

# Online corporate reputation: A panel data approach and a reputation index proposal applied to the banking sector

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## ABSTRACT

Managing an online corporate reputation (OCR) is increasingly strategic to improving the corporation's economic performance. What becomes crucial is to collect, process and analyse the comments expressed in the online medium, considering them as an intangible asset with an impact on tangible assets and consequences on business value. This research contributes to show the potential of the big-data environment, enhanced by the use of business intelligence tools and combined with panel econometric models. This is complemented by the elaboration of an Online Corporate Reputation Index (OCRI) to measure the economic corporate performance. The findings show that after applying the conceptual model to the banking sector, the experience associated with ethics is the intangible asset that has the most impact on the economic performance associated with each bank. In addition, the definition of an index helps to position one company in relation to another and to an entire economic sector.

## 1. Introduction

The emergence of the Internet and all the applications that have appeared in its medium have caused transformations in the way society works, both with regard to human behaviour and the management of organisations (Chau, Cole, Massey, Montoya-Weiss, & O'Keefe, 2002). The Internet has changed the way social communications occur, the commercialisation of products, the way persons occupy their free time and the way consumers search for information (Chau et al., 2002).

This Internet environment has caused global changes in different dimensions for consumers and organisations, such as in economics, culture and politics (Graham & Dutton, 2019). There has been a convergence in terms of communication, technology and content for the creation of an information highway between people and organisations which has forced the web to proportionate an environment for economic development and social relations. This has required organisations to adapt in terms of models, business and governance (Liao, 2018).

The convergence above has contributed to the definition of a new, digital economy which can be defined by 'the proliferation of the use of the Internet, a new level and form of connectivity among multiple heterogeneous ideas and actors, giving rise to a vast new range of com-

binations' (Carlsson, 2004, p. 245). However, the overwhelming effect of the internet in changing organisational and communication structures has also caused changes in culture and collaboration between businesses through the use of social media (Tapscott & Barry, 2009), providing an environment to the consumer which makes them the agent of the organisation through the sharing in social media of their experiences and knowledge of the corporation or brand (Hollebeek, Glynn, & Brodie, 2014).

This consumer involvement contributes to their level of interest in the brand or in the corporation, which helps to explain or predict interactive brand-related dynamics, including specific social media behaviour such as sales growth; cost reduction; brand referrals; enhanced consumer contributions to collaborative product development; enhanced co-creative experiences and increased profitability; and the consumer's engagement level. These types of social media behaviour can contribute to the definition of a new metric to measure brand or corporate performance (Hollebeek et al., 2014) as well as to the organisation's customer experience management, as presented by Holmlund et al. (2020).

Performance is defined by reputation (Hearn, 2010), which is a concept that must be measured and represented and is facilitated by the rise of social media in the nature of capitalism because consumers display the personal emotion and affect that is clearly linked to monetary value.

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Consumer participation in online rating and review contributes to the expression of public sentiment and to the definition of brand measurement which collectively press towards generating ethically and socially responsible behaviour on the part of businesses organisations. At the same time, customer participation helps to identify the relation between public emotions and the monetary value of the brand which contributes to the reputation economy, raising the issue of: Who defines what constitutes a 'good' or 'valuable' reputation and how does online feeling measurement contribute to a company's reputation and stock market value (Hearn, 2010)?

To help define the reputation of a company in this environment provided by social networks, it is necessary to be analysed what the experiences, emotions and behaviours of consumers, to what they relate and how they contribute to increase the economic performance of a company. Basically, when a complete relationship exists between an organization's intangible and tangible assets, how they influence each other and cause the definition of a value that positions them in an online reputation index for the entire economic sector, it is possible to find but to not include the opinions expressed in the digital environment, as in the work of Cravens, Oliver, and Ramamoorti (2003) which only considers internal intangible assets. There are also no studies that show how social evaluations of the corporate are simultaneously influenced by a tendency to humanise and to the features of behaviour (Nardella, Branicki, & Brammer, 2019) or how reputation can be defined by the image or experience that consumers have of a corporation's reputation (Podnar & Golob, 2017). If other studies exist, they consider assets expressed online (Fernández-Gámez, Gil-Corral, & Galán-Valdivieso, 2016) rather than a company as a holistic system and how its online reputation is affected by emotions and consumer behaviours; that is, how the online reputation expressed by emotions, experiences and attitudes can help to improve the performance of an organisation and consequently increase its economic value and provide help to overcome crises.

Since the previous challenges have been identified as gaps in the analysis of an organisation's reputation, the aim of this study is to examine the following questions:

1. How do online emotions, expressed in social media, contribute to corporate reputation in the banking sector?
2. How do online emotions influence tangible assets?
3. How do online emotions define an online reputation index for an economic sector?

This article is divided into three sections, not including the introduction and conclusions. The section that follows (identified as section 2) presents the concepts and the state of the art associated with the reputation economy in the digital environment, conceives a conceptual Online Corporate Reputation (OCR) model and proposes an OCR indicator. Section 3 presents the methodology, which considers the approach based on panel data models and the formulation for the creation of a reputation index of an economic sector. Section 4 estimates the OCR model, analyses the results and calculates the Online Corporate Reputation Index (OCRI) to assess the performance of the banking sector.

## 2. Literature review and conceptual development

### 2.1. Corporate reputation in the digital environment

Analysing a brand's reputation performance via the Internet is becoming increasingly important, since it is an important objective of the intangible economy to be visible, tangible and, under certain conditions, even measurable through online reputation scores (Elmurngi & Gherbi, 2020).

The valorisation of the reputation can be seen as a way to increase economic return (Fombrun, 2005; Wang, Yu, & Chiang, 2016), which was once considered as a form of social capital that an organisation could develop to create relationships and enable growth (Doorley & Garcia, 2015). Corporate reputation can be considered as the great connection to organisation identity, which results from a combination of performance, behaviour and communication (Gandini, 2016).

With the emergence of the online environment provided by Web 2.0, the reputation expressed in the digital medium has become more critical for organisations (Hearn, 2010). As Gandini (2016) suggests, such reputation 'is crafted over the judgments made upon the mosaic of information publicly available' (p. 30). However, reputation and trust can be confused, since both are subjective and social concepts. Marwick (2013) considers reputation as a performance metric associated with an economic resource; trust can be seen as a public good that, in the context of the digital medium, gives the sense of trustworthiness (Gandini, 2016; Gandini, Pais, & Beraldo, 2016).

The conjugation of trustworthiness and reputation was the main motive to develop or launch the Online Reputation System (ORS), which includes an algorithm that produces a score to represent these two concepts (Marwick, 2013). These concepts are considered to be part of the knowledge economy that contributes to the social capital of an organisation (Gandini, 2016). The ORS integrates an algorithm that aggregates feedback and reviews that are expressed on a platform which, in turn, are used to produce a score or rank defined by numbers or symbols such as stars or points. Some of these systems include gamification to achieve rewards for the users that post the reviews or express their opinions in the digital medium.

The reputations expressed in the digital medium can also be considered as electronic word-of-mouth (e-WoW; Dellarocas, 2003). This reputation system contributes to define the socio-technical capital of an organisation (Resnick, Kuwabara, Zeckhauser, & Friedman, 2000), which can be seen as a reputation-based economy related to information systems science; that is, emerging innovations relate to socio-economic aspects of the society that can be interpreted in the digital medium or a digital reputation economy (Gandini, 2016; Nica, Potcovaru, & Mirică, 2017).

Associated with the digital reputation economy, social capital has emerged, which can be defined as an explanatory variable that measures 'the possibility to access, and make use of, resources embedded within a social network' (Gandini, 2016, p. 35). Lin (2017) defines social capital as a relational asset that is both an individual and group feature. Furthermore, social capital can be mobilised as an investment into social relations with an expected economic return (e.g., stock market value) that individuals expect by gaining access to socialised resources, as a way to create trust in social media (Archer-Brown & Kietzmann, 2018; Meek, Ryan, Lambert, & Ogilvie, 2019), such as the ethics associated with the experiences associated with an enterprise.

The relationship between social capital and trust contributes to reputation, with reputation as both an intangible asset that measures the contributions to it in a visible way and as a tangible asset associated with economic transactions (Esteban-Sanchez, Cuesta-Gonzalez, & Paredes-Gazquez, 2017) that increases the importance of social media in society and in the knowledge economy (Archer-Brown & Kietzmann, 2018; Goleman, 2007; He, Wang, & Akula, 2017).

An intangible asset is difficult to measure, however, with Web 2.0. Several social networking sites where consumers express their opinions and become digital influencers (Gandini, 2016) contribute to the creation of rankings and provide evaluations with likes, tweets and shares. As a consequence, it is possible to measure the reputation of an organisation or an economic sector.

Intangible assets can have several types of relationships, such as those between experiences and emotions (Pandey, Kumar, & Soodan,

2012; Park & Lee, 2007); emotions and attitudes (Holmes, 2000; Labroo & Rucker, 2010; Thomson, MacInnis, & Park, 2005); and experiences, emotions and attitudes (Agrawal, Han, & Duhachek, 2013; Ajzen, 1991; MacMillan, Money, Downing, & Hillenbrand, 2005).

The relationship between experiences, emotions and attitudes is the most complete and thus useful to define intangible assets. According to Fombrun, Gardberg and Server (2000), reputation consists of two components: (1) emotional (affective) and (2) rational (cognitive). The experiences with a brand, product or enterprise can explain both components and can cause an emotion and, in turn, the emotion can cause an attitude. The intangible, relational capital of an organisation can be considered as the set of relationships which the organisation maintains with its exterior or internal agents (Inkinen, 2015). As presented in Fig. 1, within relational capital there are: (1) lived experiences of the public with brands or products; (2) emotions that the surrounding and differing stakeholders perceive about brands or products; and (3) a good attitude and conduct towards the brand or product loyalty.

An experience associated with an organisation can be investigated, considering the 'consumer experience' (Bolton, Gustafsson, McColl-Kennedy, Sirianni, & Tse, 2014; Lemon & Verhoef, 2016; Rose, Clark, Samouel, & Hair, 2012; Schmitt & Zarantonello, 2013). Some examples of experiences include benefits received from the brands (McDonald, de Chernatony, & Harris, 2001); communication received by stakeholders regarding the brand (Duncan & Moriarty, 1997); trust behaviours related to the brand in the past; and commitment to the stakeholders (Conway & Briner, 2002). In terms of the different dimensions associated with the brand's or organization's experiences, there are a vast number of authors that have investigated the main variables which explain customer evaluations (Casado & Peláez, 2014; Ponzi, Fombrun, & Gardberg, 2011; Ramos Casado-Molina, & Ignacio-Peláez, 2019). Currently, the studied variables are very similar; the variables with more multi-stakeholder application are those defined by Fombrun and Gardberg (2000) and Ponzi et al. (2011), such as product, ethics, direction, labour environment, social responsibility and profitability of the brand or organisation.

Consumer experience can contribute to the development of a relationship between the consumers and the corporation, expressed in the digital environment where they can communicate and engage interactively, allowing the organisation to achieve its main objective: to maximise performance (Ferreira & Zambaldi, 2019). The digital environment also provides a greater dynamic to the corporate reputation, characterised by slow increases and sudden drops (Cabral, 2016). Corporate reputation, however, is not a trivial problem, as reputational dimensions are subjective. The concept itself involves many dimensions, and only a few studies (Casado-Molina, Ramos, Rojas-de-Gracia, & Peláez Sánchez, 2020) have established a model that demonstrates transversal and holistic relationships between relational intangible and tangible assets of an organisation that function in digital environments.

In the work of Casado-Molina et al. (2020), corporate reputation is defined by the relationship between emotions, experiences and attitudes that have an effect on the tangible asset and, consequently, are correlated with the business value of the corporation. The authors consider that an emotion is a complex concept. As defined by Scherer (2005), an emotion is expressed through feelings and arises as a reaction to any situation or thing. Feelings summarise an experience, and they can convey the meaning of that experience as a direct reaction to an individual's perception (Jalonen, 2014). The emotion can be characterised by extension, duration and feature: the pleasantness dimension (positive or negative polarity or valence); agitation dimension (intensity); and tension of that excitement (control when facing the event) (Gabay, 2015).

Casado-Molina et al. (2020) also considered the work of Scherer (2005), which contemplates that an attitude can be considered as a set of beliefs or predispositions towards specific people or objects and that are associated with an intention and behaviour (Ajzen & Fishbein, 2005; Ponzi et al., 2011). Many intangible reputation models acknowledge the effects that this has on behavioural intentions but not the effects it has on generated behaviours (Bartikowski & Walsh, 2011, Mazurek, 2019). A positive behavioural intention seldom generates the same conduct.

In the digital environment, consumers have the opportunity to elaborate reviews about everything in a textual or rating form, enabling them to become digital influencers (Uzunoğlu & Kip, 2014) and define an OCR (Bratu, 2019). In this context, the organisation should manage the assets in an adequate way, considering the intangible and tangible values and the relationships between them to develop a competitive online reputation.

Considering the above, the first hypothesis, dealing with the differential characteristics of the model, is proposed:

Hypothesis 1

:  
The intangible relationships are transversal and holistic to the entire company.

2.2. OCR model

In socio-economic terms, the Internet technology has caused a transformation in the way the organisation and society works, mainly the social-media platforms that empower consumers to express their opinions about an organisation or economic sector (Archer-Brown & Kietzmann, 2018).

The reputation created in the digital environment can be very sensitive to consumer experiences and emotions, which produce an attitude and, consequently, increase or decrease the economic value associated with the brand or sector (Casado-Molina et al., 2020).

Considering the concepts presented in Fig. 1, Fig. 2 presents a conceptual OCR model and expresses determinants (particularly those associated with intangible assets) for different experience dimensions,

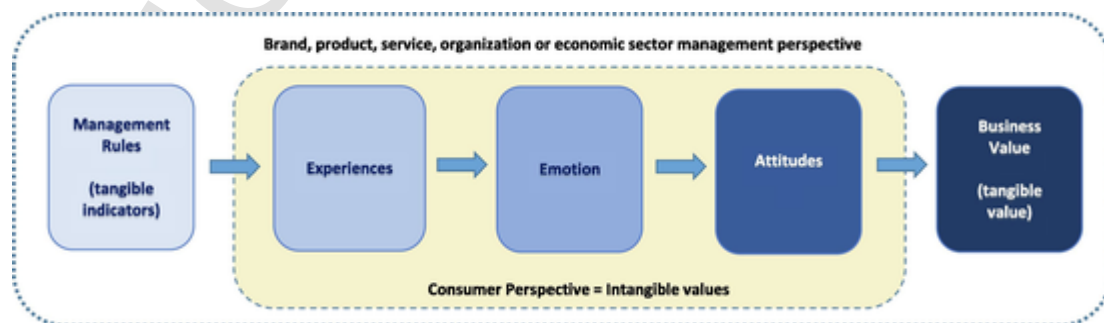


Fig. 1. The relationship between assets: tangible and intangible.

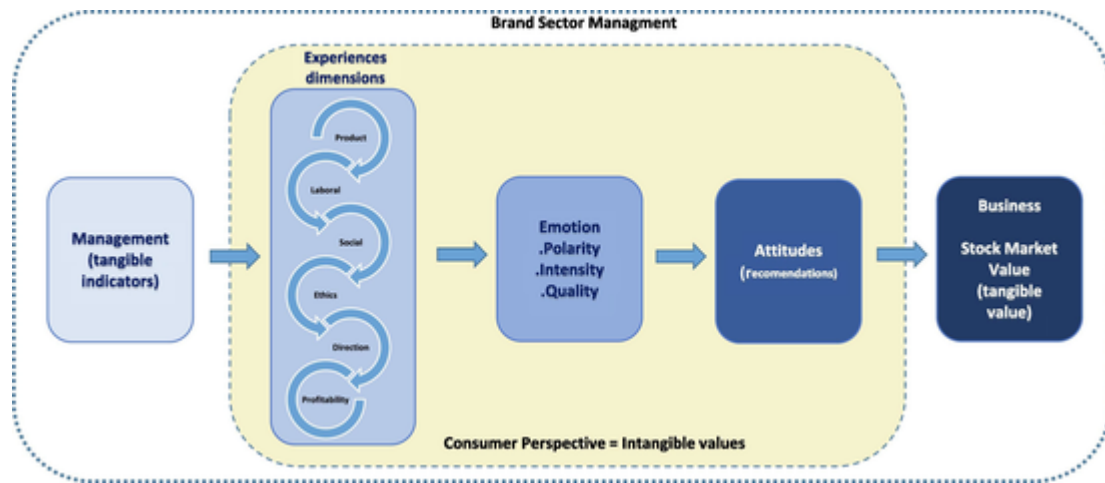


Fig. 2. The conceptual model associated with OCR.

emotions and attitudes. The definition of the business as a way to measure OCR can be expressed by the stock market value, which highlights the relationship between the intangibles and results in a tangible value.

The conceptual model for managing intangible assets in an organisation can be considered in a holistic way, with business value measured by the tangible indicators. However, this management of intangible assets results in consumer experiences which can be classified in six different dimensions: product experience, labour experience, social experience, ethics experience, direction experience and profitability experience (Casado-Molina et al., 2020; Ramos, Casado-Molina, & Ignacio-Peláez, 2019). Nevertheless, an experience with an organisation or economic sector causes an emotion in the consumers and, consequently, produces an attitude towards the product or the company which results in an economic value.

The model proposed in Fig. 2 considers the relationship that exists between an organisation's tangible and intangible assets for which management defines indicators to monitor the organization's performance and to manage the brand sector with a view to creating tangible values, measuring the stock market value and assessing the demand for the company's product. However, for the brand sector to be carried out properly, it is necessary to manage the different perspectives that the consumer has towards a product by listening to their perceptions expressed in the online environment, which can be just perceptions or can be experiences associated with the product as well as emotions caused by the references experiences that lead to a certain attitude of buying, selling or neutrality about the product's acquisition.

Considering the above, the second hypothesis, dealing with the differential characteristics of the model, is proposed:

#### Hypothesis 2

*Experiences, emotions and attitudes have an influence towards the tangible asset.*

### 2.3. OCR performance indicator

Currently, the management of organisations goes through a process of maturity that implies the need to capitalise and develop their intellectual capital and to generate knowledge about their business through the application of concepts associated with management and knowledge engineering (Vasconcelos & Barão, 2017).

Knowledge management not only improves the decision-making process and the organisation's ability to solve problems but also contributes to innovate and increase the organisation's intellectual capital, which includes intangible assets that are fundamental for obtaining a

competitive advantage (Santos & Ramos, 2009). Intellectual capital is considered as an instrument through the definition of metrics associated with the organisation's strategy, and it contributes to assessing economic performance and increasing the company's value (Petty & Guthrie, 2000).

The definition of an OCR indicator which is associated with an organisation's intellectual capital is: an innovative factor in managing an organisation that will demonstrate its potential competitive capacity to improve its economic performance when compared with others in the same or similar economic sectors. To deepen the reputational benchmarking of an economic sector, a KPI (Key Performance Indicator) associated with the intangible assets (Csikósóvá, Čulková, & Janošková, 2016)—which compares the behaviour of the assets to their economic sector as expressed in the digital environment—can contribute to adding value to the brand, attracting more customers, increasing sales, detecting ways to innovate and defining new business strategies.

Considering the above, the third hypothesis, dealing with the differential characteristics of the model, is proposed:

#### Hypothesis 3

*An economic sector has an OCR based on an organisation's intangible assets.*

## 3. Methods

### 3.1. Panel data models

Panel data methods have been recognised as a useful approach in several economic sectors. These methods consider the cross-sectional and time-series properties of the data and make it possible to analyse changes in the variables over time and between different units, which may be a set of countries or companies (Baltagi, 2001).

The junction between temporal and sectional data allows a better estimation of econometric models. These models have the following advantages (Baltagi, 2001): they enable control of the individual heterogeneity of each section; they present more information, more variability and less collinearity between variables, more degrees of freedom and more efficiency; they allow the study of the dynamics of adjustment to changes that unexpectedly arise; they are better at identifying and measuring effects which are purely sectional or temporal and that are simply not detected in the data; they permit the construction and testing of more complicated models that assess only sectional or temporal data; and they are usually more useful for data with a relatively small number of time units.

In addition, econometric models allow the simultaneous analysis of changes in variables over time and between different sectional units; make it possible to use a large number of observations to ensure the asymptotic properties of the estimators; reduce the risk of multicollinearity due to the presence of different structures for the sectional units; and present more information due to the combination of temporal data with sectional data. However, the models also have limitations (Baltagi, 2001), for instance, they can distort the errors evaluation during collection and data for all variables and dimensions (Ramos & Rodrigues, 2013).

3.1.1. Estimation methodology using panel data

The methodology considered for modelling and estimating online reputations using panel data methods is based on: (i) the formulation of hypotheses based on the relationship between the intangible and tangible assets; (ii) the specification of the OCR model; (iii) the collection and organisation of data; (iv) the modelling and estimation of stock market value; (v) the analysis of the results; and (vi) the testing of hypotheses.

3.1.2. Formulating the hypotheses

The conceptual model considers that an economic sector or brand will perform adequate management when there is consistence between the nature of the sector (identity), what it does (performance) and what it says (Riel & Fombrun, 2007).

As presented in Fig. 2, the experience intangible asset is defined by six different dimensions: (1) product, (2) laboral, (3) social, (4) ethics, (5) direction and (6) profitability, all of which are relevant to expressing the experience associated with an organisation. In the present study, the authors intend to investigate if the experience, emotions and attitudes associated with an organisation contribute to an increase in its business value. Considering the concepts and theories presented above, the authors have proposed the following hypotheses:

Hypothesis 1

The intangible relationships are transversal and holistic to the entire company.

Hypothesis 2

Experiences, emotions and attitudes have an influence on tangible assets.

Hypothesis 3

An economic sector has an OCR, based on an organisation's intangible assets.

3.1.3. Specification of the OCR model

The online reputation model will be applied to the seven most relevant corporations in the Spanish banking sector listed on the IBEX35 stock market. The model is applied to intangible assets (i.e., experiences, emotions and attitudes that stakeholders express about the most relevant companies in the banking sector) and tangible business assets (i.e., stock market value).

The data sources, from which opinions are extracted, derive from the digital ecosystems of the Spanish market, such as: economic and financial sources (e.g., the stock market Value Platform), hyper-textual sources (mass media, online media, forums, websites, social platforms), multimedia sources (YouTube) and social networks (Twitter, Facebook).

For the sample period, daily data for 2015 was considered for the seven banking corporations.

The dependent variable is the stock market value (i.e., the tangible asset), which is collected daily for all seven corporations in the banking sector.

The independent variables are the intangible assets, such as the experiences, emotions and attitudes. The scales associated with the independent variables are constituted by a valuation rank that can be defined with a granularity of five values (Miller, 1956; Ramos et al., 2019), as presented in Table 1.

3.1.4. Data collection

The data was collected by applying the processes associated with big data (Erevelles, Fukawa, & Swayne, 2016). These processes include steps to collect and store records from different sources using a web crawler (Corley, Cook, Mikler, & Singh, 2010) and to transform and prepare to upload the data to a Data Warehouse. The transformation of the data is part of a step called ETL (Extraction, Transform and Loading), in which the data is prepared and uploaded to a Data Warehouse. The data is transformed through semantic analysis that uses probabilistic techniques, such as Naïve Bayes or pattern-based techniques. A Data Warehouse is structured to support the decision-making process (Inmon, 2005) and to contribute to the process of extracting insights from the big data (Erevelles et al., 2016). Finally, the data is prepared for the data panel models (Baltagi, 2001) and the application of the OCR model (Chaudhuri & Dayal, 1997).

3.1.5. Variables construction

While collecting and preparing the data, the authors considered a variable for each dimension associated with consumer experiences: experiences associated with the banking product (EP), labour environment (EL), direction of management (ED), social responsibility (ES), ethics (EE) and profitability (ER) of the banking corporations. Data for all of these variables was collected daily during the year 2015. Fig. 3 presents the six experience variables, as it is possible to compare them with the emotion (EM), attitude (AT) and stock market value (SM) variables, thus showing a correlation between some of the variables.

As shown in Table 2, the authors included a Pearson correlation analysis to identify the relation between the variables. Based on the results (see Table 2), it is possible to confirm the correlation between the variables, which is formatted in bold. The experience associated with the product (EP) correlates with labour environment (EL), social responsibility (ES), direction of management (ED), profitability (ER) and emotion (EM). The experience associated with the labour environment (EL) correlates with social responsibility (ES), direction of management (ED), profitability (ER) and emotion (EM). The experience associated with social responsibility (ES) correlates with direction of management (ED), profitability (ER) and emotion (EM). The experience associated with the direction of management (ED) correlates with profitability

Table 1  
Intangibles values granularity scale.

Scale Values	Experiences	Emotions	Attitudes
1	< 2 => Hate	< 2 => Hate	< = 1,25 => Sell
2	> = 2 and < 4 => Rejection	> = 2 and < 4 => Rejection	> 1,25 and < = 3,75 => Hold / Sell
3	> = 4 and < 6 => Neutral	> = 4 and < 6 => Neutral	> 3,75 and < = 6,25 => Neutral
4	> = 6 and < 8 => Acceptation	> = 6 and < 8 => Acceptation	> 6,25 and < = 8,75 => Hold / Buy
5	> = 8 => Admiration	> = 8 => Admiration	> = 8,75 => Buy

Source: Adapted from Miller (1957) and Ramos et al. (2019).

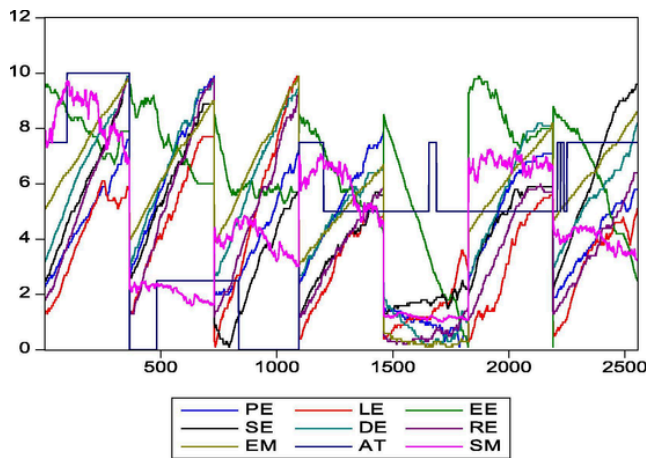


Fig. 3. Experiences variable daily for the year 2015 and for seven banking companies. Source: authors elaborations in Eviews 6.0.

(ER) and emotion (EM). Finally, the experience associated with profitability (ER) correlates with emotion (EM).

Only the experience associated with ethics (EE) is considered in the model to represent the dimensions associated with this experience provided that it is not correlated with other variables. Therefore, the following variables are not included in the model: experiences associated with the product (EP), the labour environment (EL), social responsibility (ES), the direction of management (ED) and profitability (ER).

### 3.1.6. OCR function

The relation between the dimensions can be defined by a function that investigates the OCR of an economic sector and helps to identify the most valuable intangible asset to the organisation in terms of its contribution to the tangible assets and economic performance of the organisation. The OCR function of an economic sector defines the relationship between the intangible and tangible variables that define the online reputation amongst the digital influencers.

In this study, the OCR function considered for a corporation (*i*), expressed in *j* period, is given by:

$$S_{ij} = f (Ex_{ij}, Em_{ij}, At_{ij}, \epsilon_{ij}) \tag{1}$$

The OCR function presented in Equation (1) is a theoretical model that only indicates the potential relationship between variables. In practise, the equation will assume an exponential relationship (also known as Cobb-Douglas function) between the variables (see Equation (2)), which assumes the linear form after logarithmic transformation. Another advantage of this formula is the fact that its coefficients can be

interpreted as elastic.

$$\ln S_{ij} = \alpha_i + \beta_1 \ln Ex_{ij} + \beta_2 \ln Em_{ij} + \beta_3 \ln At_{ij} + \mu_{ij} \tag{2}$$

When applying Equations (1) and (2) to the banking sector, the experience is represented by the ethics dimension, where  $\ln Ex_{ij}$  is the logarithm of the number of experiences associated with the ethics value of the corporation (*i*) in period of time (*j*). The banking OCR function is expressed in Equation (3):

$$\ln S_{ij} = \alpha_i + \beta_1 \ln Ex_{ij} + \beta_2 \ln Em_{ij} + \beta_3 \ln At_{ij} + \mu_{ij} \tag{3}$$

### 3.2. Online corporate reputation index (OCRI)

To deepen the reputational benchmarking of an economic sector, the KPI associated with the intangible assets—which compares the behaviour of the corporations’ intangibles in relation to their sector—can be defined by:

$$KPI_j = \frac{\sum_{i=1}^n (\alpha_{ij} * x_{ij})}{\sum_{i=1}^n \alpha_{ij}} \tag{4}$$

where KPI is a Key Performance Indicator, *j* is the dimension of the intangible asset (*j* = 1,...,8), *i* is the scale level (*i* = 1,...,n),  $\alpha_{ij}$  is the Intangibles Values Granularity scale level and  $x_{ij}$  is the reputation value for the *i* level.

When applying Equation (4) to the banking sector, and considering the variable construction presented above, the KPI of the intangible assets of the banking sector are presented in Fig. 4.

In Fig. 4, the variable that measures consumer ethics experience assumes higher values as compared to emotion and attitude for the vast majority of banks, which permits the conclusion that it is the most valuable resource of a corporation in defining their online reputation.

An OCRI was defined by Equation (5):

$$OCRI_j = \frac{\sum_{i=1}^n (KPI_i)}{n} \tag{5}$$

where *i* is the dimension of the intangible asset considered significant to measure the performance of the corporation, KPI is the Key Performance Indicator, *i* represents the intangible resources and *n* is the number of significant variables, considering the variable construction presented above.

For each bank, the significant variables are ethics experience, emotion and attitude. A KPI was created for each variable to help define an OCRI for all the banks and another KPI was created to represent the bank economic sector, normalised on a scale from 1 (minimum) to 10 (maximum).

Table 2

Pearson correlation between the variables associated to the intangible and tangible assets.

	EP	EL	EE	ES	ED	ER	EM	AT	SM
EP	1.0000								
EL	0.7984	1.0000							
EE	0.1696	-0.1857	1.0000						
ES	0.7996	0.6924	0.0246	1.0000					
ED	0.9101	0.8671	0.1962	0.8099	1.0000				
ER	0.8959	0.9223	0.0329	0.8166	0.9639	1.0000			
EM	0.8182	0.7698	0.2902	0.7764	0.9627	0.8973	1.0000		
AT	-0.0886	-0.2368	0.0876	0.2775	-0.0569	-0.0598	0.0048	1.0000	
SM	0.2332	0.0253	0.5425	0.1927	0.3437	0.2320	0.4425	0.5322	1.0000

Legend: EP- Experience associated to the product, EL – Experience associated to the laboral environment, EE – Experience associated to the ethics, ES – Experience associated to the social responsibility, ED – Experience associated to the direction, ER - Experience associated to the Profitability, EM – Emotion, AT – attitude and SM – Stock market value.

Source: Authors elaboration.

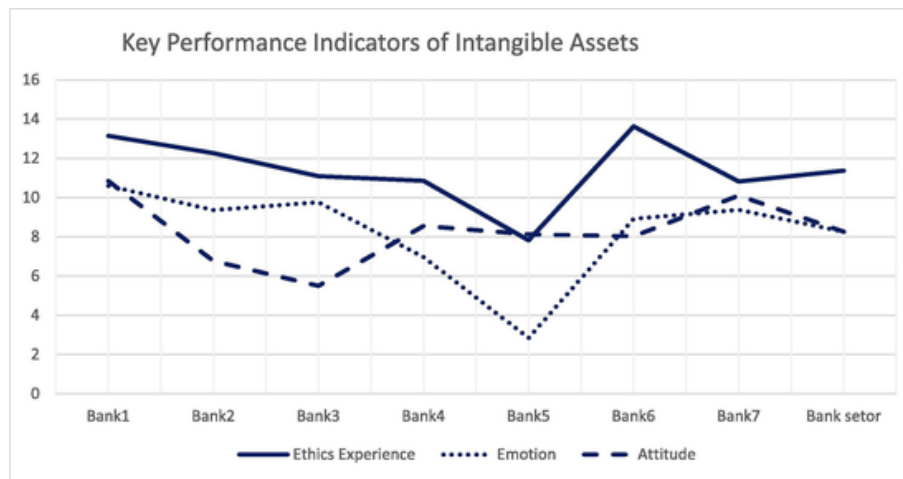


Fig. 4. Key Performance Indicators of Intangible Assets.

## 4. Results

### 4.1. Panel data estimation

The OCR is increasingly relevant to the organisations to survive and compete globally in an environment in which a negative reputation can become viral and contribute to the economic decline of the organisation. In general, and in this case of banks, econometric methods of panel data modelling are adequate to analyse the OCR.

In panel data modelling, it is important to detect whether the model contains fixed or random effects. To detect the effects, it is necessary to apply the Breush-Godfrey statistic test, proposed by Hausman (1978) and presented in Equation (6). To perform this test, it is necessary to do a panel data estimation with fixed effects and another with random effects. Tests to the model specification are used to analyse what effects are present in the panel data or if it is more appropriate to consider a pooled data model. In this sense, the first test to consider is the *F*-test (see Equation (4)), which allows us to analyse whether a pooled model or fixed-effects model is more appropriate.

$$F_{(N-1, NT-N-K)} = \frac{(RSS_{R2} - RSS_{R1}) / (N - 1)}{(1 - RSS_{R2}) / (NT - N - K)} \quad (6)$$

The panel data with fixed effects was estimated and we obtained  $F(6,2545) = 9130.6351$  with a *p*-value = 0.0. Once the *F* value became bigger than the *F* critic, the null hypothesis of homogeneity in the intersection and slope coefficients was rejected; therefore, the data model pooled cannot be considered to analyse the data of this present study.

Next, a random effects estimation is required to perform the Hausman test, as expressed in Equation (7):

$$H = (\hat{b}_{je} - \hat{b}_{re})' (\hat{\Sigma}_{je} - \hat{\Sigma}_{re}) (\hat{b}_{je} - \hat{b}_{re}) \quad (7)$$

After the panel data estimation with random effects, we obtained the value of  $\chi^2 = 10.7869$  with a *p*-value = 0.0129. For this probability, considering a 5% significance level, the null hypothesis was rejected; therefore, the fixed-effects model was the most appropriate model to use.

After the first estimation of the panel data model with fixed effects, the results obtained are presented in Table 3.

Table 3  
Results of the Panel Data Model Estimation with Fixed Effects.

1 <sup>st</sup> Estimation		
<i>R</i> <sup>2</sup> = 0.9817		
Adjusted <i>R</i> <sup>2</sup> = 0.9816		
Variable	Coefficient	Probability
<i>C</i>	1.3676	< 0.0001
<i>lnEE</i>	0.0922	< 0.0001
<i>lnEM</i>	-0.1349	< 0.0001
<i>lnAT</i>	-0.0041	< 0.0001

Considering the results presented in Tables 3 and 4, the estimated online reputation model is expressed by Equation (8):

$$\ln \widehat{S}_{ij} = 1.3676 + 0.0922 * \ln \widehat{EE}_{ij} - 0.1349 * \widehat{lnEM}_{ij} - 0.0041 * \widehat{lnAT}_{ij} + \Phi_i \quad (8)$$

In Equation (8), it is possible to conclude that the experience associated with the bank's ethics is the most positive asset of a corporation that has a proportional effect on the tangible value (i.e., stock market). On the other hand, emotions and attitudes have a negative effect on the bank's reputation depending on the value associated with the emotions and attitude, thus decreasing the tangible value that represents the business since it has a negative sign.

In summary, the ethics experience associated with a bank is the most valuable intangible asset that a corporation has for defining the bank's online reputation.

Table 4  
Fixed Effects Associated to Each Bank.

#Bank	Fixed effect ( $\Phi$ )
1	0.8454
2	-0.5890
3	0.0662
4	0.4569
5	-1.4834
6	0.5974
7	0.1065

### 4.2. Banking OCRI

Considering the benchmarks between the companies that belong to a sector or activity and to complete the OCR analysis, it is relevant to define a KPI to evaluate the OCR of an organisation, such as an OCRI. The concepts of Diamantopoulos and Winklhofer (2001) will be defined as an index to evaluate the online reputation of the banking sector, as presented in Fig. 5.

In Fig. 5, it is possible to analyse the ethics experience associated with the banks, which is the indicator that contributes to increases in the banks' online reputations. However, emotion contributes negatively to the OCR of the banks, as the results of the estimated model show. Attitude is also an intangible asset that has a negative impact on the OCR of a bank, as presented in the estimated model.

### 5. Discussion

Corporate reputation makes a critical contribution to the development of potential value. Actually, the reputation achieved in the digital environment, considering its intangible character, makes the management of the relation between consumers and organisations more challenging in a competitive environment. The empirical research confirms that there is a positive relationship between intangible assets and business value, mainly the ethics experience that the consumers have with the organisation. This kind of asset also contributes to the definition of OCR.

Considering Equation (8), it is possible to conclude that Hypothesis 1 is true: that all intangible relationships affect the organisation in a holistic way. Together, both Equation (8) and Hypothesis 1 contribute to the economic performance of the corporation, since they are represented by the dependent variable (i.e., stock market value).

In terms of the intangible assets, emotion is the variable that presents more variability from bank to bank, which is likely defined by the ethics associated with customer experiences with that bank. In addition, emotion presents a behaviour similar to ethics as shown in Equation (8). If the bank has a good score on ethics experience, it also has a relatively good score on emotion; if the ethics experience is not good, then the emotion associated with the bank also has a low value.

With regard to the experiences, emotions and attitudes expressed in social media, as represented in Equation (8), it is found that experiences are associated with the ethical dimension. Consumers' emotions

and attitudes have a significant co-deficient, which together influences the tangible asset expressed by the stock market value, as assumed in Hypothesis 2. Therefore, Hypothesis 2 is validated through the significance attributed to the coefficients of each intangible asset, where the *p*-value presents the value of 0.000.

In this study, we can conclude that the ethics experience is the most relevant intangible asset for a banking organisation with a great contribution of 0.0922 to the stock market value. Yet the emotion associated with a banking organisation is the most critical intangible asset, presenting a coefficient of -0.1349 to the stock market value. Attitude has a negative effect which is very low when compared with the other intangible assets. In this context, Hypothesis 3 is considered to be valid, since it is possible to define the reputation of an economic sector through its intangible assets.

As a theoretical contribution, this study shows that it is possible to interconnect the concepts and tools of business intelligence with panel data. Due to its characteristics, the authors also consider this as a future trend since these econometric models will be an excellent ally for data collected in a big data environment. The reasons behind this motivation are related to the fact that econometric models allow researchers to analyse different companies, consumers or brands over time, considering the dynamic models or PVAR (panel vector autoregressive) models that are used with big data. We hope that our study, despite considering static panel data, is the precursor of future studies that link the areas of business intelligence, data mining and panel data applied in different business areas. As a complement, the creation of an index intends to include the concepts of indicators that analyse the performance of the organisation, in this case, elaborated with the independent variables considered significant in the case study as applied to each economic sector.

In addition, we believe our study will aid bank managers (or managers from other economic sectors) to realise the potential of using their Data Warehouse combined with panel data models to detect patterns and relationships in data and define new strategies for the future. Another implication of this study is that it should enhance the transfer of knowledge between academia and companies, informing managers that it is possible to extract economic intelligence on big data. In turn, such information should enhance the growth and economic performance of organisations.

As a last management implication, it is pertinent that corporate reputation is increasingly managed in a strategic way. In situations in

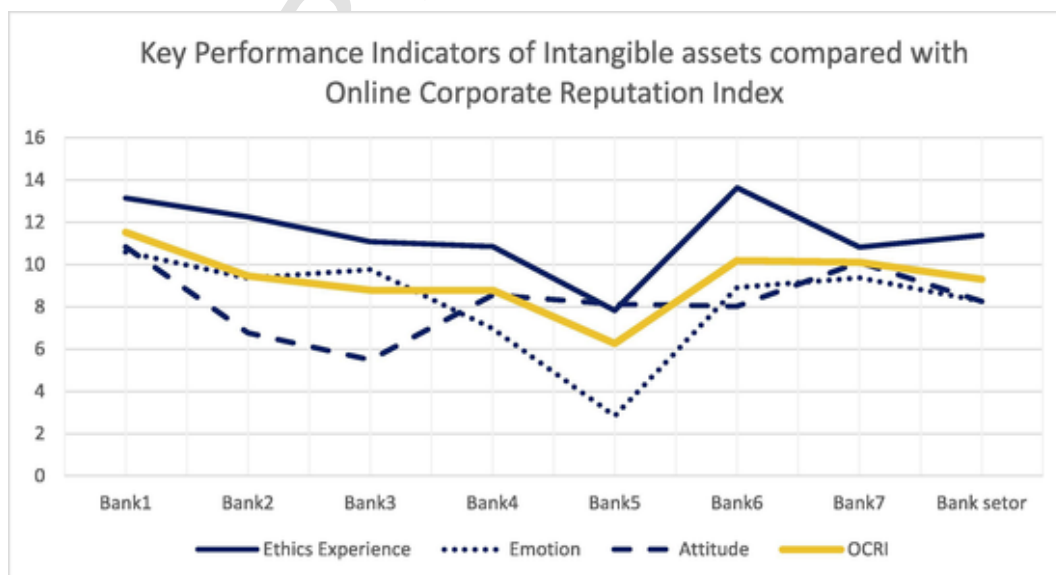


Fig. 5. Key Performance Indicators of Intangible Assets and OCRI of the Banking Sector.

which it is necessary to consider the experience of consumers, in general, as well as ethical behaviours, appropriate methods and rules must be considered so that there are no doubts about the functioning of banks in ethical terms. Specific rules must be defined for the online environment, in which transparency, trust and good conduct should be the main messages.

## 6. Conclusions

The environment, proportioned by the technologies associated with the concepts of Web 2.0, has contributed to changes in the way a business is managed, both in general and strategic terms. One of the features that has emerged in that environment is a new economy (i.e., the digital economy) with new metrics and new concepts in which consumers play an important role as agents of a corporation or a brand through the expression of their feelings on social-media platforms.

In this environment, consumer emotions, brand experiences and attitudes become an intangible asset of a corporation and have a great role in the tangible assets of the business. However, the ethics experience is the most valuable dimension to represent the experiences associated with all banks.

In the estimation of the panel data model, only ethics experience, emotion and attitude were considered significant. Consequently, these three variables were used to develop a KPI and an OCRI to measure the impact of the online environment on the reputation of the seven Spanish banks, with ethics experience emerging as the variable that had the most impact on bank reputation.

There are several limitations that were needed to achieve the aim of this investigation, such as collecting all the daily data about the banks' reputations, even though such data was necessary to develop a complex algorithm. Another difficulty involved creating a team that included all the requisite knowledge (i.e., computer science, marketing, econometric and business intelligence) to achieve the objective of this paper.

In theoretical terms, the present investigation gives future clues for how the different scientific areas can be joined together and applied to areas of management and marketing. This shows the potential of extracting insights from a huge volume of data and perceiving how the dependent variable can be explained by the behaviour of one or more other variables. In this environment, knowledge in the area of technology is combined and leveraged, mainly in the areas of big data, artificial intelligence and decision support methods. Quantitative methods have been applied to economics, management and marketing through panel data models, enhancing the decision support environment. The growth in knowledge about online reputation allows for the most appropriate and effective decision making, enabling dynamic analysis and the investigation of the relationship and effects between the different variables. With regards to online reputation as applied in the banking sector, it is concluded that ethical experience is the intangible asset with the greatest impact on the tangible assets which represent the value of the business. Thus, more importance should be given to this intangible asset in future studies in terms of both the definition of corporate reputation and the effect of ethical experience on the company's economic performance. Finally, the study contributes to the development of an indicator to measure reputation in the online environment, which allows the definition of a company's index and its position in its economic sector.

In practical terms, this investigation shows that corporate reputation must be managed in a strategic way; since ethics is the intangible asset that has the greatest effect on the value of the business, it cannot be neglected. In the banking sector, all the factors that can affect the customer's experience in ethical terms must be addressed in order to create a good ethical experience for the customer. Appropriate methods and rules must be defined so that there is no doubt about the sector, the company and the ethical behaviour of the employees. Trans-

parency, trust and good conduct should be the main messages. The ethical experience that the client has enjoyed and will report in the digital environment will contribute to the definition and the public awareness of the reputation of the bank or company and will consequently contribute towards increasing or decreasing the volume of the business.

With this study, and using the indicator, it will be possible for a bank manager to study the performance of his bank as compared to that of other banks and the banking sector and to act strategically, based on an analysis of the variables that affect a bank's reputation, to improve the reputation of his bank and consequently the bank's economic performance.

In terms of future work, with a higher volume of data, the potential of dynamic models of panel data will be considered to ascertain how the past influences the present. Panel VAR models will also be used to give a more complete picture of the relationship between the variables. The online reputation indicator will be improved to reflect the complexity associated with the dynamism and relationship between the variables. Finally, this broader methodology will be applied to other economic sectors where the Sustainable Development Goals will be considered and integrated into the definition of reputation and its indicator.

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