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Abstract

The notion of Product Quality has been explored from different perspectives such as Total Quality Management (TQM), an approach that has emerged in parallel with the development of new technologies. The vast amount of research on this subject has yielded an overload of information making it necessary to develop and apply bibliometric techniques to manage it, assess its scientific performance and identify the thematic areas and their evolution over time. Thus, the present study carried out a bibliometric analysis of 3,484 published documents spanning 1989 to 2019 related to Product Quality in the field of business. The tools serving for the analysis were the Web of Science (WoS) Analyze Results and Science Mapping (SciMAT). The results highlighted the themes of greatest interest and their interconnections throughout each of these three last decades. It is noteworthy that the theme of *Price* stands out throughout the three decades. The tools also shed light on the evolution of the different themes, the inception of new motor themes and the areas devoid of in-depth analyses that require further investigation. The present study therefore serves as a starting point for future research in this field.

Keywords: product quality, technological development, business.

1. Introduction

The perception of the quality of a product has changed dramatically in recent times with the emergence of new information and communication technologies. More and more consumers carry out their purchases through digital platforms which complicates evaluating Product Quality as the goods themselves cannot be physically tested before acquisition (Rao, Lee, Connelly, & Iyengar, 2018; Xiao, Guo, D'Ambra, & Fu, 2016). This reality is a challenge as

most of the day-to-day operations of the last decade are carried out by new smart devices, a fact that generates asymmetric market information (Mavlanova, Benbunan-Fich, & Lang, 2016). Despite this situation, research on the perception of product quality remains scant (Akdeniz & Calantone, 2017).

Science has likewise, due to the great technological advances, progressed rapidly leading to an information overload (Huggett, 2013). This excess of data has forced the scientific community to develop new techniques to analyse the great amount of information, a course of action that has led to the emergence of the science of Bibliometry (Castillo-Vergara, Alvarez-Marin, & Placencio-Hidalgo, 2018). One of the most relevant tools of Bibliometry is Scientific Mapping (Martínez, Cobo, Herrera, & Herrera-Viedma, 2015).

Although bibliometric analyses have been widely adopted by a wide range of academic disciplines to identify key concealed aspects, there is a paucity of this approach as to product quality in business spanning the decade preceding the inception of the Internet and the World Wide Web until today. Thus, the purpose of the current study is to close this gap by means of a bibliometric analysis of this subject over the last three decades [1989-2019] applying two tools (WoS Analyze Results and SciMAT) to data gleaned from the Web of Science (WoS) platform, currently one of the most relevant databases.

The study of the perceived quality of products forms part of research on information systems, marketing and operations management (Palese & Usai, 2018). Given its relevance coupled with the dearth of bibliometric analyses in this realm, the current study intends to offer data serving as a starting point to filling this research gap. Its main contribution is to identify the themes linked to product quality perception, the focus of most earlier related studies, and highlight the themes that merit further investigation which will lead researchers into potentially unaddressed and unexplored fields.

Specifically, the research questions answered by this study are the following: which thematic areas have attracted the interest of the scientific community of the field; which are the key and marginal themes throughout the different periods of scientific development; which themes have achieved the greatest impact and visibility; and which have the potential for future research.

This study therefore contributes to the existing body of knowledge by examining the evolution of product quality in the field of business, by highlighting the research trends and patterns, and by recommending areas for future studies.

2. Background to product quality

Product quality is a construct that is central to a number of fields of management and business. It is a significant driver of firm profitability and can lead to the success of a new product (Gervais, 2015; Sethi, 2000). The perception of the quality of a product can therefore have a great impact on business performance and can serve as a major source of data for managers (Guru & Paulssen, 2020; Lange, Lee, & Dai, 2011).

Although there is no definitive conceptualisation of perceived quality (Snoj, Korda, & Mumel, 2004), it is generally defined as the subjective assessment by consumers of the degree of excellence of a product or a brand and the level of its performance (Dean, 1999). Thus, quality can be considered as a generic value (Zeithaml, 1988) and defined as the degree to which a set of inherent characteristics of a good fulfils certain requirements (ISO, 2015). A positive perception of product quality can be achieved by complying with the standards of quality management systems that require introducing specific characteristics or elements related to its manufacturing process or technique (Pu, Chong, Cai, Lim, & Tan, 2019). Likewise, the perception of quality is conditioned by intrinsic and extrinsic signals (Mavlanova et al., 2016) closely linked to the Theory of Signalling (Spence, 1973) that serves

to explain how signals offer information allowing to estimate product quality in the case of consumers and retailers information asymmetry (Wells, Valacich, & Hess, 2011).

Although this theory has its origins in traditional market research (Baker, Grewal, & Parasuraman, 1994; Dawar & Parker, 1994; Erdem & Swait, 1998), its application to e-commerce is due to the difficulty of identifying the quality of goods that cannot be physically tested before their purchase (Pee, Jiang, & Klein, 2018; Spence, 2014). Hence, various traditional market signals have served as indicators of quality in e-commerce. These include branding (Brady, Bourdeau, & Heskel, 2005; Erdem, 1998; Rao, Qu, & Ruekert, 1999), advertising (Aiken & Boush, 2006; Biswas & Biswas, 2004), retailer reputation and price (Agarwal & Teas, 2001; Anderson & Simester, 2001; Brady et al., 2005; Lee & Shavitt, 2006; Sullivan, & Kim, 2018), word-of-mouth (WOM) (Cheung, Xiao, & Liu, 2014; Guo, Zhang, Thalmann, & Yorke-Smith, 2014), website design quality serving like a window display of traditional shop (Chen, Huang, & Davison, 2017; Lee, Ha, & Johnson, 2019; Pee et al., 2018; Wells et al., 2011) and the quality of product information (Yeon, Park, & Lee, 2019).

Certain quality cues, notably those in the area of marketing (i.e., price, reputation and advertisements) can be directly controlled by managers while others of non-marketing type such as expert product reviews defy this control (Kwark, Chen, & Raghunathan, 2014; Narwal & Nayak, 2020). As product quality is a determinant of the performance of firms, it is imperative to enhance this aspect (Cannatelli, Pedrini, & Grumo, 2017).

Furthermore, owing to the potential effects of product quality perception on consumer behaviour (Busalim, Hussin, & Iahad, 2019; Everard & Galletta, 2005; Langan, Besharat, & Varki, 2017; Wells et al., 2011), retailers must focus on transmitting adequate signals of quality to consumers. These signals, due to the uncertainty provoked by information

asymmetry, need to be conveyed through both traditional and electronic market environments (Yu, Hudders, & Cauberghe, 2018). The current analysis thus explores this question.

3. Methodology

3.1. The bibliometric analysis

This study resorted to a bibliometric analysis of data of secondary sources to examine the specific or general concepts of the field and obtain a visualisation of its thematic evolution (Chen & Xiao, 2016; López-Robles, Otegi-Olaso, Porto-Gómez, & Cobo, 2019). The method therefore offers an array of valuable data to specialists of the field (Rey-Martí, Ribeiro-Soriano, & Palacios-Marqués, 2016). Moreover, its tools are gaining in value as a means to evaluate quality, productivity and evolution (Gomez-Jauregui, Gomez-Jauregui, Manchado, & Otero, 2014; Martínez et al., 2015). This type of analysis organises information from any given academic field due to its objective and quantitative approach to collecting bibliographic resources (Albort-Morant & Ribeiro-Soriano, 2016).

3.2. Database selection

WoS, Scopus and Google Scholar are the most common databases available to researchers (Martínez et al., 2015). WoS is nonetheless the most broadly accepted and common to surveys related to science, social sciences, arts and humanities as it offers access the greatest number of publications (Norris & Oppenheim, 2007). In this study it served to collect data for the three decades between 1989 and 2019 serving as the base to analyse the scientific evolution of product quality. These three decades span the timeframe prior to the widespread adoption of the Internet and the World Wide Web in 1993 to the present when commercial transactions have turned from traditional commerce to e-commerce complicating the evaluation of product quality. This study thus applied the queries: TS = 'Quality Product' OR 'Product Quality' and SU = 'business'. SU refers to the field where the search was conducted

while TS alludes to the theme of the search. These queries allowed to isolate a vast number of documents related to product quality from a wide variety of areas such as management, finance, consumer behaviour, organisational theory and international business. The study applied a successive fractions approach which reduced the vast initial number of documents by eliminating those less relevant (Rowley & Slack, 2004). Thus, given that the aim of this paper is to offer a clear view of the evolution of the notion of quality, the queries led to excluding unrelated documents or those not explicitly delving into the concept. The final base serving for the study consisted of 3,499 publications.

A debugging process was then carried out among the series extracted thorough WoS. In line with the procedure advanced by Cobo, López-Herrera, Herrera-Viedma, and Herrera (2012), it consisted, after reviewing the content of the documents, in eliminating duplicates reducing the corpus to 3,484. Figure 1 depicts the distribution of yearly publications linked to the theme of product quality in the field of business. The graph depicts a gradual growth from 1989 until 2017, the year with the greatest number. This development was probably reinforced by the many transformations undertaken by academic institutions and organisations in tandem with the great evolution of information and communication technologies (Duart & Mengual-Andrés, 2014).

[FIGURE 1 NEAR HERE]

The interest in quality perception analyses in business was likewise bolstered by the introduction of new commercial techniques stemming from the difficulty in evaluating product quality when purchased with IT devices, a phenomenon from the early 1990s coinciding with the rise of e-commerce due to the World Wide Web and Internet marketing (Palese & Usai, 2018). Another point worth highlighting is the descent of the number of

publications in 2019 which is explained by the fact that only the first three quarters of 2019 were computed.

3.3. Analytical tools

Two tools served to carry out the current research. The first, the WoS Analyze Results application, served for a qualitative and quantitative identification of the themes and thematic areas throughout the entire academic field which, in turn, led to single out the most prominent, productive and impactful subfields (Muñoz-Leiva, Viedma-del-Jesús, Sánchez-Fernández, & López-Herrera, 2012).

A content analysis was likewise conducted to identify the core elements of the knowledge base of product quality in the field of business. Academic interest in content analysis techniques has escalated in recent years in a variety of areas including quality management, supply chain, consumer behaviour, and certain disciplines of social science (Chiarini, Castellani, Rossato, & Cobelli, 2020; Clube, & Tennant, 2020; Kühl, Bourlakis, Aktas, & Skipworth, 2020; Reza, Subramaniam, & Islam, 2019; Segarra-Ciprés, Escrig-Tena, & García-Juan, 2020; Shi, Duan, Wu, Zhang, & Feng, 2020). The content analysis resorted to SciMAT, a mapping tool that generates scientific graphs facilitating the visualisation of the evolution of a specific academic area (Cobo et al., 2012). Applying SciMAT to the current study thus yielded scientific graphs based on the values of frequency of centrality and density of keywords over the last three decades (1989-1999, 2000-2009 and 2010-2019).

The first period [1989-1999], represented by 407 documents, corresponds to an early stage of research on the theme of product quality while the second [2000-2009] is marked by a notable upswing attaining a peak (1,072 publications). The final period [2010-2019] equates with a surge of research reflected by 2,005 publications coinciding with the advances in technology cited above.

The first stage of the analysis consisted of keyword normalisation so as to unify, without loss of meaning, both the plural and singular forms and the acronyms (Cobo, López-Herrera, Herrera-Viedma, & Herrera, 2011). This step yielded 9,284 keywords.

The subsequent actions were carried out with SciMAT mapping software following the indications of Cobo et al. (2011): 1) choice of keywords to serve as the units of analysis, 2) choice of the co-occurrence analysis to create the networks, 3) choice of the equivalence index to normalise the networks, 4) choice of the simple centres algorithm to identify the possible groups and, finally, 5) choice of the h-Index (Hirsch, 2005) and the total number of citations to measure the quality of the publications.

This yielded strategic diagrams based on the parameters of centrality and density serving to identify the most representative research topics (Cobo et al., 2011). Centrality ranks the strength of the external links of a theme with another and can be interpreted as the degree of relevance of a subject in an area of study. Density, in turn, ranks the strength of the internal links between the keywords and is indicative of the degree of their development (Callon, Courtial, & Laville, 1991).

Then, according to the approach defined by Cobo et al. (2011), the ensuing strategic diagram is transformed into a bi-dimensional space classifying the themes into four groups: 1) motor themes, 2) highly developed and isolated themes, 3) emerging or declining themes, and 4) basic and transversal themes (Figure 2). Motor themes grouped in the upper right quadrant represent topics that are relevant to the structure of a field of research. Highly developed and isolated topics grouped in the upper left quadrant are the strongly related, highly specialised themes that remain nonetheless peripheral and only of marginal relevance to the area of study. The emerging and declining research topics in the lower left quadrant, by contrast, correspond to poorly developed and marginal themes. Finally, the basic and transversal themes in the

lower right quadrant, while relevant to this field of research, are devoid of internal development.

The strategic diagram (Figure 2) also depicts the thematic networks that allow evaluating the interrelations between the different thematic areas of the diagram whose volumes potentially reflect different bibliometric indicators (Alvarez-Marin, Castillo-Vergara, & Geldes-González, 2017).

[FIGURE 2 NEAR HERE]

4. Results

4.1. Analysis of scientific performance

The 3,484 documents identified by the bibliometric analysis can be broken down as follows: 2,680 scientific articles (76.92%), 619 proceeding papers (17.77%), 76 book chapters (2.18%), 67 article reviews (1.92%), 16 editorial materials (0.46%), 11 meeting abstracts (0.31%), 7 book reviews (0.20%), 5 books (0.14%) and 3 corrections (0.09%).

The country yielding the greatest number of publications (1,460) is the United States (41.91%). It is followed by China with 427 (12.26%) and England with 212 (6.08%) (Figure 3). This study only retained the countries/regions with more than 10 documents.

[FIGURE 3 NEAR HERE]

Among the top ten journals with the greatest number of documents related to product quality in the field of business are *Management Science* (83), *Journal of Business Research* (57), *Total Quality Management Business Excellence* (36), *International Journal of Quality Reliability Management* (35) and *Journal of Product Innovation Management* (35) (Table 1).

[TABLE 1 NEAR HERE]

4.2. Content analysis

A total of 659 groups of 9,284 keywords were pinpointed through the SciMAT software for the study's three time periods.

4.2.1. The initial stage before the widespread adoption of the Internet (1989-1999)

The strategic diagram of the initial period (Figure 4), corresponding to the first decade, yielded a total of seven themes: *attitudes*, *determinants*, *innovation*, *market-competition*, *price*, *competence* and *market*. The means to measure performance such as the sum of citations and the h-Index suggest that the motor theme with the greatest impact, designated by 3,288 citations and an h-Index of 9, is *determinants* (Table 2). This focused mainly on the notions of client and Japan as it is based for the most part on research in the fields of consumer, consumer satisfaction, service quality, behaviour and the country of Japan. *Attitudes*, with a lower number of citations (184) and an h-Index of 5, represents a second motor theme that focuses on the topics of country, origin, consumer behaviour, country-of-origin and brand name. These reveal that research on the quality of a product during this initial decade was for the most part focused on the perspective of country-of-origin.

[TABLE 2 NEAR HERE]

Innovation, on the other hand, is a highly developed and isolated theme which was examined from the point of view of technology, industry, organisation, success and cycle. These reflect entrepreneurial and academic impulses stemming from the introduction of information and communication technologies linked to the surge of the Internet and the World Wide Web. Another highly developed and isolated theme is *market-competition* centred on choice, oligopoly and location.

Price, in turn, is a motor theme identified in the field of research on decision making, brand, retail, signal and asymmetric information. Hence *price* begins in this decade to be considered as a signal of product quality in parallel with the outset of the asymmetry of information between retailers and consumers. In addition, the topic of *market*, reflecting the least centrality, becomes a basic and transversal theme analysed from the perspective of business, reputation, costs, hedonic price function and moral hazard.

Finally, *competence* is an emerging or declining theme, approached only from the perspective of advertisements and purchase, which suggests that it began to evolve towards other quadrants of the diagram.

[FIGURE 4 NEAR HERE]

4.2.2. The stage of technological development (2000-2009)

The strategic diagram (Figure 5) of this second period reflects nine research topics related to product quality. The topic of *price*, progressively in motion towards becoming a motor theme in the previous decade, is now the motor theme with the greatest number of citations (3,561) and the highest h-Index (32) (Table 3).

[TABLE 3 NEAR HERE]

Price in this decade, identified through the areas of market, competence, guarantee, signal and brand name, reinforces the findings of the previous decade that it serves as a signal of perceived product quality. *Business* and *choice* emerge likewise as motor themes yet with a lower number of citations and h-Index than *price*. The *business* node appears through studies on innovation, policy, organisational performance, research and development, and competitive advantage, whereas *choice* stems from research on oligopoly, consumer behaviour, signalling theory, market-competition and purchase decision.

It is noteworthy that two highly developed and isolated themes, *consumer satisfaction* and *strategy*, appear in this second period. The first, identified through the topics of expectations, e-commerce, consumer satisfaction, consumer loyalty, service quality and intentions, benefits from the highest density. The second stems from the topics of perspective, alliance, extensions and business performance.

Moreover, *determinants*, a motor theme throughout the first decade identified through technology, industry, new product development and behaviour, now becomes basic and transversal. *Management* is likewise identified as a new basic and transversal theme in this decade, albeit not widely developed as it is incipient. It arises through the topics of impact, environment, total quality management and empirical research.

Finally, *economies*, with the lowest values of centrality and density, and linked to organisation and government, is singled out as a declining theme. *Reputation*, in turn, is an emerging theme with trends that evolve towards a basic and transversal theme closely related to quality signal, information asymmetry and auctions.

[FIGURE 5 NEAR HERE]

4.2.3. The stage of technological revolution (2010-2019)

The strategic diagram representing the last period reveals a total of 17 themes (Figure 6). *Price*, singled out through the topics of market, competence, impact, brand and signal, is once again a motor theme with the greatest degree of centrality, number of citations and h-Index (Table 4).

[TABLE 4 NEAR HERE]

The new motor theme with the second highest centrality and h-Index is *e-commerce*, identified through the topics of websites, Internet, consumer satisfaction and re-purchase

intention. It is followed by w*ord-of-mouth*, singled out by research on the fields of online reviews, consumer reviews and recommendations (i.e., from endorsements regarding product quality in all contexts). *Market-competition* and *service quality*, marked by high levels of centrality and lower density, are likewise motor themes. *Market-competition* stems from areas such as economy, choice, oligopoly, game theory and duopoly while *service quality* is linked to studies of expectations, quality perceptions, airline industries, intentions and perceived value.

Store brands and *country-of-origin* are likewise two highly developed and isolated themes. The first is analysed in the framework of national brands, labels, retailer and retailer's brand, whereas the second stems from studies of dimensions, image, product evaluations, China and country image. *Business performance* is a highly developed and isolated theme prone to becoming a motor theme due to the incremental tendency of its centrality and density, identified through the areas of firm performance, total quality management, supply chain management, operational performance and competitive advantage. *Corporate social responsibility* is similarly a highly developed and isolated theme with a trend towards becoming an emerging or declining theme linked to the areas of associations, ethics, government, business reputation and behaviour.

On the other hand, *management*, *consumer behaviour* and *industry* remain basic, transversal themes. *Management* is an important and underdeveloped theme which is evolving towards a motor theme. It is singled out through the topics of business, risk, perspective, systems and organisation. Likewise, *reputation*, identified by the topics of *retail, guarantee, asymmetric information and auctions,* and playing the role of an incipient theme in the previous decade, is now a basic, significant and transversal (albeit poorly developed) theme. *Consumer behaviour* and *industry* are likewise underdeveloped basic and transversal themes. *Consumer behaviour* reveals a high centrality stemming from the topics of consumers, attitudes, perceived risk and

willingness to pay, whereas, *industry* reveals the lowest density and is linked to dynamics, disclosure, networks, empirical research and supply chain structure.

Finally, the current study detected four emerging or declining themes: *determinants*, *strategy*, *exports* and *innovation*. It is worth highlighting that *innovation* is considered an emerging theme as it reflects a tendency to evolve towards becoming basic and transversal. It is singled out from the perspective of technology, strategic orientation, capabilities, patents and research and development. Likewise, *exports* reveals itself as an emerging theme with the lowest centrality and a tendency to become highly developed and isolated. It is identified through the fields of firm heterogeneity, multi-product firms and foreign direct investment. *Strategy* and *determinants* are two declining themes marked by the lowest density, recognised though the topics of exchange, brand alliances, manufacturing industries and small and medium markets. It is also noteworthy that *determinants*, a motor theme in the first decade, evolves into a declining theme linked to investment, values and credibility.

The findings therefore indicate that research carried out during this last period yielded the greatest number of contributions to the area of product quality in business.

[FIGURE 6 NEAR HERE]

4.3. Structural analysis of the evolution of product quality in the field of business

Once having identified the topics of greatest interest by decade, the study turned to analysing the evolution of the concept of product quality through the three decades. The findings do not reveal a cohesive progression as most of the themes do not stem from previous periods. There are, nonetheless, two (*price* and *determinants*) that remain stable in the domain of academic research on product quality throughout the three decades. The two can therefore be retained as classic thematic areas. Furthermore, *Price* reveals a notable increase in the last decade, while *determinants* follows a constant trend throughout the whole time frame.

The study also identified three thematic areas that emerge during the second decade that persist throughout the third decade: *strategy*, *reputation* and *management*. It is noteworthy that interest in the last two increased slightly in the last decade. It is likewise significant that the topics of *market-competition* and *innovation* from the first decade disappear during the second [2000-2009] before becoming, as evidenced by the great number of publications, once more topics of interest in the third [2010-2019]. The third also sees the emergence of new research areas: word-of-mouth, e-commerce, country-of-origin, business performance, service quality, consumer behaviour, corporate social responsibility, industry, store brands and exports.

The findings demonstrate that *price*, which in the first decade was basic and transversal, increases exponentially throughout all the decades with the antecedents of *market* and *competence* in the second, and maintains a link in the third with *market*, *competence*, *impact*, *brand* and *signal*. This clearly illustrates how *price* increases in relevance as a signal of a product's perceived quality.

Figure 7 depicts the evolution of the thematic areas according to the quantity of documents reflected by the size of each sphere (Martínez et al., 2015). Line thickness equates to the index of inclusion while dashed lines reflect a relationship between the thematic areas through shared keywords (Murgado-Armenteros, Gutiérrez-Salcedo, Torres-Ruiz, & Cobo, 2015).

[FIGURE 7 NEAR HERE]

5. Conclusions

After examining 3,484 publications garnered from WoS by means of WoS Analyze Results and SciMAT software, it was possible to pinpoint the main themes and areas of study linked to product quality in the field of business.

The Scientific Performance Analysis determined an increase of research in this area throughout the last three decades evidenced by a surge in the number of publications from 407 in the first decade to 2,005 in the last. It is thus obvious that the theme of product quality has evolved over the years, especially in the last decade. Similarly, the findings evince a great diversity among the journals publishing articles related to product quality. Among the top ten are *Management Science*, *Journal of Business Research* and *Total Quality Management Business Excellence*.

The analysis of the evolution of the different themes sheds light on the great changes undergone by society stemming from the emergence of new technological devices that facilitate interpersonal communication and an instantaneous access to information. The Internet has in fact converted itself into the main environment of transactions and communications yielding a new connection and means of distribution between customers and suppliers. This has led to a revision of the traditional market-based methods to a more digital approach characterised by novel business techniques such as e-commerce. This also explains the surge of interest in concepts such as eWOM. Recent findings likewise evidence the massive impact of e-commerce on businesses, markets, consumer behaviour and society in general (Kusumah, 2015; Mavlanova et al., 2016). E-commerce introduction is in fact behind the development of new digital markets characterised by transparent pricing, unlimited access, and well-run trade. This new type of commerce directly impacts the relationship between firms and their suppliers, customers, competitors, and partners, as well as on they market, advertise, and brand their products (Laudon & Traver, 2017).

The findings of this study likewise identify an evolution of *price* that can serve as a signal of product quality through its transformation over the last two decades into a greatly relevant motor theme. Thus, based on the results reflected in the structural analysis of the evolution of themes, *price* has become a sign of basic quality, that is, a variable essential in determining a

product's perceived quality (Alshibly, 2015; Beneke, Brito, & Garvey, 2015; Dutta, Biswas, & Grewal, 2007; Maslowska, Malthouse, & Viswanathan, 2017; Yu et al., 2018). *Price* is therefore one of the most relevant themes linked to determining product quality. Consumers, in fact, generally link more expensive products to higher quality (Choi, Ko, Medlin, & Chen, 2018; Guo et al., 2014). It is thus of essence to highlight the critical role of *price* as consumers are highly attuned to this theme (Chenavaz, Feichtinger, Hartl, & Kort, 2020).

New themes also surfaced in the last decade that begin to be regarded as signs of product quality. Word-of-mouth, for example, surges as a motor theme which has led researchers to analyse its influence on consumer behaviour and conclude that it has an effect on the perceived quality of a product and bears weight on choice and other aspects (Koh, Hu, & Clemons, 2010; Liu, Hu, & Xu, 2017). In addition, this motor theme is represented by online reviews, consumer reviews and recommendations which, again, reflect the impact of new information and communication technologies on recent research. With the emergence of the Internet and e-commerce, eWOM, defined as the positive or negative statements shared by consumers over the Internet as to a product, service, brand or company, influences the perception of quality. In this respect, the findings by Choi, Seo, and Yoon (2017) suggest that consumers manifest more positive reactions to eWOM when focusing on perceived quality. One of the most researched elements of eWOM is defined as Review Valence which equates with positive or negative experiences of products or services shared by buyers. These can be consulted, for example, through five-star rating systems in e-commerce platforms (Choi et al., 2018).

Furthermore, country-of-origin emerges in the last decade as a highly developed and isolated theme that serves as a signal of product quality to attract consumers through appropriate marketing strategies (Pérez-Ajami, Navarro-Elola, & Pastor, 2018). Consumers most often perceive goods produced in more advanced countries to be of higher quality. This idea is

bolstered, for example, by the association of the label "*Made in China*" with low quality (Lew & Sulaiman, 2013; Muhamad-Yunus & Wan-Rashid, 2016). However, there is evidence that quality perception linked to country-of-origin is dynamic and it is possible for transitional countries to improve the perception among consumers of their national brands (Karimov & El-Murad, 2019).

Finally, it is noteworthy that innovation, corporate social responsibility and reputation also emerge as motor themes in the last decade with the first two serving as variables, according to Youness and Valette-Florence (2017), linked to the reputation of the retailer. Reputation renders it possible to evaluate the quality of the product as a relevant intangible element difficult to imitate (Boyd, Bergh, & Ketchen, 2010; Parkhe, 1998; Zeithaml, Parasuraman, & Malhotra, 2002) demonstrating that this is a key element serving to identify product quality, which ultimately affects consumer purchasing behaviour (Brady et al., 2005; Brodie, Whittome, & Brush, 2009; Roy, 2010). It is also noteworthy that the association of a business with strong corporate social responsibility leads consumers to assume that it produces high quality goods (Chen, Hong, & Li, 2017), a notion that has prompted many firms to adopt corporate social responsibility strategies.

6. Implications and future research

This is the first bibliometric analysis of the notion of product quality in the field of business spanning the last three decades of academic research. The first [1989-1999] precedes the great advances in information and communication technology, the second [2000-2009] corresponds with the outset of technological development, and the third [2010-2019] is marked by a technological boom. Although bibliometric research has in fact been carried out on total product quality management systems in the last two decades (Khiste, 2018; Lee & Hew, 2017), none of these studies resorted to co-word analyses such as those of the current study.

In fact, among the 3,484 documents garnered through WoS and analysed by SciMAT, there is no bibliometric analysis pertaining to product quality. Thus, the present investigation represents a step forward as it sheds new light on this topic. Its main contribution is pinpointing the basic themes of this field that are currently in decline, notably *determinants* and *strategy*, as well as highlighting the thematic areas linked to product perceived quality relevant to future research.

The current bibliometric analysis thus attained its initial objective of narrowing the gap of product perceived quality research by exploring the evolution of the term in the field of business. It now facilitates researchers as it pinpointed both the highly developed and emerging themes, as well as the main sources and countries carrying out this type of research. It can therefore serve researchers to track down studies related to their areas of interest allowing them to contrast their hypotheses with published work so as to discern potential differences of findings as well as detect new thematic areas. It is also noteworthy that this study contributes to quality literature in general by extending the discussion on perceived product quality in the field of business through an analysis of its evolution throughout three different periods marked by a vast range of technological developments.

The findings specifically establish *price* as the item associated with a greatest number of citations and publications. *Price* must therefore be taken into consideration along with other variables such as *reputation* when analysing product perceived quality. Researchers should thus widen their focus on the new topics regarded as product quality signals and orient their framework to the Theory of Signalling to measure the perceived quality of products in the new context of e-commerce. Researchers should likewise place emphasis on the necessity of management to produce goods that meet quality standards. Similarly, despite the fact that consumer behaviour is a subject explored since the outset of academic research, the results suggest that it is a compelling issue that has yet to be sufficiently and thoroughly analysed

from the perspective of product quality in business. Thus, the current study yields new lines research.

This study is not directed exclusively to academia. It also is intended for practitioners who can apply content analysis for business purposes. The findings point to the emergence of new research areas characterised by motor themes such as word-of-mouth and country-of-origin. Managers should pay attention to these variables when defining and implementing specific strategies. The current results also offer insight into other factors such as innovation and corporate social responsibility that must be taken into consideration by managers since they can affect firm quality position and reputation. Furthermore, businesses should direct their efforts towards managing product quality in order to enhance their performance.

This analysis hence serves as a tool for professionals as it offers them options coming to decisions as to the quality of a product. This is an issue concerning both traditional and electronic commerce (Chakraborty, 2019; Foster & Sjoblom, 1996; Kusumah, 2015) as it assumes a special role in the latter due to the impossibility of physically testing products (Mavlanova et al., 2016; Wells et al., 2011). Specifically, this study leads professionals to identify the elements essential for consumers to perceive a product to be of quality. In this sense it is noteworthy that product quality also serves as an essential indicator of firm performance (Parker, Krause, & Covin, 2017).

Thus, this study advances compelling implications for both academia and business as it offers data to researchers and professionals as to the perceived quality of a business product. On the one hand, it highlights to academia the necessity of exploring themes of great relevance while simultaneously guiding professionals where to dedicate their efforts in developing adequate strategies to emit effective signals of product quality in both the traditional and electronic environments and how these signals can lead to competitive advantages (Kusumah, 2015).

Future research through bibliometric analyses can fill the research gap cited above (Akdeniz & Calantone, 2017) as to product quality perception. Future work should also take into account other areas beyond business to explore the different perspectives of analysis of product quality. In addition, it would be of great interest to consult other databases whose records differ from those garnered through WoS.

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Table 1. List of core journals by number of publications.

Name of journal	Number of documents
Management Science	83
European Journal of Operational Research	66
Marketing Science	61
Journal of Business Research	57
Economics Letters	43
International Journal of Industrial Organization	43
Journal of Marketing	39
Total Quality Management Business Excellence	36
International Journal of Quality Reliability Management	35
Journal of Product Innovation Management	35
American Journal of Agricultural Economics	34
Journal of Marketing Research	33
Industrial Marketing Management	31
Journal of International Economics	31
Journal of Economics Management Strategy	29
Psychology Marketing	27
Rand Journal of Economics	27
Journal of Product and Brand Management	26
Journal of Retailing	23
Journal of Industrial Economics	22
Journal of the Academy of Marketing Science	22
Advances in Economics Business and Management Research	21
Journal of Business Ethics	21
Journal of Retailing and Consumer Services	21

Table 2. List of themes from the period 1989-1999.

Theme	h-Index	No. documents	Citations	Centrality	Centrality Range	Density	Density Range
Price	17	22	2303	8.12	0.86	4.51	0.43
Determinants	9	9	3288	5.58	0.57	12.66	0.86
Innovation	9	11	824	4.49	0.43	7.56	0.57
Market	9	16	1261	9.06	1	4.24	0.14
Attitudes	5	6	184	7.97	0.71	22.78	1
Competence	3	3	78	3.11	0.29	4.39	0.29
Market-Competition	2	4	48	1.81	0.14	8.8	0.71

Table 3. Results of the mapping themes for the period 2000-2009.

Theme	h-Index	No. documents	Citations	Centrality	Centrality Range	Density	Density Range
Price	32	92	3561	14.87	1	7.39	0.89
Business	22	38	2926	5.83	0.78	5.29	0.67
Management	18	35	1938	4.94	0.56	2.46	0.22
Consumer-Satisfaction	17	28	1207	3.09	0.33	10.02	1
Strategy	12	15	509	2.1	0.22	6.82	0.78
Determinants	12	15	1880	5.32	0.67	2.72	0.44
Choice	11	22	1182	6.56	0.89	3.33	0.56
Reputation	9	15	370	3.71	0.44	2.64	0.33
Economies	7	9	260	1.06	0.11	2.19	0.11

Table 4. Results from the mapping of the themes of the 2010-2019 decade.

| Theme	h-Index	No. documents	Citations	Centrality	Centrality Range	Density	Density Range
Price	26	250	2709	29.03	1	5.59	0.82
E-commerce	18	65	1027	16.5	0.94	9.05	0.88
Word-of-Mouth	17	46	1256	9.52	0.76	15.47	1
Management	15	68	1456	10.82	0.88	2.55	0.41
Business-Performance	14	41	672	5.93	0.47	5.41	0.76
Service-Quality	11	369	40	9.81	0.82	3.29	0.59
Reputation	11	25	418	6.21	0.53	1.95	0.29
Industry	11	20	254	6.81	0.59	0.7	0.06
Consumer-Behaviour	10	35	396	8.84	0.71	1.77	0.24
Store-Brands	9	22	209	3.03	0.12	12.11	0.94
Corporate-Social-Responsibility	9	24	194	5.46	0.35	2.91	0.53
Country-of-Origin	8	21	212	4.56	0.29	4.97	0.71
Market-Competition	8	51	363	7.13	0.65	3.93	0.65
Innovation	8	33	567	5.6	0.41	2.2	0.35
Exports	6	15	307	1.55	0.06	2.57	0.47
Determinants	6	13	130	4.24	0.24	0.89	0.12
Strategy	5	16	78	4.15	0.18	1.09	0.18
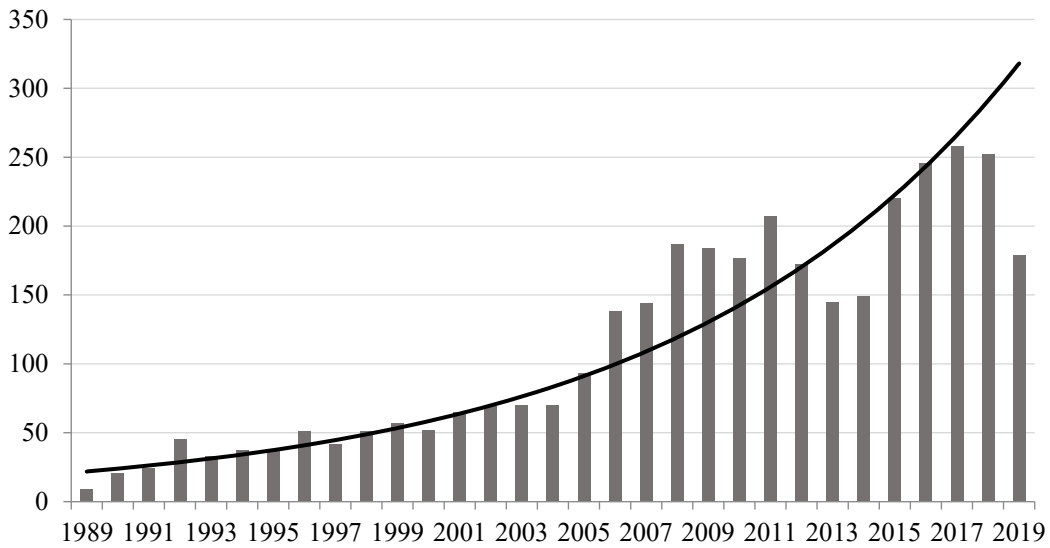
Fig. 1. Number of documents published by year over the last three decades on the subject of product quality.
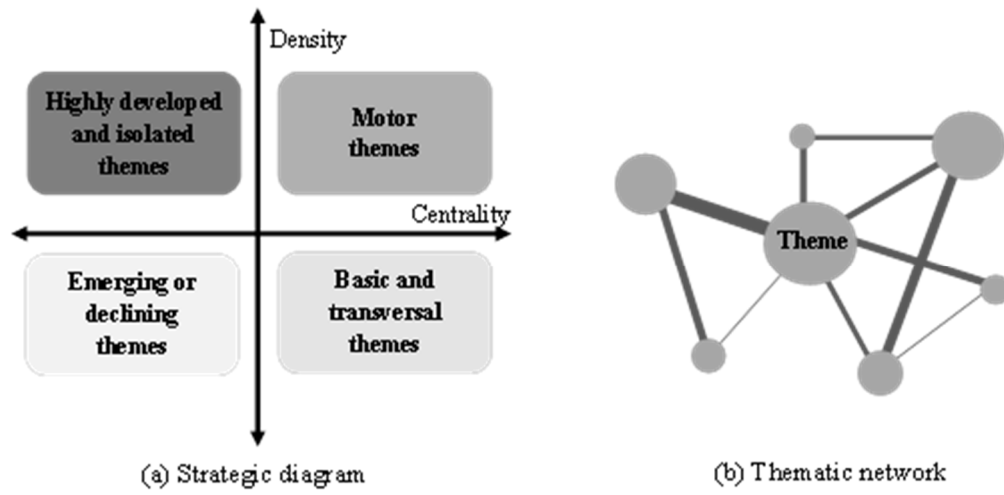
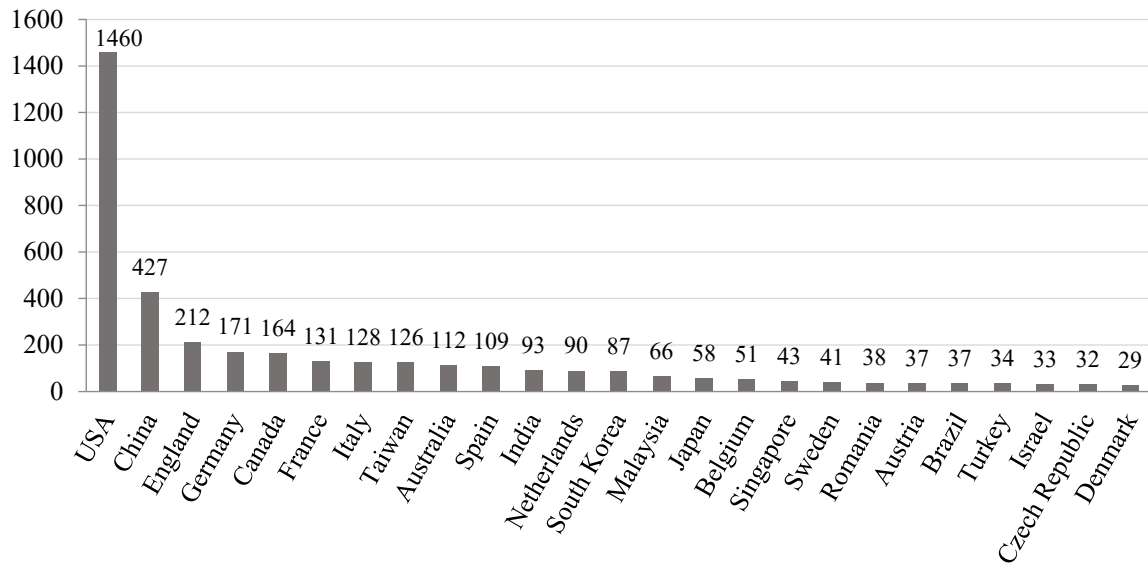**Fig. 2.** The strategic diagram and thematic network (Cobo et al., 2011).

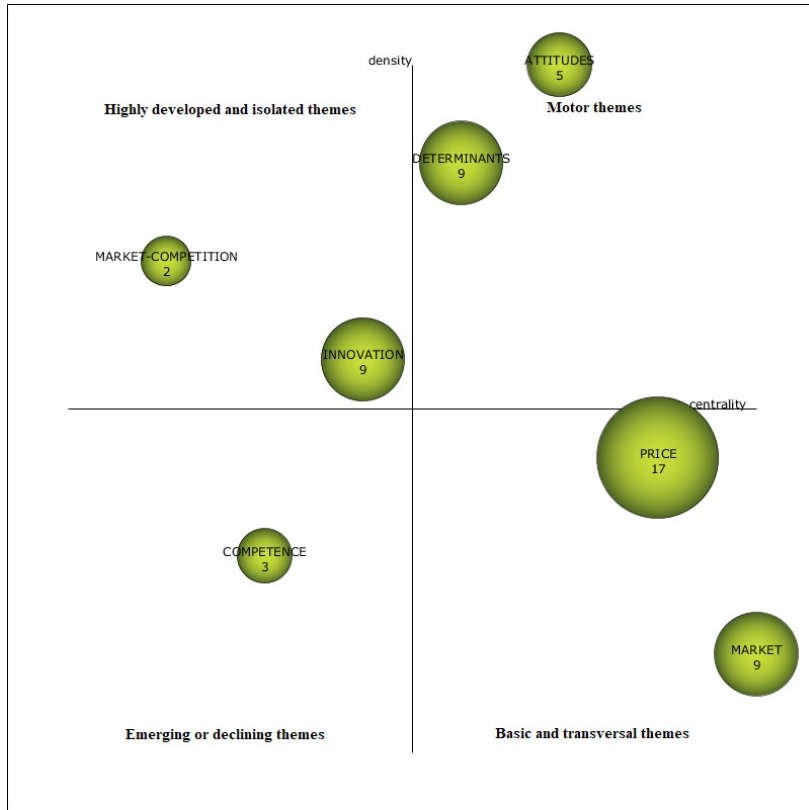**Fig. 3**. Number of published documents on the subject of product quality by country.

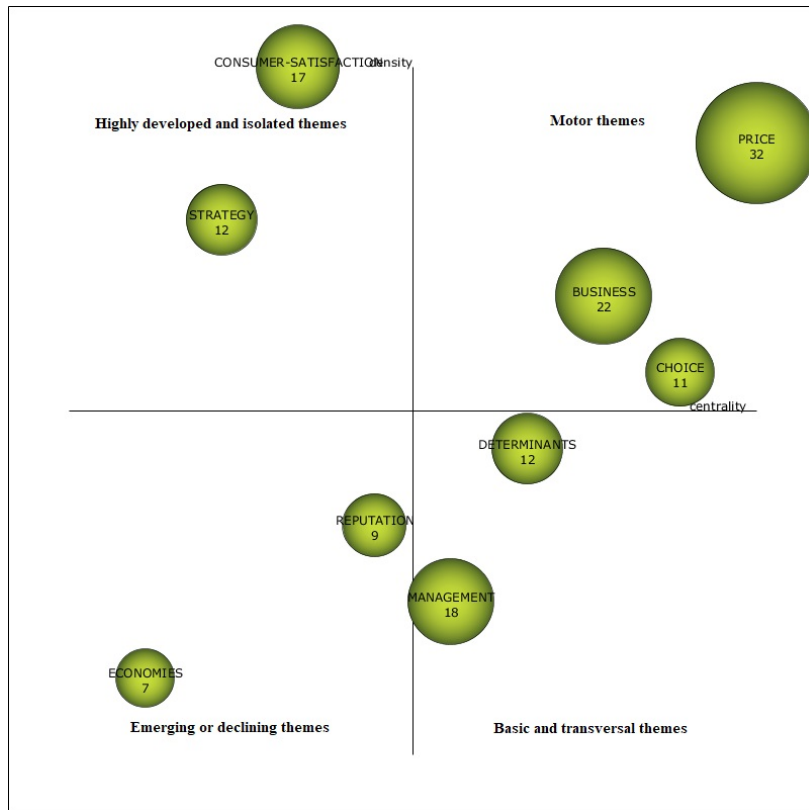**Fig. 4.** Strategic diagram corresponding to the decade of 1989-1999.

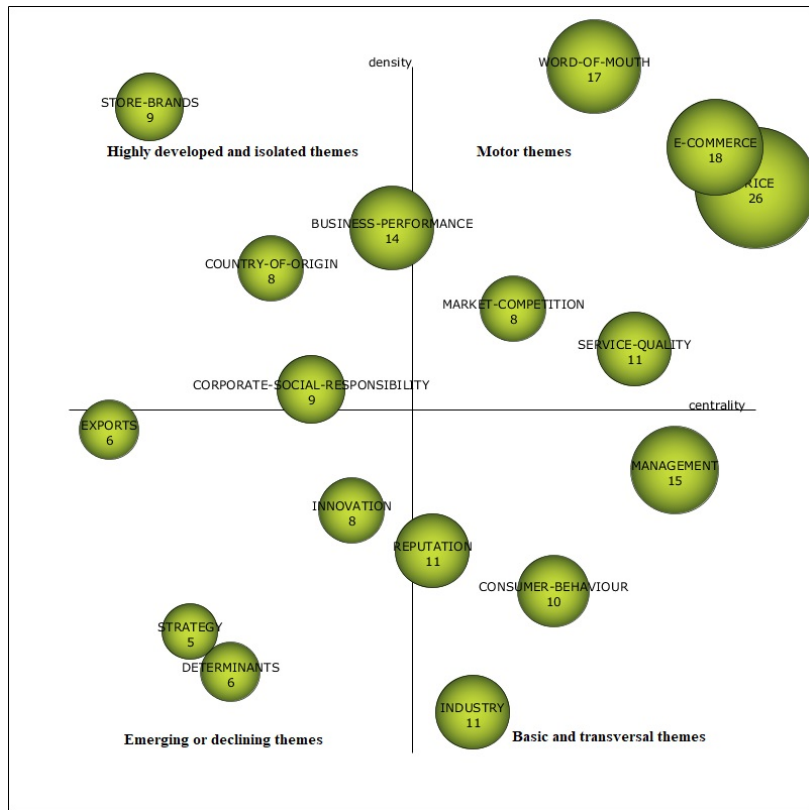**Fig. 5.** Strategic diagram corresponding to the decade of 2000-2009.

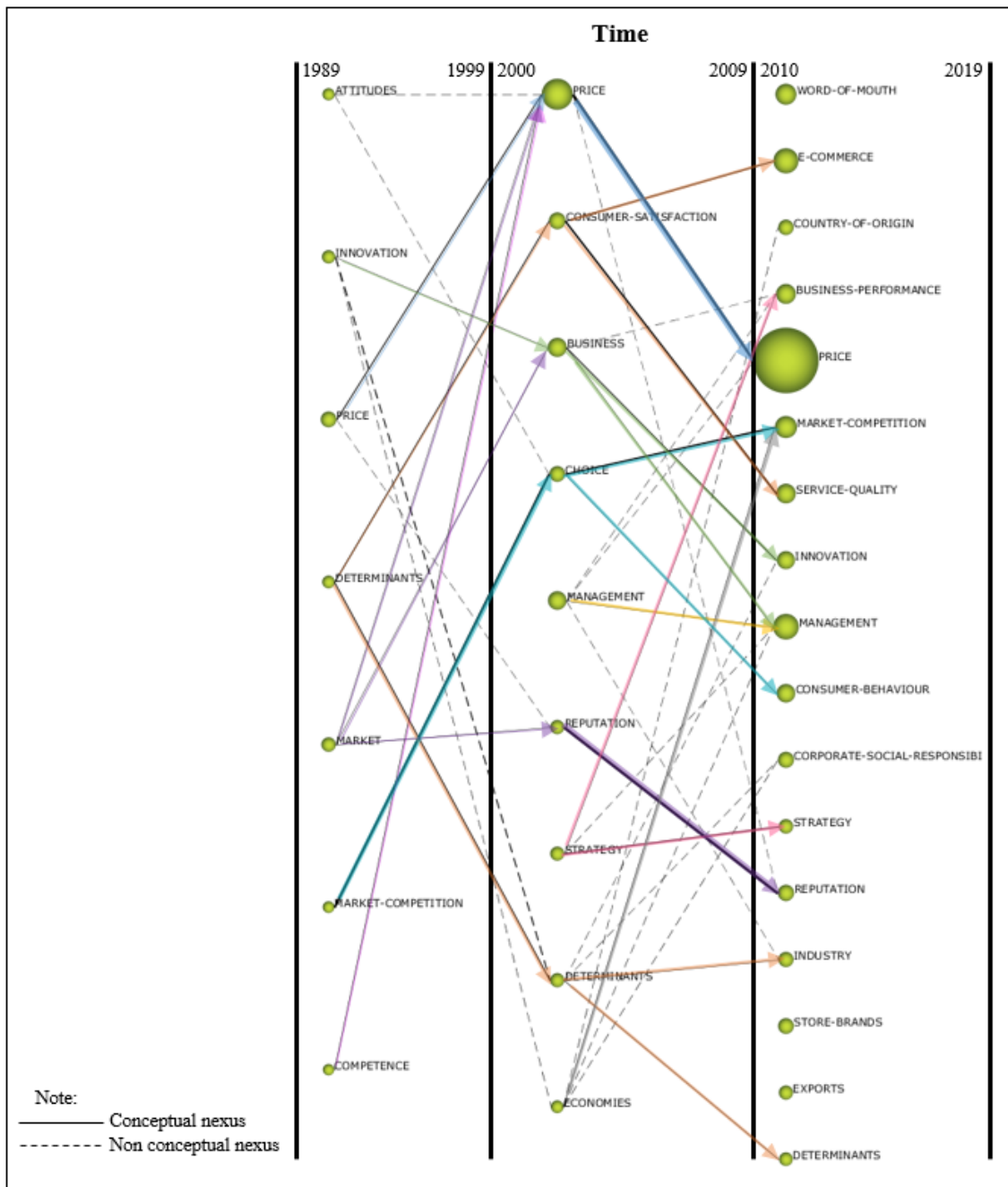**Fig. 6.** Strategic diagram corresponding to the decade of 2010-2019.

Fig. 7. Thematic areas and evolution of product quality in the field of business throughout the three last decades [1989-2019].

Figure captions

- **Fig. 1.** Number of documents published by year over the last three decades on the subject of product quality.

- **Fig. 2.** The strategic diagram and thematic network (Cobo et al., 2011).

- **Fig. 3.** Number of published documents on the subject of product quality by country.

- **Fig. 4.** Strategic diagram corresponding to the decade of 1989-1999.

- **Fig. 5.** Strategic diagram corresponding to the decade of 2000-2009.

- **Fig. 6.** Strategic diagram corresponding to the decade of 2010-2019.

- **Fig. 7.** Thematic areas and evolution of product quality in the field of business throughout the three last decades [1989-2019].