perceptions (built through corporate investment) on product brand perceptions.
- (4) *Country of origin’s sustainability reputation (COSR)* shapes the effectiveness of sustainability efforts, with brands from countries with weaker sustainability reputations, experiencing stronger brand value benefits (Cowan and Guzman, 2020). As sustainability practices become more widely adopted within a country, their effectiveness in differentiating the brand diminishes, thus reducing their impact on brand value. This finding aligns with the crowding-out thesis proposed by Pope and Kim (2021).
- (5) *Marketing capabilities*, including the level of digitalization, strengthen sustainability signals to consumers, enhancing brand perceptions and positively influencing brand value (Lin *et al.*, 2021; Wang *et al.*, 2024). This highlights the importance of aligning sustainability initiatives with strong marketing efforts to ensure their full potential is realized.

5. Conclusions

This research synthesizes different approaches to measuring the impact of sustainability on brand value. By conducting a comprehensive literature review and bibliometric analysis, we shed light on the current landscape of the discipline and propose an integrative framework to explore the mechanisms by which sustainability impact brand value. Additionally, we address existing controversies in the brand value-sustainability literature and delve into the causes of contradicting findings by analyzing the approaches and measures adopted by different scholars.

We identified two main approaches to assessing the impact of sustainability on brand value: the customer perceptions of sustainability and the company’s sustainability performance. We also discuss the limitations and implications of these approaches and suggest new avenues for further research.

Our study provides several theoretical contributions to the brand value-sustainability literature.

First, sustainability efforts impact brand value via two key pathways, consumer and corporate. To fully capture the effects of sustainability on brand value, both must be considered in tandem.

Second, we find mixed results regarding the effect of sustainability on brand value. Studies focused on corporate sustainability, often measured through ESG activities, generally find a positive association with brand value. However, these studies are limited to the corporate path where ESG compliance mitigates risks. To assess the impact of sustainability on consumers, alternative approaches are necessary as ESG reports are disclosed at the corporate level. To address this gap, we recommend the inclusion of sustainability perception metrics in brand valuation models to clarify whether sustainability acts as an asset or liability, depending on product category (Luchs *et al.*, 2010) and country context (Cowan and Guzman, 2020). These first two contributions answer our RQ1 providing important insights to understand the context and results of current studies.

Third, and answering our RQ2, we identify key mechanisms through which sustainability investments affect brand value. In the consumer pathway, consumer perceptions—which have been underexplored in the literature—are crucial to brand value creation, directly influencing profitability. In the corporate pathway, factors such as analyst ratings and investor sentiment help mitigate risks, thus protecting brand value.

This study offers relevant managerial implications. It suggests that managers should integrate sustainability perceptions into brand valuation models to justify the financial impact of sustainability investments. Understanding how sustainability influences consumer perceptions and brand value across different categories and markets can guide managers in effectively communicating sustainability initiatives to create value. For instance, in the laundry detergent category, where performance is paramount, sustainability perceptions should be assessed alongside perceived quality to identify potential trade-offs and estimate their overall impact on brand value (Luchs *et al.*, 2010). Following the sustainability liability and COSR theories, sustainability communications should be emphasized in hedonic categories and in countries with lower sustainability reputations to maximize impact on brand value. However, as categories and countries develop—and the effects of sustainability may vary over time (Pope and Kim, 2021; Qi *et al.*, 2021)—managers must dynamically monitor sustainability perceptions to assess their role in value creation.

Finally, managers should balance both consumer and corporate pathways when assessing sustainability's role in brand value creation. Even if in a utilitarian category, the consumer path shows that sustainability efforts will not have a positive impact on brand value in the short-term, still such initiatives may play a role in the corporate path mitigating corporate risks and protecting brand value in the long-term.

6. Further research

Through this critical literature review and bibliometric analysis, and addressing our RQ3, we have identified important themes that require further research.

Considering the divergent findings on how sustainability affects brand value, there is a need for a deeper understanding of the role sustainability plays in creating brand value. The mixed results in the literature may be partially attributed to the use of different sustainability metrics by the scholars exploring the sustainability-brand value link. While some authors resort to sustainability rankings that gauge investment performance, others employ metrics of perceived sustainability to assess the effect of sustainability on brand value. Thus, selecting an appropriate measurement method—whether based on perceptions, investments, or a combination of both—to reflect the impact of sustainability should be further validated through empirical studies.

Additionally, our findings suggest that specific brand valuation methodologies, such as the one used by the World Brand Lab focused on the Chinese market, may affect the findings regarding the nature of the relationship between sustainability and brand value. A deeper examination of these methodologies is necessary to understand their potential influence on research outcomes.

Notably, many recent studies (2023–2024) have focused predominantly on the Chinese market, a context characterized by unique regulatory frameworks, consumer expectations, and

sustainability practices. This geographic concentration raises important questions about the generalizability of findings to other cultural and economic environments and may partially explain the divergent results in the literature. These dynamics highlight the need for a broader, more inclusive understanding of how sustainability influences brand value globally.

We also recommend exploring moderating factors that may influence the effect of sustainability on brand value, including the impact of category, which has been identified as a crucial factor affecting consumers' overall perceptions (Luchs *et al.*, 2010). Given that studies supporting the positive effect of sustainability on brand value are often based on large firms and investment performance metrics, further research should specifically examine how firm size moderates the relationship between sustainability perceptions and brand value.

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Corresponding author

Gabriela Salinas can be contacted at: msalin04@ucm.es

