MODEL TO EVALUATE CUSTOMER SATISFACTION IN E-COMMERCE THROUGH MULTI-CRITERIA AND SEMANTIC ANALYSIS

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DEDICATION

I dedicate this work to God who always guides my actions and to my daughter Karol Daniela, who is the person who motivates me every day to get ahead and inspires to teach her that dreams come true with discipline and effort.

For you!

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ABSTRACT

The evaluation of customer satisfaction is a subject that has been studied for a long time, since the need to know the customer and understand him does not stop, rather, it is in constant evolution. Companies are increasingly concerned about continually improving and pleasing their customers, which is why the need arises to understand those factors that intervene in the perception of satisfaction independently and analyze them as a whole, so that from these areas for improvement in specific aspects of the operation can be identified. Social networks have become essential allies for commerce and the use of this channel is a differentiating factor for the success of a business, since more people can be reached in less time and at low cost, they provide updated, nurtured and spontaneously information, and additionally provides real data on customers, competitors and the market. All these data are beneficial for the process of evaluating customer satisfaction, therefore, this work presents a multicriteria evaluation model, where in the first instance it extracts the comments made by customers on the social network Facebook, semantically organizes them and It analyzes them against 7 objective evaluation criteria: security, information, product or service, logistics distribution, site design, customer service and usability, these criteria have a weight calculation that varies according to the importance perceived by customers. The model was applied to two e-commerce platforms, Mercado Libre and Linio, to determine their performance. The results of the evaluation show close averages, however, Linio with a little more than half (55%) had better results. This work shows that social networks capture quite interesting textual data, that by structuring them in logical components and when it is analyzed, allows decision-making supported by data, which generates business knowledge and helps in business intelligence

Keywords: E-commerce, customer satisfaction, social networks, semantic analysis, multi-criteria decision making.

1. INTRODUCTION

E-commerce is constantly growing both nationally [1] and globally [2], due to the important benefits it provides to customers and sellers, where it is located, the convenience generated by virtual stores, the savings in time and money by being able to access and offer a wide variety of products, services and brands, as well as discounts and promotions in an easier and more massive way [3]. This growth goes hand in hand with the entry of new competitors, broadening of customer expectations and the production of large amounts of data throughout the value chain.

The knowledge base of business intelligence lies in the ability to analyze the information that surrounds its actions and guide it to make decisions quickly that allows it to adapt to changes in the environment [4]. In the last 10 years, the management and treatment of information has evolved, going from being an operational by-product to becoming a strategic concern for senior management [5].

In the field of e-commerce, companies must take care of both their administrative and operational activities, as well as the arduous task of staying in the virtual market since there is no limit to competition there. In this context, it becomes even more important to manage customer satisfaction, otherwise you can quickly change and replace your preferred store with another that meets your needs. The evaluation of customer satisfaction is no longer done through customer surveys [6] because these techniques can fail to predict the consumer's mindset towards the product [7]. Now, open customer reviews are recognized as fruitful sources of information to monitor and improve satisfaction levels, particularly because they convey the real voices of real customers expressing relatively unequivocal opinions [6].

One of the sources that is generating large amounts of information are social networks, because today companies and especially electronic commerce have a presence there and their analysis becomes a challenge for researchers since the content generated by users have unstructured data and often do not comply with grammatical or lexical rules [8]. However, they have an important impact in the field of business, since they explain consumer behavior on commercial proposals, services and particular products [9] which can be expressed through reactions, such as "I like", " makes me sad ”or“ annoys me ”, etc., also through actions such as sharing the content, following the page or recommending it, and also through comments represented in textual data, all these expressions allow us to understand the relationships between the client and the business.

The most common use of social network analysis is to extract customer opinion to support marketing and customer service activities [9] which is the focus of this degree project, whose main objective is to formalize a model to evaluate satisfaction of the client in electronic commerce through multicriteria and semantic analysis in social networks. Before doing so, the research question will be answered, which is divided into two parts, the first is aimed at understanding what are the factors that generate customer satisfaction in

electronic commerce and the second, how to assess the level satisfaction perceived as the effect of purchasing a product or acquiring a service.

This work takes as an object of investigation two electronic commerce platforms that have a presence in Colombia, seeking to carry out an objective multicriteria measurement, based on 7 variables that base the perception of customer satisfaction. The main input of this research are the opinions found in social networks, which will be structured in their semantic form and located in variables and sub variables to be evaluated logically.

The type of project is framed in applied scientific research, the results of which will provide new knowledge on the evaluation of customer satisfaction in electronic commerce and enable the continuation of other lines of research in the future. The proposed model based on multicriteria analysis and customer comments will help companies to know the points of view of their customers in a quantitative way, identify their critical factors and those of the competition, in such a way that the decision-making process be more successful and reliable.

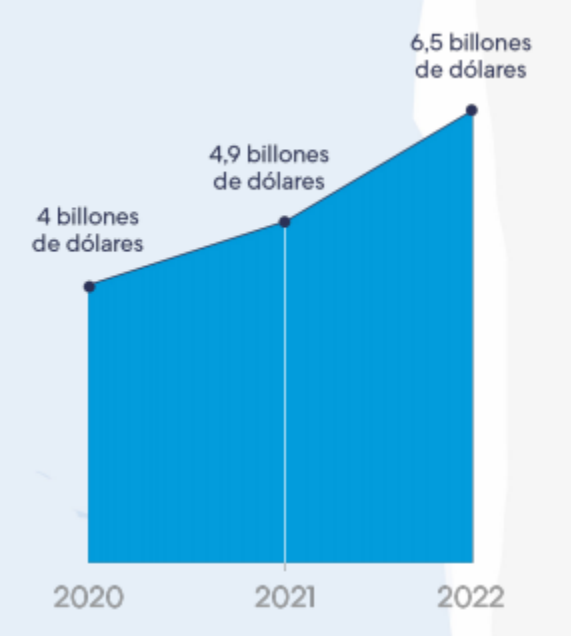
This work has been structured in twelve chapters: in Chapter I, the subject is introduced; then, in chapter II the state of the problem is presented; Chapter III establishes the objectives to be met; later in chapter IV, the main concepts to work on are framed; in chapter V, the theoretical considerations are deployed; Chapter VI, delves into the state of the art; then in chapter VII, the methodology that will be carried out in this investigation is revealed; in chapter VIII, a technological surveillance of the evaluation of customer satisfaction is carried out; in chapter IX, an ontology of electronic commerce is constructed; then in chapter X the results of the investigation are presented; in chapter XI, the conclusions are presented and finally it ends with in chapter XII, future works.

2. PROBLEM STATEMENT

Organizations that implement electronic commerce as one of their sales channels are motivated, among other things, by generating lower operating costs and greater profitability. Electronic commerce is a necessity, not only because of the benefits it generates for companies, but also because the consumer is asking for it, their purchase decision and the materialization of that decision are being made through electronic means [10].

E-commerce is a great opportunity to grow a business. This statement is based on the annual electronic commerce report delivered by Nube Commerce, the largest electronic commerce platform in Argentina, who comments that e-commerce worldwide, had a turnover of almost 3 billion dollars in 2018, had an increase of 17% for 2019, that is, 3.5 trillion dollars and it is expected that the increase will continue to be maintained in the coming years as shown in the following graph [11]:

Figure 1. E-commerce billing expectation

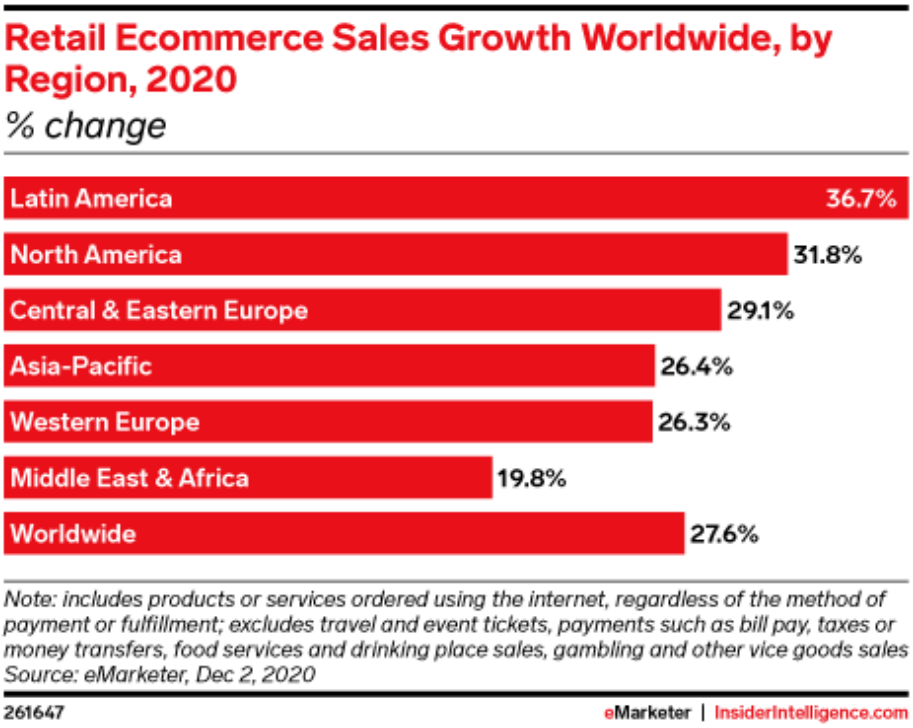


Source: [11]

The expectation of Nube Commerce is ratified by the report of the Cámara Colombiana de Comercio Electrónico, which confirms that, as a result of the pandemic, between the months of January and August 2020, non-contact purchase transactions had an average increase 25.3% compared to 2019, despite the fact that the commerce sector in Colombia received a negative impact as a result of the measures taken to contain the COVID-19 virus. Electronic commerce in Colombia is expected to close in 2021 with an increase of 16% compared to 2020 [1]. These national results are consistent with the global outlook,

where retail e-commerce sales grew 27.6% during the year, for a total of $ 4.28 trillion. The following graph shows the behavior in sales worldwide, where Latin America experienced abnormally outstanding growth (36.7%), followed by North America with 31.8% and Central Eastern Europe with 29.1% [2].

Figure 2. Global performance of e-commerce in 2020



Source: [2].

Despite the promising outlook expected for electronic commerce, the difficulties faced by companies that are in this electronic sales channel cannot be ignored. For example, in a study carried out in Venezuela, 70% of companies that use electronic commerce are especially satisfied in aspects such as the quality of the platform and the technological change that translates into shorter delivery times for the company, operating costs, improvement in corporate image, company value, market share, competitive advantages, operational logistics and the balance between supply and demand, however the remaining 30% are unsatisfied, derived from the fact that they have had difficulty in achieve sales, profit and customer acquisition goals [12].

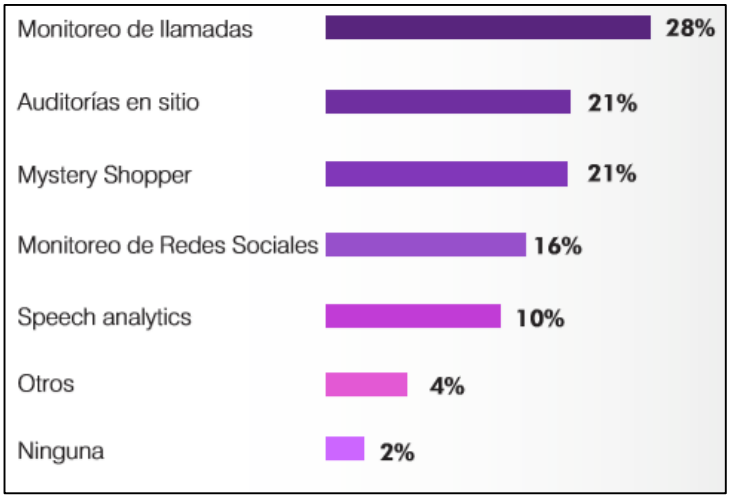
To achieve a good result in customer acquisition, e-commerce must focus its work on four pillars: infrastructure and platform, 360 marketing, logistics and customer service [10]. It is said that in e-commerce there are no bad media, but bad executions or markets not suitable for those media [13].

Marketing specialists know this, which is why 82% of those surveyed in a study conducted in the United States hope to increase their investment in digital media. Social networks were ranked as the most important channels (73%). However, they report that the proof of the effectiveness of digital media remains unclear, even more so when only 26% of respondents know how to accurately quantify the ROI (Return On Investment) of these media [14]. If marketers are not confident in their ability to measure investment returns in electronic environments, inaccurate, questionable, or false reports are submitted [15].

In the same sense, nine out of ten (91%) marketing specialists consider that market research, as a tool to obtain information and make decisions, is beneficial for marketing, however, this does not mean that everyone feels capable of run it. In the research of S2 Research, respondents evaluated their own capacity, finding that only 56% handle marketing metrics, 55% surveys, data analysis 55%, advertising and marketing tests 53%, audience segmentation 53%, focus groups 52% and secondary research 52% [16].

In the study carried out by the Universidad de la Sabana, in which senior executives of medium and large companies in Colombia, located in the cities of Bogotá, Medellín, Cali, Cartagena and Bucaramanga were interviewed, it showed that 69% of the companies make use of traditional techniques for measuring customer experience (call monitoring, on-site audit, Mystery Shopper) and only 26% apply more robust measurement tools such as Social Media Monitoring (16%) and Speech Analytics (10 %) [17].

Figure 3. Customer experience measurement techniques



Source: [17].

Data analysis bias, metric selection, data noise, and unstructured data are challenges faced by companies with a presence in electronic media [18]. It is evident, shortcomings at the time of drawing conclusions and making corresponding decisions about the results obtained, sometimes, because companies do not know how to link the results of the studies with their processes, on other occasions, the fault is that there is no will actual improvement

or change and the reports with the results are left in a drawer [19], also because companies receive sales numbers, and they believe that comparing these numbers with the evaluation criteria reflects how satisfied the customer is [20].

Carrying out a good evaluation of customer satisfaction will help companies to understand consumer behavior and know their strengths and weaknesses so that they can implement a series of effective measures [21] and thus be able to capitalize on that knowledge generated by the results obtained.

Traditionally, the measurement of customer satisfaction has been carried out through customer surveys [6] or interviews [22] where customers are regularly asked to give their feedback to the company using previously established scorecards, quantifying the level of performance provided by the company, but the client is not allowed to give free feedback on the level of perceived satisfaction [20]

Employing an interview method has relevant advantages, such as the ability to ask complex questions, clarify questions, control samples and control quality, but on the other hand, it has its disadvantages, such as costs, the possibility of interviewer bias and a longer duration of data collection [22] and the static and instantaneous expression that gives a superficial appreciation of the consumer in a single moment [23].

Companies want to accurately predict the behavior of buybacks, but it may not be enough to know if the response from customers is positive or negative; rather, researchers must functionally and adequately discover how to make predictions and perform analyzes on the resources allocated to customer satisfaction management [24] and it would be enough to follow the long-term results, observe if the level of satisfaction has increased or decreased compared to previous promotions of the same product [25].

For many years it has been said that collecting useful, reliable and up-to-date information necessarily requires a lot of time, effort and money. However, to solve this problem, today there is a wide range of theoretical methods and tools that allow the level of customer satisfaction to be measured automatically or semi-automatically [6].

From a methodological point of view, it is clear that new methods such as sentiment analysis [6], social network monitoring, website tracking, among others, will not completely replace traditional methods [23]. On the contrary, it is necessary to look for a combined approach of methodologies that offer greater benefits to the business objective in an iterative way, without saying that one is better than the other since they are complementary.

The monitoring of the different channels used as a means of sales or communication with customers, contain valuable information for organizations, their comments allow to improve decision-making in terms of productivity, design of new products or services, understand market conditions and of the competition, and especially for this study, allows to know the levels of satisfaction with the brand. This is where the question of the present investigation arises: What are the factors that generate customer satisfaction in electronic commerce

and how to evaluate the level of satisfaction perceived as an effect of the purchase of a product or acquisition of a service?

There is then evidence of the opportunity to investigate the use of modern tools for data extraction and subsequent evaluation of customer satisfaction in electronic commerce and to know their feeling after the sale of a product or the provision of a service, which can be of great help to evaluate the success of an e-commerce, especially when the technological and cultural revolution is in the hands of new methods to improve online reputation [26].

3. OBJETIVES

3.1 GENERAL OBJETIVE

Establish a model to evaluate customer satisfaction in electronic commerce through multicriteria and semantic analysis in social networks.

3.2 SPECIFIC OBJETIVES

- Characterize the attributes of the entities, procedures, metrics and trends regarding the evaluation of customer satisfaction in electronic commerce through a technological surveillance exercise.

- Formalize a data semantics in at least one social network to locate them in logical components that enable the evaluation of customer satisfaction.

- Identify the components of events extracted from social networks and evaluate the level of customer satisfaction

4. CONCEPTUAL FRAMEWORK

4.1 MARKETING

For Peter F. Drucker, marketing is the process through which the economy is integrated into society to satisfy human needs and is one of the most powerful levers to turn danger into opportunity. Marketing makes producers capable of producing marketable products, providing them with standards, quality demands and specifications for their products; makes the product can be taken to the markets instead of appearing on the road; and makes the consumer capable of discriminating, that is, of obtaining the highest value for their purchasing power [27].

Kotler & Armstrong, 2003, define marketing as the business function that identifies the needs and wants of customers, determines the target markets that can best serve the organization, and designs the appropriate products, services, and programs to serve those markets. Their goal is to profitably create customer satisfaction by forging value-laden relationships with important customers [28]. It is based on a set of research techniques associated with the strategic analysis of the markets and marketing techniques associated with the operationalization of response actions towards the markets [29].

It is speaking of traditional marketing, which is based on the well-known 4P's variables, in which the strategies are oriented on the product, price, place and promotion. On the other hand, it is speaking of modern marketing or digital marketing, which is framed in the 4 F's, flow, functionality, feedback and loyalty [30]. Marketing can be seen from different perspectives, but in general it is a tool for studying and understanding consumer needs and desires, in such a way that companies establish strategic and operational actions aimed at providing benefits that add value [31].

After this, it can be said that the strategic and operational development of marketing has made possible the appearance of multiple commercial opportunities for the growth and expansion of organizations at a global level, until the fact that the physical presence of companies ceases to be indispensable and is complemented and even replaced by the presence on the web [32].

4.1.1 Digital Marketing. The era of one-way advertising, known with the concept of push that was aimed at a passive audience is less and less conceived, now, thanks to the worldwide web, they are focused on pull-marketing, whose model is bidirectional and its multimedia capabilities make it a powerful interactive tool [33]. For this reason, the marketing techniques developed in an offline environment are reconfigured and adapted to guarantee their usefulness in an online scenario [32]**.**

Digital marketing consists of all the marketing strategies carried out through the web [30], through the use of digital or social channels to promote a brand or reach consumers. This type of marketing can be done on social media, search engines, the internet, mobile

devices, and other channels. Requires new ways of marketing to consumers and understanding the impact of their behavior [34].

4.1.2 Marketing 360. Marketing cannot be taken in parts since the essential characteristics are lost, so it must be studied as a whole. In the same sense, the term 360 refers to the degrees that a circumference has that encompasses the totality of something, then, it is called 360 marketing, where online, offline, the most traditional and the most innovative strategies are implemented ... "anything goes " [35].

In summary, the objective of 360 degree marketing is to reach its target audience, with the difference that it seeks to achieve it using traditional and digital channels [36], it includes all the communication tools available to companies, such as: media (television, radio and press), traditional advertising (billboards, business cards, roll-ups, etc.), public relations (commercial visits, commercial calls, letters, email marketing, etc.), online advertising (banners, SEM, etc.) blogs, social networks, etc. [37].

4.2 E-COMMERCE

Increased competitiveness, constantly changing consumer expectations, increased supplier capacity, and technological advances have forced considerable changes in the way of doing business [38]. An example of this is that while traditional commerce is characterized by the participation of a large number of intermediaries, in electronic commerce, the producer can send the product directly to the consumer [39].

E-commerce is the use of information technology and telecommunications, which support the transactions of products or services between companies, between companies and individuals, or with the state [38]. It includes all those commercial transaction systems that are carried out electronically through the networks available on the internet and that use electronic money as modes of exchange [32].

The field of electronic commerce is very broad, both in terms of activities and technologies, as far as activities are mentioned: contact between customers and suppliers; exchange of information, goods and services; online provision of digital content; electronic payments; union of virtual organizations; sharing of business processes between an organization and its collaborators; provision of online services; public procurement; auctions; and pre-sale and after-sale services. On the other hand, with regard to the technologies used, the following stand out: email, fax, multimedia, directories, electronic transfer of funds or electronic exchange of documents [40].

E-business must be distinguished from e-commerce, since, although they are related terms, they are also different terms. E-commerce covers the processes by which it seeks to carry out transactions with consumers and suppliers, including activities such as sales, promotion, order taking, delivery, consumer services and consumer loyalty management. For its part, e-business includes e-commerce, but also covers internal processes such as

production, inventory management, product development, risk management, finance, human resources, strategy development and negotiations, all based on development Internet, Intranet and Extranet [38].

E-commerce allows the use of technology to obtain advantages over the competition, fundamentally in two aspects: decision-making and the provision of services to customers. In such a way that e-commerce allows to rethink the objectives in the company with a clear strategic direction, facilitating the creation of new products and markets, new distribution channels, reducing the cost of business activities and favoring the opening of new markets [41].

Due to the growth, fame, diffusion and integration of new technologies that electronic commerce has in the world, the following types of electronic commerce stand out:

4.2.1 E-Commerce B2C (Business to Consumer Transaction Orientation). It is the transaction between business and the consumer, it allows a personalized relationship between seller and consumer, favoring loyalty and the effectiveness of the sale. The channel allows collecting information about the consumer (their interests, preferences and needs), carrying out transactions and having secure means of payment [38].

4.2.2 E-Commerce B2B (Business to Business Transaction Orientation). It refers to trade between companies. In this, the short-term sale may not be the primary function, but it favors the establishment of collaborations that benefit both [38].

4.2.3 E-Commerce C2C (Consumer to Consumer Transaction Orientation). It refers to trade between consumers, basically auctions, where consumers offer and buy different products among themselves through the network [38].

4.2.4 E-Commerce Bs y Ss Digital (Production Orientation). It refers to the production of digital goods and services, it is one of the most complete forms used by some industrial sectors, such as those that develop software. Not only is there a communication channel for shipments, suggestions, etc., but it is complemented by a distribution channel: all the elements that make up the trade are electronically integrated, lowering costs and reducing delivery times, thus obtaining a competitive advantage over others [38].

4.2.5 E-Commerce G2C (Government to Consumer). With regard to the public sector, the Government - adapting its structure and its way of operating to the guidelines dictated by new technologies, will be able to apply the principles of electronic commerce to its operations as a provider of goods and services. Thus, the actions of the public administration will be improved through the use of new systems in the area of information technology and telecommunications; more efficient management and simplification of procedures will be achieved that will benefit the national economy as a whole [38].

4.2.6 E-Commerce G2B (Government to Business). This modality allows a more personalized relationship between the State and the companies. Companies can obtain

government information, pay their tax obligations and access business opportunities through competition or tenders [38].

4.3 SOCIAL MEDIA

Social networks are a group of applications that, built on the ideological and technological foundations of web 2.0, allow the creation and exchange of user-generated content. Social networks allow users to connect either, creating profiles of personal information, inviting friends and colleagues to access those profiles, sending emails or through instant messages between them [42]. Thus, social media sites and services began to develop in 1997 with the Six degrees social network, which allowed its users to create a profile, list their friends and add friends of their friends to their lists [43].

The technological developments of social network platforms have simplified, in addition to social communication, the exchange of goods and services, allowing the collaborative economy [44]. In addition, it has been given business use allowing the dissemination of information in terms of viral marketing and online word of mouth [45] since consumers perceive social networks as a more reliable source of information about brands than the content generated by the marketers [46].

Until a few years ago, the main barrier for someone who wanted information to spread throughout a community was the cost of the technical infrastructure needed to reach large numbers of people. Today, with widespread access to the Internet, this bottleneck has been largely removed. [45].

Social media platforms are also known as online collaboration platforms due to the communication, creation and consumption of peer-to-peer information between online users [44], which can be classified depending on their format (text, audio, images or video) [47] in Social Network Sites SNS, weblogs, portals to share images, also as online communities, among others [45]. Here are some types of social networks:

4.3.1 Collaborative projects. They are websites that allow users to add, delete, and change text-based content. These collaborative projects allow the joint and simultaneous creation of content by many end users [42]. Within these, there are the online collaborative encyclopedias, for example, Wikipedia [44].

4.3.2 Blogs. They are special types of websites that usually display dated entries in chronological order, are usually managed by a single person, but offer the possibility of interacting with others by adding comments. A blog can describe the life of the author or contain summaries of relevant information about a specific content [42].

4.3.3 Micro-blogging. It is a form of blogging in which the posts usually consist of short content, such as phrases, quick comments, images or links to videos [45]. The micro-blogging phenomenon focuses on providing real-time updates [43]. One of the best known is Twitter, which is related to various topics around the world [9].

4.3.4 Content Communities. The main objective of content communities is to share multimedia content between users. Content communities exist for a wide range of different types of media for sharing books (eg Book Crossing), photos (eg Flickr), videos (eg YouTube), and PowerPoint presentations (eg Slideshare) [42].

4.3.5 Social networking sites. They are applications that allow users to connect by creating profiles of personal information, inviting friends and colleagues to access those profiles. For example, Facebook or MySpace [42].

4.3.6 Virtual worlds. They are platforms that replicate a three-dimensional environment in which users can appear in the form of personalized avatars and interact with each other as they would in real life. They offer a multitude of opportunities for companies in marketing (advertising / communication, sales of virtual products / v-Commerce, market research) and management of internal processes and human resources [42].

4.3.7 Virtual game worlds. They require their users to behave according to strict rules in the context of a massively multiplayer online role-playing game. For examples from 'World of Warcraft [42].

4.3.8 Virtual social worlds. It allows the inhabitants to choose their freest behavior and essentially live a virtual life similar to their real life. It has been shown that, with the increase in the intensity of use and consumption experience, users or "residents", as they prefer to be called, show a behavior that is closer and closer to real life. The most prominent example is Second Life [42].

4.4 CUSTOMER SATISFACTION

Satisfaction is described as the evaluation of an emotion that reflects the degree to which a consumer believes that the possession and / or use of a service evokes positive feelings ((Hunt, 1977 and Rust and Oliver, 1994) cited by [41]. Satisfaction refers to an emotional state of mind after exposure to the opportunity to interact with an attribute, which is purely experimental [48]. It is a subjective variable that arises from feelings, perceptions and comparison of what clients obtain with what they hope to obtain [25] that feeling that their request has been satisfied depends on the perception of the clients about the products or services compared to their expectations [49].

From the customer's perspective, satisfaction is a specialized form of evaluation to determine the value of what is used or provided. From a business perspective, satisfaction is a critical element of consumer retention that leads to a successful long-term relationship with consumers, as it is a particularly important foundation for a successful long-term relationship. [50].

Consumer satisfaction brings with it benefits for the organization such as, a) increased loyalty; b) keeps customers away from the efforts of competitors; c) reduces the costs of future transactions; d) reduces costs to attract new clients and e) contributes to the reputation of the firm. Additionally, satisfied customers are more willing to pay for the benefits they receive and are more tolerant of price increases (Reichheld and Sasser, 1990 and Fornell 1992 cited by [51].

There is a very fine line between satisfaction and dissatisfaction, since the satisfying components are factors that satisfy, excite and motivate [48], however, these factors can be influenced by the different thresholds or tolerance levels that buyers have [24], thus, dissatisfaction may be due to inherently poor service, or perhaps the continuation of a previously acceptable level of service that no longer meets customer expectations due to competitive marketing of improved standards or changing customer tastes [52]

Consumers' behavioral intentions are directly determined by satisfaction, value and quality of the service and are indirectly related to each other, since it has been proven that both the quality of the service and the value of the service lead to satisfaction. and satisfaction is generated through good quality and perception of value. Therefore, in any study a simultaneous and multivariate analytical approach must be assumed, since establishing initiatives to improve only one of these variables is an incomplete strategy if the effects of the others are not considered. [53].

The power of feedback is important when analyzing the satisfaction of customer needs and expectations, since doing it in a traditional way through surveys of a large number of groups and subgroups of the market is a difficult task. However, for this is the internet and the importance of the third F of digital marketing (feedback) since it gives the opportunity to get the information saving hundreds of thousands in research [33].

4.5 ONTOLOGY

An Ontology is a formal representation of the relationships between one or more concepts, referring to a particular domain. They provide information and/or knowledge on a specific topic, which can be easily shared among other people or even other machines or programs [54]. For the Semantic Web realm, an ontology defines the common words and concepts used to describe and represent an area of knowledge. This implies the definition of domain objects, relationships between them, properties, functions and processes that involve the objects, restrictions and associated rules [55].

Ontologies are classified into 6 categories: Domain Ontologies that only specialize in a specific domain; Metadata Ontologies that describe the content of online publications and serve to describe information, content and other special characteristics of some data or content; Generic ontologies that are based on organizing or representing knowledge in general, providing a basic notion about the topic to be treated; Representative ontologies which do not refer to a specific domain, but rather represent anything that you want to represent by means of an ontology; Method and task ontologies that define the key tasks, their inputs and outputs in a process; and method ontologies that provide the base terms in order to use or apply Problem Solving Methods (PSM) [54].

Generally, the definition of an Ontology involves the following elements: the classes that contain the concepts, sets, collections, or types of objects; the Instances: involving individuals or objects; the relationships that represent the way objects interact; properties are the attributes that objects can have and share; [55][56] constants are numerical values that do not change over a long period of time; formal axioms are always true logical expressions that are often used to define constraints in ontology; rules are used to infer knowledge in the ontology, such as attribute values, relationship instances [56].

The ontology is used as a transition between the semantics of the behavior of a process and a specific domain language, in this process a conceptual framework is established for the transition from a model to a meta model [57].

5. THEORETICAL FRAMEWORK

5.1 CUSTOMER SATISFACTION MEASUREMENT MODELS

Among the best-known customer satisfaction measurement models are those from the schools presented below:

5.1.1 Nordic School. It is based mainly on models that identify the factors that intervene in the quality of the service and their interrelationships. One of them is the service quality perception model that starts from the difference between perceptions and expectations within three dimensions (technical quality, functional quality and corporate image). The Grönroos - Gummesson Quality Model combines the previous model with the 4Q model, which are the four influencing qualities in the quality perceived by customers: that of design, production, delivery and relationships and the way in which they are managed. Now, the Eiglier and Langeard Model introduces the concept of servuction, which refers to the process of creating the service, concentrating it on the elements of physical support, personnel and customers and the relationship between these three factors. Then the Three Component Model of Rust and Oliver (1994) was known, which is based on the Grönroos model and summarizes the quality of service in the result of the service, the delivery of the service and the service environment. The hierarchical service classification model presented by Brady and Cronin in 2000, is a qualitative model and establishes 3 levels, in the first level appear the global perceptions of the quality of service that customers have; in the second level the primary dimensions, and in the third level are the subdimensions. However, these models do not show a methodology for evaluating customer satisfaction. [58].

5.1.2 American school. It is based on quantitative models. The SERVQUAL model presented by Parasuraman, Zeithaml and Berry in 1985, allows to measure the perceived quality of the service through the theory of Gaps or discrepancies and allows to measure the satisfaction that customers obtain for the service provided, through the difference between the expectations and perceptions of customers, by evaluating 5 dimensions: Tangible elements, Reliability, Responsiveness, Security and Empathy. The SERVQUAL questionnaire contains 22 questions and its result can give: Low level of quality or Expectations> Perception, when the perceived quality does not generate satisfaction and tends towards an unacceptable quality with divergences between expectations and perception. Moderate level of quality or Expectations = Perception, when the perceived quality is satisfactory. Y High level of quality o Expectations <Perception, when the perceived quality generates great satisfaction and this makes it tend towards the ideal quality with an increase in the difference between perceptions and expectations.

The SERVPERF Model was developed by Cronin and Taylor in 1992, it says that service quality should measure customer service perceptions and not like the SERVQUAL model that takes into account both expectations and perceptions for this measurement, they concluded that customer satisfaction is the product of the quality of the service and that this influences the customer's purchase intention. Teas 1993's Evaluated Performance Model

(EP) focuses on evaluating perceived quality through attributes that can be defined through a quantitative approach. The Standardized Quality (NQ) Model proposed by Teas (1993) measures the perceived quality of the service provided by comparing the quality of a product or service with respect to an excellent product or service, this is a gap or discrepancy of the standardized quality [58].

5.2 CUSTOMER SATISFACTION INDICES

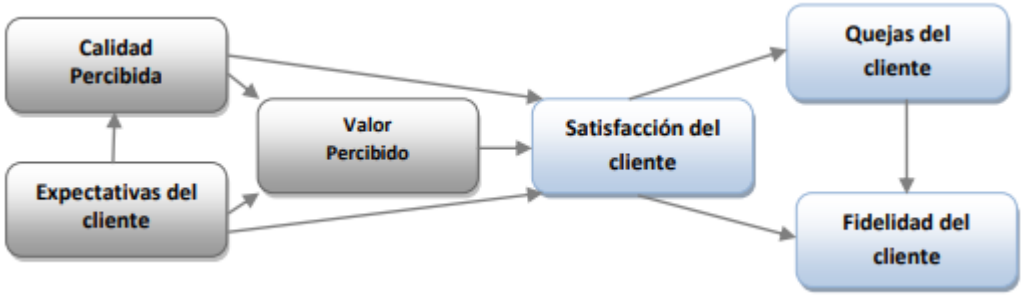
5.2.1 Swedish Index - SCSB Model. (Swedish Customer Satisfaction Barometer) was developed in 1989 by the University of Michigan-National Quality Research Center. This model focuses on the one hand on causal variables, such as expectations and perceptions, and on the other hand, variables of loyalty and defects, such as complaints and claims. Through a survey, the variables are evaluated on a 10-point scale, the result of which forms the satisfaction variable. The main characteristic of this model are the multiple equations that correlate the value and perception of quality with the satisfaction and loyalty of customers [58].

Figure 4. SCSB Model

Source: [58]

5.2.2 American Index - ACSI Model. (American Customer Satisfaction Index 1994). Like the SCSB model, it has been measured in telephone surveys, but adds other components: a) customer expectations, refers to the assumption of customers about the quality of the service or the product offered by the company, this is formed through from the previous consumer experience, non-experiential information such as advertising, word of mouth communication, among others; b) Perceived quality, is evaluated by the client through the experience of consumption of the products or services offered by the company; c) perceived value, is the comparison that the client makes between the quality and the price, the client evaluates what he expected from the product or service and what he really received compared to the purchase price; d) Customer complaints are a measure of dissatisfaction, since they negatively influence customer satisfaction; e) Customer loyalty refers to the probability of repurchase by the customer in the future, this primary factor since if the result is negative there is a probability that the customer will buy from the competition [58].

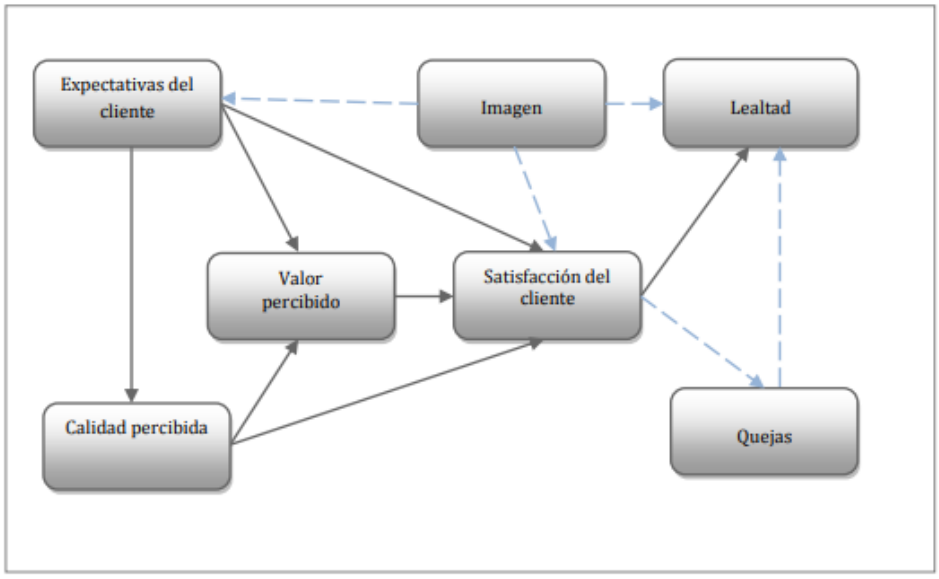
Figure 5. ACSI Model



Source: [58]

5.2.3 European Index - ECSI Model. It was created in 1999, it contains seven interrelated variables, the traditional latent variables based on the perceived quality of products and services, customer expectations, perceived value (relationship between quality and price), customer satisfaction and loyalty, and for its part, the optional latent variables are, the image and the complaints [58].

Figure 6. ECSI Model

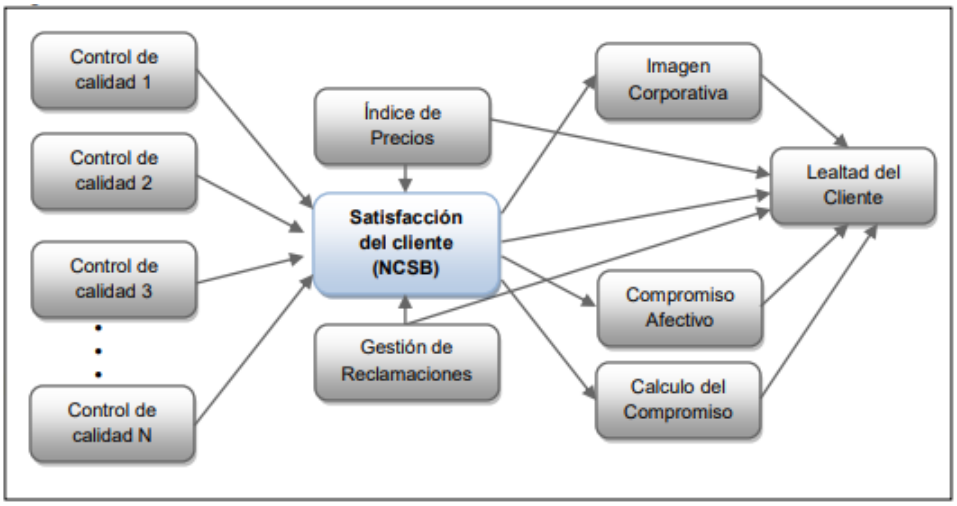


Source: [58]

The variables that are observed on the left side of the figure, lead to the Customer Satisfaction Index and the variables on the right side (loyalty or complaints), are the performance indicators as the consequence of satisfaction

5.2.4 Norwegian Index - NCSB Model. Developed in 1994 - 1995, it allows discovering the degree of customer satisfaction through surveys. The first model is similar to the ACSI model, except that it includes the corporate image and its relationships with customer satisfaction and customer loyalty. The NCSB identifies the total customers of the buyers and then identifies the company in which the customer has bought or consumed instead of taking the list of customers of an identified company. The second model developed by Johnson et al. (2001), replaces the variable of value for price, replaces customer expectations with corporate image, also incorporates the potential effects of price on loyalty and includes the handling of complaints as a satisfaction and loyalty builder [58].

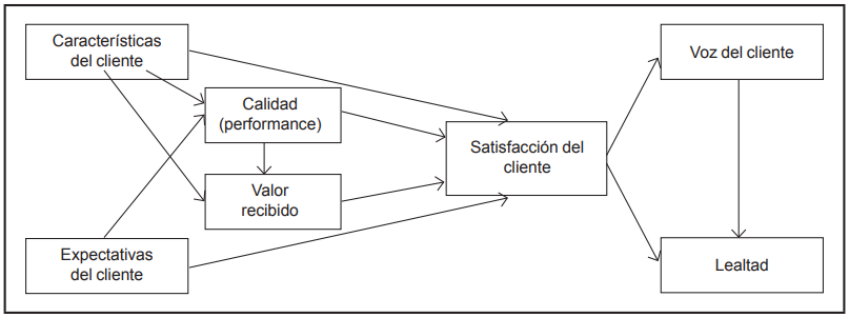
Figure 7. NCSB Model



Source: [58]

5.2.5 Hong Kong Index - HKCSI Model. It was developed by Chan et al. (2003). The main difference of the model is that it focuses on the evaluation that customers make of their experiences of consumption of specific products and brands and not on the evaluation of a company. The methodological process to establish this index at the macro level is based on estimating the perceptions of consumers at the product level and then, from the individual indices obtained, carry out an aggregation process and obtain evaluations by product categories, and subsequently a global index [59].

Figure 8. HKCSI Model

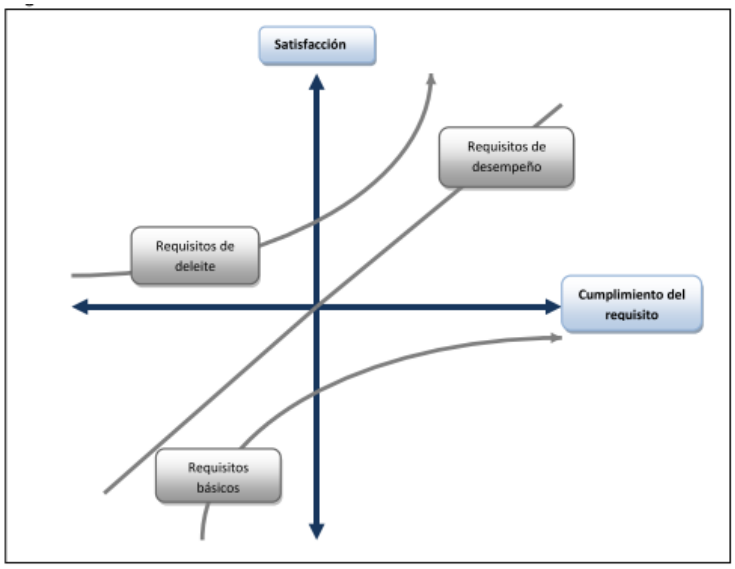


Source: [59]

5.3 OTHER MEASUREMENT MODELS

5.3.1 Kano Model. Attractive quality creation model, developed in 1984. The model can be applied to products, services, business processes and even software. Customer preferences are classified into three categories, the first refers to performance factors or reactive quality, since customer satisfaction increases or decreases proportionally according to the quality components that are provided. The basic factors or the duty to be are expected by customers and therefore do not generate satisfaction, but if there is non-compliance with any of them, it will generate dissatisfaction. Factors of delight or attractive quality, are related to innovation or added value to the customer, when they are missing they do not cause dissatisfaction, but if it is executed, it is a differentiating factor from the competition and customers will be very satisfied [58].

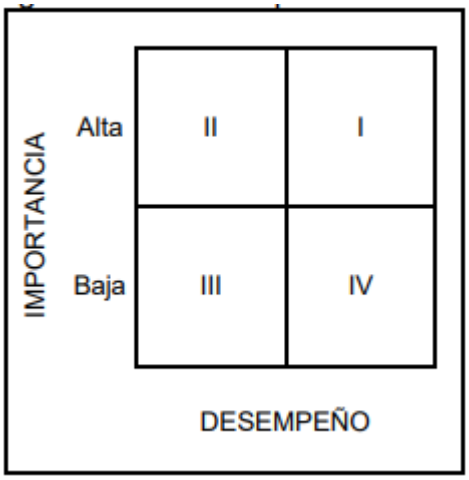
Figure 9. KANO Model



Source: [58]

5.3.2 IPA Model. Importance-performance analysis model, was developed in the 70's, the model identifies strengths and weaknesses through two factors (relative importance of attributes and evaluation of the offer). The values of the attributes are taken as coordinates within a scale of importance-performance. The first quadrant shows high performance and importance, the second quadrant low performance and high importance, the third quadrant low performance and importance and the fourth quadrant high performance and low importance, the results are used for the formulation of strategies from of the identification of the weaknesses and strengths found in the matrix [58].

Figure 10. IPA Model



Source: [58]

5.3.3 MUSA. (multicriteria Satisfaction Analysis) was created by Evangelos Grigoroudis and Yannis Siskos in 2003, in this model customer satisfaction is evaluated by breaking down customer preferences through ordinal regression analysis. The data is obtained from a satisfaction survey, as the model assumes that overall customer satisfaction depends on the characteristics of the service, the result is a function made up of the sum of the customer's perception of the different characteristics of the service in which global and partial satisfaction are denoted as Y * and X * respectively all this using linear programming techniques [58].

5.3.4 PRIEX Method. (Prioritization of Expectations) was created by Aguiar Laurenciano 2001 in Brazil, in this case, the expectations of new clients are determined and prioritized, it is based on the method of interviews in focus groups and takes some items from the SERVQUAL and QFD methods. This method is divided into eight stages: 1) Knowledge of the clients' socio-economic aspects. 2) Preparation of the questionnaire. 3) Determination of the participants in the focus groups. 4) conducting the pilot test of the questionnaire; 5) Preparation of the interview; 6) Interview of the focus groups; 7) Interpretation of the results; and 8) Presentation of the conclusions obtained. Taking into account that it is a method to analyze new clients and prioritize them, it is concluded with a roadmap for the interested researcher [58].

5.3.5 Service audit model. It was prepared by Humberto Serna 1996, in Colombia, and later developed by Kjerulff (2000), Sudy and Manero (2002) and Aguilar (2004). The objective is to know the levels of satisfaction and perception of the clients, on the quality of the service received. To carry out the audit, planning must be carried out, obtaining the client's information, then the information obtained is processed, later the information is analyzed (quantitative analysis and qualitative analysis) and finally the client's report card is made, which consists of a satisfaction index matrix. The evaluation is carried out through multiple regression and they use statistics such as Cronbach's Alpha and t-student test [58].

5.3.6 Structural Equations Model. It allows identifying causal and non-causal linear relationships between the variables identified to measure customer satisfaction, its development consists of four stages. In the first, the model is specified, then the model to be used is identified, the parameters are estimated and finally the model is evaluated. The tools used to confirm the variables are factor analysis (exploratory and confirmatory) and Path Analysis or trail analysis [58].

5.4 CUSTOMER DATA COLLECTION TOOLS

Data collection is an important part of the models for the measurement of customer satisfaction, for which the suggested tools for the analysis of customer satisfaction are mentioned: [60].

5.4.1 Customer panels. It selects a group of customers who are sufficiently familiar with the product, they are analyzed over a long period, by observing trends, suggestions and opinions are obtained from the experience of each customer, and conclusions are finally established. The opinion of new customers and especially the effects of the first impression are neglected [60].

5.4.2 Satisfaction survey of real and historical clients. Satisfaction questionnaires for three types of clients: new, those who are reducing their purchase volume and those who have stopped consuming the product. In order to determine the elements that lead a customer to sue and stop demanding the product. Likewise, it is possible to have an idea of what elements influence the image of the company and to what extent they affect the levels of loyalty. The different types of clients to analyze, force to define very well the information that is needed from each type of client and to abstract it with precision in order to enunciate generally acceptable conclusions. At the same time, customers are not always able to respond to questionnaires [60].

5.4.3 Satisfaction survey. It is based on carrying out short questionnaires to selected clients, based on previously defined objective criteria that allow obtaining the opinion of the clients at a certain point in time after the purchase of the product or service. Obtain a sufficient index of clients who respond to be able to accept the sample as significant of the total clients of the organization [60].

5.4.4 Group sessions. Meetings with small groups of clients focused on very specific aspects of the product or service, in which participants can provide a lot of information, open communication barriers and limitations in the generalization of conclusions [60]

5.4.5 Individual reviews. Periodic individual meetings with selected clients, in which a great selection of aspects related to the product or service are dealt with in great detail in a formal way, in order to be able to identify real customer expectations. The difficulty of the method in terms of costs and generalization of the conclusions, since it is practically based on tailored suits [60].

5.4.6 Market research. Research on the totality of real and potential consumers of the products, in order to evaluate the products or services with those offered by the competition and thus identify opportunities and threats. It does not allow to obtain detailed or concrete information about own clients [60].

5.4.7 Hidden customer. An evaluator pretends to be a customer of the company and simulates a purchase to assess the aspects related to it, generally at the service assessment level. This technique allows evaluating customer service, dealing with staff, and other aspects related to the service. It requires a great effort to define the bases of the study so that the conclusions are not misinterpreted among the affected staff [60].

5.4.8 Reports from field staff. Certain aspects are analyzed in direct contact with the client, to know the direct opinion that the product deserves and thus be able to receive feedback. It is necessary to dump the information obtained as it has been received in order to be able to treat it later if you want to reach relatively valid conclusions, accepting at all times the criticisms that may arise [60].

5.4.9 Personnel surveys. Employees who are in direct contact with the client can be surveyed, in order to obtain direct information on the opinion of the clients. The conclusions may have a certain degree of subjectivity, as it analyzes what the employees they believe that customers think [60].

5.4.10 Analysis of operational measures. Analysis system through indicators or other monitoring and measurement methods, all operations that affect customer satisfaction to a greater or lesser extent. Determine the critical indicators that provide adequate and real information so that there is a relationship direct between the opinion of customers and the trends reflected by the indicators [60].

5.4.11 Análisis de redes sociales. Social media analytics is the practice of collecting data from social media platforms and analyzing that data to make business decisions, it helps companies to know the views of customers and their comments on the quality of products and services to make successful business decisions [9]. It is an easy and cost-effective way to analyze the opinions of a customer segment almost instantaneously. A key limitation of this analysis is that it is descriptive, as it does not provide the means to understand the rationale for these views (the why) [61].

5.5 MULTI-CRITERIA ANALYSIS

Multi-criteria decision making (MCDM) is one of the most common methods for solving conflict management problems [62]. MCDM addresses decision and planning problems considering multiple criteria and the importance of each [6]. Additionally, it provides a general environment to address decision problems without making assumptions about the independence between variables of different hierarchical levels [63].

Decisions must be made considering not only quantitative aspects, such as economic ones, indicators, among others, but also qualitative ones, for example aspects of perception, intuition, experience and others, which are non-valuable qualities of a problem and that cannot be excluded when address it [64]. Customers' perception of e-commerce is strongly influenced by their experience on your website and measuring this and other factors is a crucial step for any type of organization in building customer relationships [65].

The decision process requires a comparison between the alternatives that can be chosen in the face of a certain dilemma, for this it is necessary to separate a decision problem into the "elements" that compose it for subsequent comparison between them, so that a tool is effective and efficient and that supports decisions, it is important to have the greatest number of analysis elements and an adequate process and the best way is to use a set of theories, methods, models and support tools [64].

5.5.1 AHP analytical hierarchy process. The Analytical Hierarchy Process (AHP) is a simple, flexible and practical multi-criteria decision-making method. It is a simple method to make decisions for complex and fuzzy problems, and it is especially suitable for those problems that are difficult to analyze quantitatively [66].

This is a hierarchical weight analysis method proposed by Professor T. L. Saaty of the University of Pittsburgh in the early 1970s [67]. AHP combines quantitative and qualitative analysis together, its premises consist of making the problems hierarchical, grouping the combination according to the factors to form a multilayer analytical structure model, and finally obtaining the relatively important weight that the most layer has. low relative to the highest layer [68] The advantage of AHP is that it allows the incorporation of qualitative aspects that are usually left out of the analysis due to their complexity to be measured, but that may be relevant in some cases [69].

The analytical hierarchy process includes four basic steps: the first is the establishment of the hierarchical structure model, which includes the objective of the decision, the factors and objects considered; the second, the construction of the judgment matrix, where a pairwise comparison is carried out between the factors in the same layer and the importance of the objective in the upper layer; third, single hierarchical arrangement and consistency check; and fourth, total hierarchical arrangement and consistency control [68].

5.6 METHONTOLOGY

It is a structured method to build ontologies [70]. It was implemented by the Ontological Engineering Group of the Polytechnic University of Madrid, which allows building ontologies at the level of knowledge [56]. This methodology has been applied in different ontological developments [56] [71].

Methontology proposes a scheme of templates, diagrams and tables to be used in the development of each of the conceptualization tasks, which facilitate integration and cooperation between developers, experts or inexperienced, additionally, the proposed life cycle, allows updates in any time during construction and according to the needs that arise [71].

This method proposes to establish the following information before starting the construction of an ontology: a) define a purpose, including its intention of uses, use scenarios, end users, among others; b) specify the level of formality of the implemented ontology (informal, semi-informal, semi-formal or rigorously formal), this depends on whether the terms and their meanings are encoded in a language between natural language and rigorous formal language; and c) establish the scope, which includes the set of terms to be represented, their characteristics and granularity [70].

6. STATE OF THE ART

Improving customer experience and satisfaction is a widely investigated topic, starting with traditional commerce and much more with virtual commerce. An example of this is the study carried out by Vásquez et al, using the method of personal interviews through Using a structured questionnaire, it was proposed to design an e-service quality scale, determining the perceptions of customers in the dimensions of utilitarian and hedonic quality for Virtual Travel Agencies. Taking as a reference two dimensions of quality: The utilitarian, functional or extrinsic quality that is composed in turn by four sub-dimensions: design and functionality of the web (includes the design of the web site, efficiency and ease of navigation), quality of the information (relevance of the same and degree in which it is complete, detailed and updated), reliability (fulfillment of promises, speed, privacy and security) and response capacity (variety of services adapted to each client, individualized attention services, price offer for customer segments, ease of contact with the company through alternative communication channels, commitment to changes and compensation). The second dimension is the hedonic or intrinsic quality, which integrates aspects related to fun, enjoyment and entertainment, which generate different feelings (having a pleasant time, adventure, forgetting problems, possibility of communicating experiences). Among the conclusions, the e-service quality variables that most influence customer satisfaction are: responsiveness, reliability and hedonic quality [72]

For their part, in the study by Ruíz et al, they sought to give a qualitative perspective to the key fundamental factors to achieve a satisfied customer in online sales, analyzing it from the point of view of e-commerce experts and online buyers online. It was found that the experts focused on two aspects, firstly, the service offered during the purchase process: emphasizing accessibility issues related to being able to easily access the people behind the website, it can be through a phone, mail or a chat for assistance; compliance within the agreed delivery time; adequate customer service throughout the purchase process; deep knowledge about what you sell; an adequate logistics system; appropriate information on the web; give support to the problems and returns that may arise in the purchase. Secondly, the aspects related to the product: meet or exceed the expectations that the customer had and that pushed him to purchase, therefore, here is the added value; the customer must perceive the benefit of the product; and price - quality ratio. The contributions of consumers presented somewhat more classic variables, in terms of service, they only mentioned logistics, delivery within the term and the fact that there are no breakages or damages in the products, and, secondly, the aspects related to the product, the value for money, the performance and the positive disconfirmation of expectations were mentioned [51].

In another investigation carried out on a virtual supermarket, whose need was to know the behavior of its customers online, they applied a web questionnaire divided into three sections. In the first, the items were aimed at assessing the perception of the quality of the service provided by the virtual supermarket in general; the second, focused on assessing the company's response when a user had had a problem or incident; and the third, the questions were aimed at evaluating customer satisfaction in the purchase process and their intention to buy back. From the results obtained, it was possible to know the most valued

characteristics in online stores, Efficiency, related to the organization of the web, provision of information, speed of the purchase process, ease of use or ease of finding the products; System availability is defined by aspects such as the operation of the web (access, downloads, blocks); Reliability, referring to the delivery process of the products; and Privacy, in the sense of protecting information (credit card, user data, purchasing behavior). In the supermarket under study, it had scores above 4 in the four factors, within a scale of 1 to 5. which allows to conclude that the satisfaction of the shopping experience was positive [73].

The relationship between the user and the product evolves over long periods of time and the evaluation of customer satisfaction is more effective through social networks, since customers are more likely to be honest about their reaction to a product or service In a neutral forum, additionally, companies can better understand customer behaviors by combining the intelligence acquired by social media platforms with traditional customer intelligence [74].

In a study carried out in Bogotá, where the main objective was to establish how different digital strategies impact management indicators, such as customer satisfaction, process validity and change management. To examine how effective, the digital campaign was, a social media content study was conducted, where the real impact of the campaigns (number of likes, comments, clicks and shares) was examined. Likewise, it was reviewed how effective companies are to interact with customers and resolve concerns (customer service). Regarding customer satisfaction, it was found that, in the advertising campaigns analyzed, companies answered questions from customers effectively, in a timely manner and sought to solve the problems / concerns that users had. Likewise, the reception that the campaigns had towards clients is shown by the number of followers they managed to add. However, no metric is analyzed that allows knowing the level of customer satisfaction with the campaign [75].

The research showed some limitations, since at the beginning it was intended to make a comparison between different types of social networks, but the metrics were complex when creating correlations and a clear analysis. For example, on YouTube, some videos had a considerable number of views, however, the report is not entirely clear how this fact helps the conversion funnel or the generation of a lead. As for Facebook, it does show clear metrics of the type: clicks on the link and actions taken which allow more specific conclusions to be drawn, especially if they are measured over time. [75].

The method of automatic monitoring of customer satisfaction through social networks, developed in 2011 and patented under the number US20110276513, proposes to develop an ability to monitor interactions on social networks to produce a customer satisfaction metric without formal surveys or other artificial methods. The system gives a satisfaction score in real time and tracks the evolution of that score over time. The method consists of the following steps: a) detects a lift start trigger; b) identifies one or more sources of information available to the public; c) monitors the sources of information; d) retrieves data

from one or more information sources; e) generates survey results. based on what was recovered [76].

To understand and evaluate the success of e-commerce, it is suggested to analyze 7 interrelated dimensions, namely, customer continuation intentions, it is directly influenced by perceived utility, user satisfaction, and system quality. User satisfaction was directly affected by service quality in the first place, and then utility was perceived in second place. This affirms the strong association between a satisfied customer and good quality service. The perceived usefulness was influenced by the confidence and the quality of the information. Trust in turn was influenced by the service and quality of the system [77].

On the other hand, in Argentina, 5 important factors are mentioned for customer satisfaction in e-commerce, starting with a) a good pricing strategy, which includes low prices, offers, discounts and offering shipping within the price; b) Offer a wide variety of products in an attractive and accessible way for customers; c) Reach users directly by optimizing search engines, advertisements, advertising and maintaining a wide range of customer service through telephone, chat, emails and social networks; d) Shopping experience through ease of use, clarity of the offer, means of payment, delivery times, technology and quality; e) Radiate trust, guaranteeing a high level in the transfer of the good or service, security in the payment and in the private data of the clients [78].

For its part, Sanyal refers to four key factors that affect customer satisfaction in electronic commerce are access, security, ease of use of the website and availability of multiple payment options and price, being the last two with the greatest impact on customer satisfaction. This is explained due to the fact that most customers shop online to take advantage of deals and discounts, and a website that is user-friendly and easy to navigate will encourage customers to spend more time online to look more. products and find a variety of payment options, increasing customer convenience [79].

The possibilities offered by the digital environment are incredible, because by knowing more data from the public, the measurement of user experience can be rethought. In this sense, Aguado mentions that it must be taken into account that the numbers (quantitative evaluations) are not always an indicator that allows measuring the opinion of users about a content or a brand, since one thing is for the public to have interactions with a medium or content and another that they give rise to positive experiences [80].

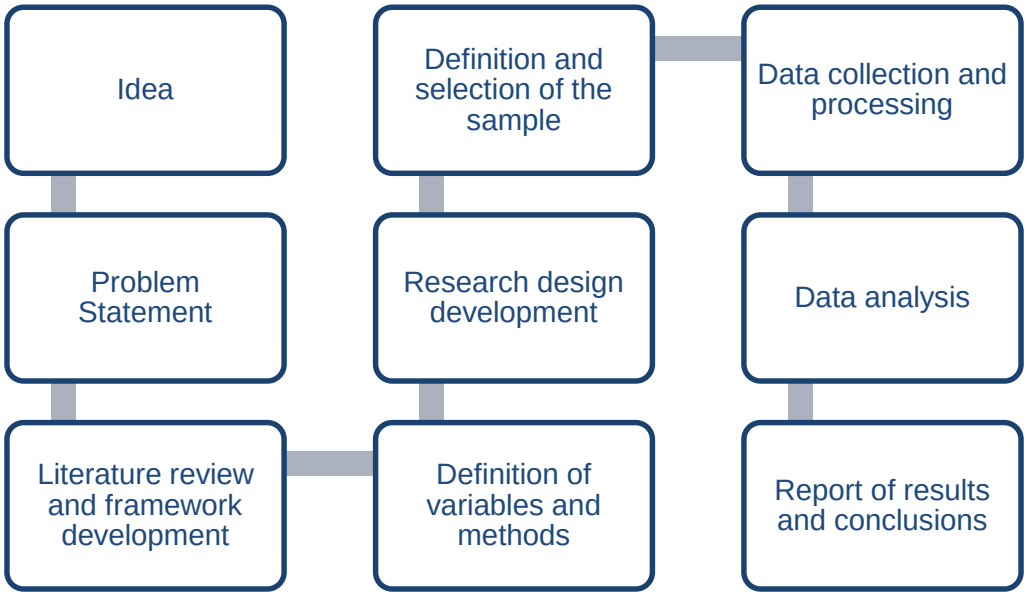
7. METHODOLOGY

7.1 GENERAL

The methodology is the description, analysis and critical appraisal of the research, whose fundamental task is to evaluate the resources, methods and limitations. Although the methodology is not a sufficient condition for the success of an investigation, without a doubt, it is a necessary condition that facilitates the delimitation of tools, techniques and methods that lead to the achievement of results. [81]

The research is carried out following the framework established by [82], starting with ideation to give focus and development to the project, subsequently the current state of the problem is described in the evaluation of customer satisfaction, then a systematic review of the literature is carried out to be able to define variables, methods, techniques and other elements that allow the design of the evaluation model, then the sample from which the data will be taken is defined and the techniques and tools for data collection and processing are established, which are analyzed, whose results will show the effectiveness of the proposed model. The activities are presented below:

Figure 11. Framework research



Source: Author based on [82]

7.2 DESIGN, TYPE AND APPROACH OF THE INVESTIGATION

In accordance with the proposed objectives and the problem raised, this research work was carried out under a non-experimental design of a cross-sectional type, with a mixed approach and descriptive scope, to establish a model that allows evaluating customer satisfaction in electronic commerce.

The research is non-experimental since it is carried out without deliberately manipulating variables, no situation is built, but already existing situations are observed. In non-experimental research the independent variables have already occurred and cannot be manipulated, the researcher does not have direct control over these variables, he cannot influence them because they have already happened, as well as their effects. It is cross-sectional because the purpose is to describe variables and analyze their incidence in a single moment. It's like taking a photograph of something that happens [83]. Likewise, this research is mixed because it collects qualitative data, makes mathematical and statistical measurements, in order to establish behavioral guidelines or test theories [82] and has a descriptive scope since the purpose is to describe through analysis and evaluations the various aspects, dimensions and variables of the phenomenon to be investigated. Descriptive studies measure in a rather independent way the concepts or variables with which they have to do [83].

7.3 POPULATION, SAMPLE AND SAMPLING

This study was carried out in the city of Bogotá - Colombia, establishing the population universe as the people who make purchases through electronic commerce.

The sample population comprised, in the first place, 2,933 students from the law school of the Catholic University of Colombia, the sample size was 382 people, with a confidence level of 95% and a margin of error of 5%.

Second, a sample population of 16,043,092 followers of Mercado Libre's Facebook and 6,431,292 followers of Linio's Facebook, each with a sample size of 97, with a confidence level of 95% and a margin of error of 10%.

It is a non-probabilistic sample, for convenience since the students were asked to be part of the study who participated voluntarily and the comments that were captured from the social network were those that were not blocked by the fan page of the e-commerce stores.

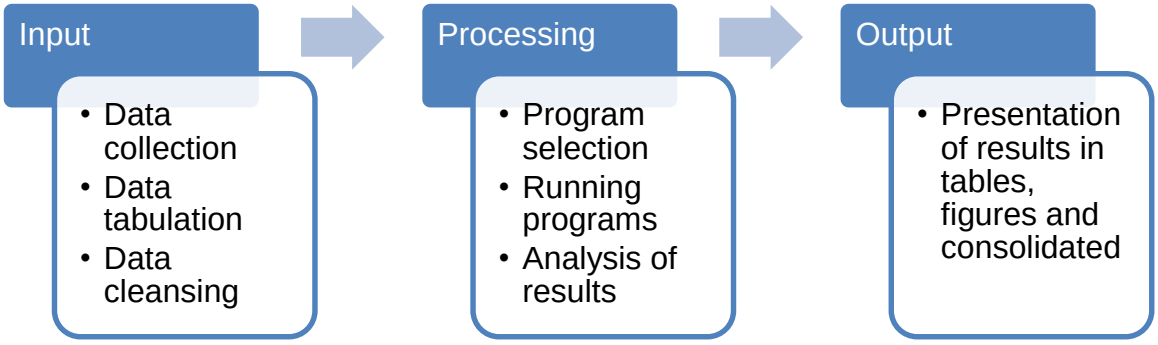
7.4 DATA COLLECTION TECHNIQUES AND INSTRUMENTS

The survey technique was selected to compare and measure the criteria that generate customer satisfaction for buyers or future buyers on electronic commerce platforms. To evaluate the level of importance of each criterion, an electronic questionnaire was designed which contained a total of 46 compulsory questions, of which 4 were closed questions and 42 were of the scale type under the Saaty scale [67].

Likewise, Web scraping was carried out, a technique that allows information to be extracted from websites through software programs, in order to collect comments from the Facebook social network of the selected electronic commerce platforms.

7.5 TECHNIQUES AND TOOLS FOR DATA PROCESSING

Figura 12. Data collection and processing



Source: Author

The collection and review of the literature was carried out systemically using the technological surveillance methodology proposed by Morcillo [84] and it was analyzed using the VosViewer software for the construction and visualization of bibliometric networks.

The survey was designed using Google's survey management software (Google Forms). Likewise, for the search and collection of comments from the social network, the Octoparse software was used in its free option, which allows the extraction of web data and allows them to be saved in a structured, clean way and in different formats.

For the multicriteria and semantic analysis of the variables and alternatives, the AHP method was applied, supported by a theoretical-practical ontology model created for electronic commerce through the Methontology methodology and developed using the Protégé software.

7.6 INNOVATIVE APPROACH

The incorporation of a new model within the customer satisfaction evaluation process in electronic commerce, supported by technological tools, techniques and interdisciplinary methods, merged in an orderly and coherent way, allows proposing a new way of measuring and analyzing customer comments. Therefore, the focus of this research work is to make a significant contribution to the marketing processes, knowledge management and business decision-making based on customer relationships, delivering a series of activities that serve as a guide for their continuous use and / or new developments.

8. VIGILANCIA TECNOLÓGICA

Surveillance has the role of detection and focuses on monitoring the evolution of technology and its implications. This is an "organized, selective and permanent process of capturing information from abroad about technology, analyzing it and converting it into knowledge for making decisions with less risk and being able to anticipate changes" [85].

For this study, the methodology established by Morcillo [84], is taken as a reference, which starts from the identification of the problem, determining the surveillance objectives, which lead to the determination of the sources of information, after the search, perform the analysis and validation of the information collected.

The objective of this technological surveillance is to characterize the attributes of the entities, procedures, metrics and trends related to the evaluation of customer satisfaction in Electronic Commerce in social networks. For which, the following keywords are extracted from the objective: Satisfaction, Customer, Evaluation, Electronic Commerce, Social Networks.

Table 1. First iteration search equations

Keyword	Equations	Documents Result
Evaluation	(TITLE ("customer satisfaction evaluation") OR TITLE-ABS-KEY ("evaluation of customer satisfaction"))	114
Satisfaction	1.1 (TITLE (customer) OR TITLE (client) AND TITLE (satisfaction))	6.105
Customer		
E-Commerce	(TITLE ("e-commerce") AND TITLE (customer AND satisfaction))	78
Social Media	TITLE ("Social media")	26.637
	(TITLE (customer) OR TITLE (client) AND TITLE (satisfaction) AND TITLE-ABS-KEY ("social media"))	74

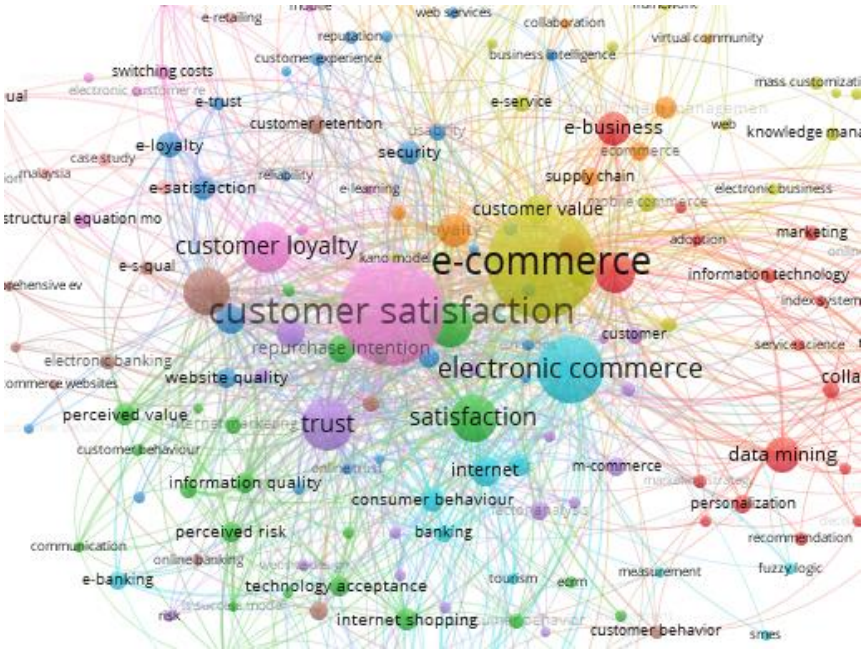
Source: Author

In the first iteration, the terms are taken directly from the research objective, for which the search equations found in table 1 were used, which allowed obtaining an initial vision about each keyword and its context.

The figures shown below were created with the VosViewer tool, which is a software for the construction and visualization of bibliometric networks, it allows to visualize the existing network between keywords, which are represented by a circle whose size is determined by the weight from the article. The greater the weight of an item, the larger the circle. The colors of the circle are determined by the group or topic to which the article belongs. The

lines between elements represent the links or correlations between them, that is, the co-keywords. The closer the ties are, the stronger their relationship.

Figure 13. Correlations between e-commerce and customer satisfaction



Source: Author

According to the correlation between keywords mostly mentioned in the published documents, it is found that the pink circle represents customer satisfaction and the yellow circle represents electronic commerce, these two are close to each other due to their relationship and are the largest due to the investigative strength they possess compared to the other elements. Around it, there are a number of topics that can direct the meaning of a research work.

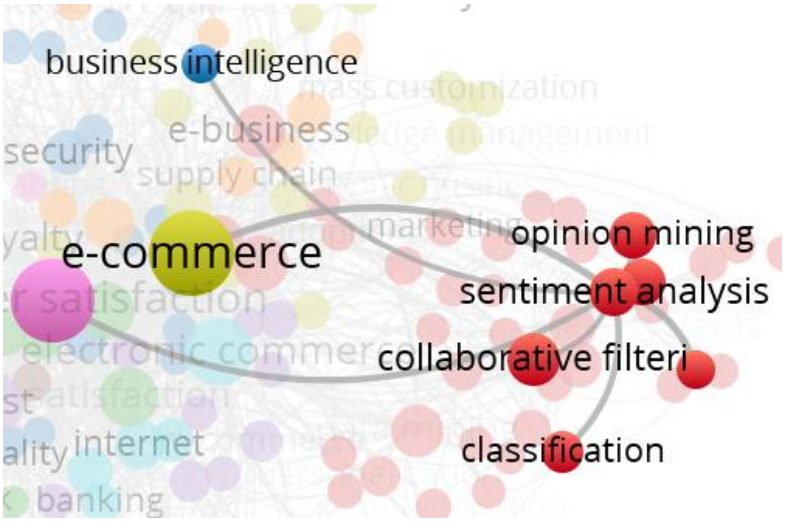
Table 2. Correlation between objective keywords

Keyword	
Evaluation	**Social media**
	

Source: Author

Although customer satisfaction and e-commerce are closely related due to the research relationship, they are not directly linked. As can be seen in table 2, but indirectly there is a link with the words: evaluation and social media.

Figure 14. Correlations between keywords and sentiment analysis



Source: Author

In the same sense, there is a strong link with sentiment analysis, which in turn is linked to opinion mining, text mining, collaborative filtering, classification, and business intelligence.

Table 3. Second iteration search equations

Keyword	Equations	Documents Result
Análisis de Sentimientos	TITLE ("Sentiment Analysis"))	1 6,172

Source: Author

As shown in Table 3, a second iteration is carried out, taking as a reference the result of the analysis carried out with the VosViewer tool, which allowed us to identify which sentiment analysis is directly related to this research and which showed greater affinity and research opportunity.

Table 4. Combining search equations

Equations	Documents Result
(TITLE ("Customer Satisfaction") AND TITLE ("Sentiment Analysis"))	14
(TITLE ("sentiment analysis") AND TITLE ("e-commerce"))	31
(TITLE ("social media") AND TITLE ("sentiment analysis"))	317
(TITLE ("sentiment analysis") AND TITLE-ABS-KEY ("social media") AND TITLE ("customer satisfaction"))	8
(TITLE-ABS-KEY ("e-commerce") OR TITLE-ABS-KEY ("electronic commerce") AND TITLE-ABS-KEY ("customer satisfaction") AND TITLE-ABS-KEY ("social media") AND TITLE-ABS-KEY ("sentiment analysis"))	4

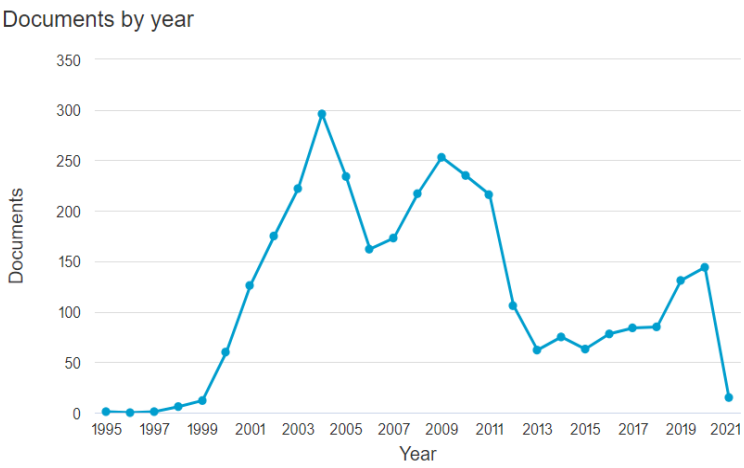
Source: Author

As expected, in the first and second iterations, a considerable amount of results were obtained, therefore, a third search iteration is carried out, combining the keywords and generating the search equations related to table 4.

The bibliographic database Scopus [86] and Patentscope [87] were used as first-level information sources. The first was used for the selection process of scientific articles and the second for the investigation of registered patents. The proposed equations were entered in the box <search terms>, likewise, in the <search fields> <article title> was selected. The results, in turn, were refined, classifying the articles most cited by other authors and by year of publication, likewise, the unrelated sub areas were discarded, this to obtain more relevant and updated results.

Using SCImago Journal Rank, the impact indicator of the journals that published the preselected documents was searched, taking as a final criterion, from lowest to highest, the quartile assigned to the journal. As a result of the exercise, 50 articles were selected, which were subjected to a systematic reading and review exercise, the result of which was deposited in a bibliographic matrix prepared by the author, where the main concepts, methods, attributes and important data were stored. the objective of this technological surveillance.

Figure 15. Annual publication of related documents



Source: Author based on [86]

Regarding the temporal evolution, on the subject object of this research, it is evident that historically there was a constant increase in the number of documents until 2004 when more publications were made, from that moment, the number of publications decreased, however, there is a slight increase between 2019 and 2020.

8.1 FACTORS THAT AFFECT THE CUSTOMER'S PERCEPTION OF SATISFACTION

Satisfaction is not only influenced by the socio-psychological state that a client brings to a site (mood, disposition, needs), but also by strange events (weather, social group interactions) that are beyond the provider's control. However, there are some factors that providers can control and in this regard, make decisions to improve satisfaction levels.

The elements that influence web-based transactions and that directly or indirectly affect customer satisfaction have been studied by various authors. Some have called them dimensions [88] [22], others have called them themes [61], also components [89] and most mention them as factors [89], [49], [68], [90] y [25]. Therefore, and for the present study, they will be taken into account as factors, additionally because they are elements that describe a quality of electronic commerce and that in principle will be based on the perception of the client and not on the measurement of indicators from a sample data set.

For example, [88] mentions as dimensions of satisfaction: the image of the merchant, the efficiency of the service, the reliability and the functionality of the site. For its part, by [89], e-satisfaction should capture the convenience, marketability, site design, and financial security of online transactions. [61] in his study, he evaluated satisfaction levels in a travel agency considering issues such as: spatial availability, temporal availability, capacity availability, information availability, travel time, service provision, security and protection and maintenance. [68] mentions that among the satisfaction factors are the characteristics

of the website, the characteristics of the store, the characteristics of the product, the logistics distribution and the security of the network. Accordingly, [90] mentions that consumers in the online shopping consumer decision-making process will be affected by several factors, such as the functional structure of the e-commerce site, types of commodities, product quality, logistics and distribution and after-sales service. [25] included variables such as quality, price, satisfaction, and complaint. [22] He also took as components the quality of the service which includes the dimensions: ease of use, website design, responsiveness, personalization or personalization and guarantee.

Below are the definitions and characteristics of the factors most mentioned by the authors, which influence customer satisfaction:

Site design: This is one of the factors that the authors agree the most on. The environment associated with the site and how it works could influence whether consumers are satisfied or dissatisfied with their online shopping experiences. When sites are fast, clear and easy to navigate, it can be enjoyable and satisfying for consumers, saving shopping time and saving the cognitive effort consumers spend figuring out how to shop online effectively. [89].

Virtual sites in online shopping are equivalent to a shopping mall in face-to-face purchases. Therefore, friendly website design, quick login, convenient ranking retrieval, quick access, and diversified payment means will greatly affect customer satisfaction. [68].

Usability: This feature closely resembles the design of e-commerce websites [22], however, it presents two special approaches: the first is ease of use, which refers to the degree to which performance is perceived in the use of a system and the second is user friendliness which is about the perception of aesthetic design in terms of the website interface. Matera et al. cited by [91].

Several designers have emphasized the importance of generating joy as a design feature, where the client can perceive pleasure in their interaction with e-commerce websites. This pleasant experience not only encourages customer engagement, but also encourages repeat visits [91].

Security: One of the main reasons people do not shop online is because of concerns about the security of online payments, the reliability of businesses, and the lack of a privacy policy [92]. This attribute is also embedded in the design of the website so that browsing is safe [91]. Security is a prerequisite for customer satisfaction, which includes the security of transaction information and the security of payments [68] and the security of customers' personal information.

Quality: According to Zeithaml et al, cited by [93], the perceived quality of a website is based on five criteria: availability and content of the information; easy to use or usability; privacy or security; graphic style; and compliance. For [25] it is a variable that is conceived

in technical terms. Therefore, it should be immersed in other associated variables such as information quality, website quality, service quality and fun [91].

Information: General feelings of satisfaction or dissatisfaction also depend on the information they received about the product [94]. Therefore, unique, reliable, and up-to-date information must be provided to clients to meet their needs [91]. Information satisfaction is defined as a subjective judgment of satisfaction with the information used when choosing a product [94].

To reduce the uncertainty that leads to perceived risk, online marketers should work to provide information that is easy to understand, accurate, complete, timely and relevant to customers' purchasing decisions, to offer various ways to obtain this information in their websites, such as: as frequently asked questions, forums and contact details [95]. The quality of information in electronic commerce should be emphasized in a number of sub-design elements, including precision; chance; Relevance; flexible information presentation; Price information; product comparability; differentiation of services and complete description of the product [91].

Customer service: This factor has a direct impact on online shopper satisfaction [96]. Quality service is a fundamental principle in e-commerce, it covers a wide range of assistance, such as frequently asked questions, order tracking and complaint management [91]. This variable includes the product update speed and the decoration of the virtual store; the communication capacity of the customer service and finally, exchange and return in the after-sales service [68].

The product: Affects customer satisfaction since the customer chooses the product based on the descriptions published by the merchant in electronic commerce, the brand, price and quality also influence [68]. The price is conceived as a comparison of the quality of the product in relation to its cost [25].

Logistics distribution: This situation mainly materializes in the modes of delivery, the delivery time, the quality of the delivery, the attitude of the delivery personnel [68].

Some of the authors went a little further than just mentioning the factors that generate customer satisfaction, but also evaluated and ordered them according to the level of importance. As shown in table 5, there is no consensus among the authors regarding the attributes that, over the others, generate greater satisfaction. For example, security is mentioned frequently but is not on the same level of importance and the same is true with customer service and communication.

Table 5. Results of factors evaluation

AUTHOR	POSITION OF IMPORTANCE ACCORDING TO THE AUTHORS			
	1°	2°	3°	4°
[68]	Safety	Product	Customer service	Comunication
[96]	Reliability	Customer service	Web design	Safety
[89]	convenience	Web design	Safety	Information
[6]	Interface	Message	-	-
[49]	Quality	Price	Service	Comunication

Source: Author

8.2 COMPARATIVE ANALYSIS OF RELATED WORKS

The following tables present a comparison between authors, consolidating the most important data to take into account, such as the origin of the data, the models, methods, tools and procedures used for the evaluation of customer satisfaction.

The authors listed in Table 6, in their customer satisfaction evaluation exercise, worked with satisfaction-generating factors, which were analyzed using statistical measurements.

Table 6. Works related to Statistical Analysis

Author	Site (Where)	Data (To Whom)	Method (How)	Evaluated (What)	Model (How)	Tool (Whit)	Procedure (How)
[96]	Tiki.vn E-commerce platform	Customer interviews	Statistical analysis	Factors: Trust, customer service, web design and security	correlation analysis, regression analysis, T-test and ANOVA	-	-
[25]	Food industry	Customer and administrative survey	Statistical analysis	Factors: Quality, price, satisfaction and complaint	-	-	-
[89]	Decision Making Research y NFO, Inc.	focus group and online surveys	Statistical analysis	Factors: convenience, marketability, site design, and financial security	varimax rotation	-	-

Source: Author

For their part, the authors listed in Table 7, proposed evaluation indices, in which they compared customer satisfaction factors. Most use models for multi-criteria decision making and provide detailed procedures on how to perform the assessment.

Table 7. Works related to the Evaluation Index System

Author	Site (Where)	Data (To Whom)	Method (How)	Evaluated (What)	Model (How)	Tool (Whit)	Procedure (How)
[66]	E-commerce platform ceramics	Customer survey	Construction System evaluation index	Factors: Business, service and complete situation	Theory of the gray system AHP Fuzzy full evaluation	-	Construction of the evaluation index, fuzzy evaluation, Analysis of evaluation results
[49]	CRM	Customer survey Best-selling product	Construction System evaluation index	Factors Product quality, price, service and communication	AHP, Expert decision-making group / Comprehensive Fuzzy Evaluation	-	Evaluation Index System, Evaluation Model, Comprehensive Customer Satisfaction Evaluation
[68]	No information	Survey	Construction System evaluation index	Factors: Characteristics (of the website, of the store, of the product), logistics distribution and network security	AHP	-	Establishment of factors, construction of customer satisfaction indexes, indicator weight confirmation and analysis
[90]	Three existing e-commerce sites in China	Books, digital, electrical appliances	Construction System evaluation index	Factors: Functional structure of the site, types of products, product quality, logistics and distribution and after-sales service	Theory of tensor analysis Expert scoring method Nonnegative Tucker decomposition	-	Data training and test validation

Source: Author

Finally, a comparison is made between the authors who, using the Sentiment Analysis method, study the polarity of customer sentiment and, applying other theoretical models, manage to measure customer satisfaction. It is important to mention that, of the selected sample, most of the studies only analyzed the polarity of the sentiment of the customer's comments (positive, negative and neutral), and only a few analyze this polarity in relation to the factors that generate satisfaction. to the customer in electronic commerce.

Table 8. Works related to Sentiment Analysis

Author	Site (Where)	Data (To Whom)	Method (How)	Evaluated (What)	Model (How)	Tool (Whit)	Procedure (How)
[97]	PConline.com	Cameras review	Sentiment analysis	actors: quality, performance, video, battery and costs	Fuzzy characterization AHP Qualitative fl exible multiple criteria method (QUALIFLEX).	R-project Multi-valued probability neutrosophic linguistic numbers (PMVNLN) to characterize online reviews	Classifying units of meaning, characterizing reviews, calculating performance, and determining weights
[6]	E-commerce platform AppStore	Reviews of Mobile Services on App Store	Sentiment analysis	Sentiment Polarity Factors Download, interface, message, noti fi cation, photo, post, search, touch, update	VIKOR Multi-Criteria Decision Making (MCDM)	Stanford Syntactic Analyzer	Collecting, processing, and measuring customer satisfaction
[62]	Twitter (Social media)	Customer reviews of Medicines, electronics and mobile phones	Sentiment analysis	Sentiment polarity	fuzzy sentiment analysis	Matlab	Data acquisition, preprocessing, analysis of linguistic coverage, detailed SA, and use of a system based on fuzzy logic
[7]	E-commerce website	website electroencephalogram (EEG) signals Customer reviews	Sentiment analysis	Sentiment polarity	Lexicon of feelings	Artificial Algorithm Bee Colony (ABC) Emotiv EPOC + device VADER	Customer review tracking and analysis, processing, VADER sentiment analysis and artificial bee colony algorithm
[93]	Employment agency	Customer reviews	Sentiment analysis	Sentiment polarity		Pyton API (Repustate) MySQL Database Management System (DBMS)	Preprocessing (extraction, refinement, opinion extraction), translation and generation of sentiment score
[98]	Cornell movie-review	Movies review	Sentiment analysis	Sentiment polarity	Fuzzy Sets	SVM algorithm Sentiment fuzzy algorithm	Text processing, transformation, selection of functions, fuzzy classification of sentiment and evaluation
[99]	Amazon E-commerce platform	Product of online shopping portals	Sentiment analysis	Sentiment polarity		(Naïve Bayes y Support Vector Machine (SVM))	Labeling of parts of speech, extraction of characteristics, pruning of characteristics, classification and summary of opinion

Author	Site (Where)	Data (To Whom)	Method (How)	Evaluated (What)	Model (How)	Tool (Whit)	Procedure (How)
[61]	Twitter (Social Media) account of TransLink	Transit Sentiment analysis user reviews	Sentiment analysis Social media monitoring	Sentiment polarity Factors Availability (spatial, temporal, capacity, information) time, services, security, protection and maintenance	Monitoreo redes sociales	SentiStrength (an off-the-shelf program)	Social media analysis, semantic analysis, sentiment analysis, compare results (survey vs sentiment analysis)
[9]	Twitter (Social media)	Interview with CE vendors Customer reviews	Sentiment analysis Social media monitoring	Sentiment polarity	Extraction method Unigram Social media monitoring	Support vector machine algorithm PHP Twitter - API	Tweets retrieval, cleaning and preprocessing, feature extraction, sentiment classification, sentiment scoring module, computational metrics
[100]	Twitter (Social media)	Reviews Food Politics Trademarks	Sentiment analysis Social media monitoring	Sentiment polarity	Information retrieval methods, computational linguistics Social network monitoring	algorithm of Paltoglou and Thelwall (2012) lexicon-based classifier	
[101]	Dangdang E-commerce platform	book review	Sentiment analysis Rastreo web	Sentiment polarity	Sentiment lexicon, word vectors, CNN, GRU	python jieba's custom dictionary	Embedded layer, convolutional layer, grouped layer, BiGRU layer, attention layer, and fully connected layer

Source: Author

8.3 MODELS USED TO MEASURE CUSTOMER SATISFACTION

Gray System Theory: [66] Built a multi-level customer satisfaction rating index system of the ceramic e-commerce platform, based on the gray system theory and using the analytical hierarchy process combined with an evaluation complete diffuse. He collected satisfactory customer data from the ceramic e-commerce platform using a questionnaire.

VIKOR (MCDM): (Serbian: ViseKriterijumsa Optimizacija, Kompromisno Resenje) is a multi-criteria decision-making approach (MCDM) compromise classification method. It is used to classify and select from a set of alternatives in the presence of conflicting criteria based on proximity to the ideal solution [6].

Analytical Hierarchy Process (MCDM): (AHP) is a hierarchy weighting decision analysis method [68]. It is a simple, flexible and practical method for making decisions about complex and fuzzy problems, and it is especially suitable for those problems that are difficult to analyze quantitatively [66]. [49] adopted AHP and the expert decision-making law to determine the weighting and evaluation matrix that can improve the accuracy of the fuzzy integral evaluation method that processes a complex question [49].

Fuzzy model (MCDM): The introduction of a fuzzy integral evaluation model is more efficient and practical [49]. Fuzzy integral evaluation is an integral evaluation method that uses the principle of fuzzy mathematics and fuzzy synthesis to qualify the evaluated object from a series of indices whose limit is not clear and difficult to quantify [66]. This system is applied to analyze customer feedback and satisfaction [62]. Fuzzy set theory provides an easier way to represent inner lack of clarity in feeling [98], thus it has been used for e-commerce item comparison, combining sentiment analysis to characterize online reviews, including star ratings and text reviews [97].

Tensor analysis: [90] constructed an e-commerce website customer satisfaction evaluation model using tensor decomposition. Taking into account the shortcomings of the existing methods and information of the e-commerce website. The establishment of the evaluation model consists of analyzing the consumer evaluation indicators of the e-commerce site, or the impact of the main factors of satisfaction of the site. Tensor analysis is a kind of multilinear or multifactorial analysis for high-order data analysis and processing, which has been widely used in signal processing, chemical analysis, image analysis, machine learning, data mining and other fields [90].

Structural Equation Model: The SEM structural equation modeling analytical technique offers the ability to run multivariate and multilevel path analysis and thus enables more complex models than traditional regression analyzes [44] Equation model results structural indicate the influence and strength of the relationship between variables [46]

Semantic equivalence matrix: The semantic equivalence matrix allows the resolution of ambiguities created due to differences in syntax and meanings associated with terminologies in different application domains [102].

Feeling lexicon model: The core of the feeling lexicon approach is to build a feeling lexicon. The corresponding sentimental lexicon is constructed by selecting appropriate sentimental words, adverbs of degree, and negative words, and sentimental intensity and polarity are marked for the constructed sentimental lexicon. This model was tested with a data set of book reviews on the website to verify the effectiveness of the model [101]. Most sentiment analysis approaches are based on the sentiment lexicon, with a list of lexical characteristics that are labeled according to their semantic orientation (positive or negative) [7].

Bayesian networks: They create a model based on a training set with a decision tree at each node and edges that represent consumer information. The model can be built offline in a matter of hours or days. The resulting model is very small, very fast, and essentially as accurate as the nearest neighbor methods, but they are not suitable for environments where consumer preference models need to be updated quickly or frequently [103]

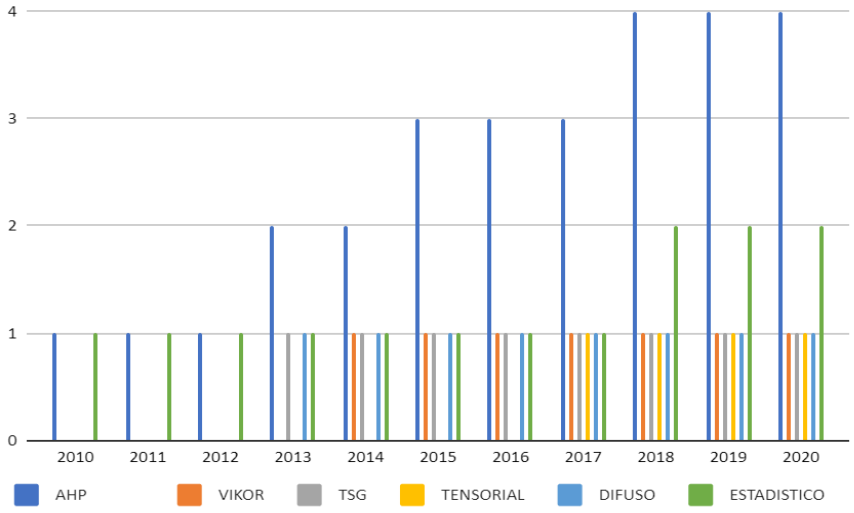
Table 9. Models used to classify satisfaction factors

MODEL / METHOD	Gray System Theory	AHP (MCDM)	VIKOR (MCDM)	Diffuse Model (MCDM)	Tensor Analysis	Correlational, regression, T-test and ANOVA	No information
Statistical analysis						[96]	[25], [89]
Evaluation Index System	[66]	[66], [68], [49]		[49], [66]	[90]		
Sentiment Analysis		[97]	[6]				[61]
TOTAL	1	4	1	2	1	1	3

Source: Author

Additionally, it can be considered that traditional statistical models are still used and that MCDM models such as AHP remain constant in research work over time and allow integration with other methods, as shown in the comparison of related works.

Figure 16. Trend of models used by years



Source: Author

8.4 TOOLS USED IN CUSTOMER SATISFACTION MEASUREMENT

SentiStrength: was used by [45] to analyze the level of sentiment in politically relevant tweets. It is based on a logarithmic transformation of the conditional expectation of the dependent variable and requires an exponential transformation of the estimated coefficients to evaluate and interpret the effect sizes. This tool was also used by [61], to study the sentiment of each tweet.

Stanford Syntactic Analyzer: It is a program that determines the grammatical structures of sentences. This program assigns PartsOf-Speech (POS) tags to all words based on the contexts in which they appear [6].

VADER: It runs faster compared to other methods like NaiveBayes parser, TextBlob, and also works well on texts that have slang, smileys, and acronyms [7].

COntext INterchange (COIN): It is a knowledge-based mediation technology that allows the meaningful use of heterogeneous databases where there are semantic differences [104].

Nearest neighbor algorithm: they are based on calculating the distance between consumers based on their history of preferences. Predictions of how much a consumer will like a product are calculated by taking the weighted average of the opinions of a set of closest neighbors for that product. Neighbors who have not expressed an opinion on the product in question are ignored [103].

Machine learning algorithms: Among those found, the Naïve Bayes algorithm and the Support Vector Machine (SVM) algorithm, used for sentiment analysis by classifying Amazon customer reviews [99].

Deep learning: Deep learning models commonly used in the field of text sentimental analysis are CNN, Recurrent Neural Network (RNN), LSTM, and Closed Recurrent Unit (GRU) [101].

R-project: It is used to obtain high frequency words. These words are considered keywords and may be the most useful words for identifying the unit of meaning criterion [97].

8.5 PROCEDIMIENTOS APLICADOS POR LOS AUTORES

This section briefly explains the steps traced by the researchers to carry out the evaluation of customer satisfaction in electronic commerce:

The framework suggested by [6] consists mainly of two stages: data collection and pre-processing, and customer satisfaction measurement.

[93] did something similar, first performed a preprocessing, which involves the selection of the user's comments, the second step was the translation of the comments to the English language and finally, the last step was the generation of the sentiment score for each commentary.

[62] began with the acquisition of data, then carried out the preprocessing, to continue with the analysis of linguistic coverage, which generated the detailed result of the satisfaction analysis, and finally, he used a system based on fuzzy logic to analyze the feedback customer satisfaction.

The approach proposed by [61] includes four main steps: the first is the analysis of social networks, the second is the semantic analysis, the third is the sentiment analysis, and finally the fourth is the comparison of the survey results with the results. of the analysis of opinions.

[9] Presents a five-tier client-server architecture model consisting of a presentation layer, a business logic layer, and a data access layer for internals, and the additional integration layer and source layer. data are used to describe external components.

To improve the precision of sentiment analysis in product reviews [101] proposes a 6-layer model: an embedded layer, a convolutional layer, a grouped layer, a BiGRU layer, a care layer and a fully connected layer, where first the lexicon of feeling is used to improve the characteristics of the feeling. Then, the CNN and GRU networks are used to extract the main characteristics of the sentiment and the characteristics of the context, later the attention mechanism is used to weigh and finally, the weighted characteristics of the sentiment are classified.

The decision support model of de [97] establishes five main stages: stage I is the classification of units of meaning; Stage II characterizes revisions based on the categories of units of meaning obtained in stage I; Stage III aims to calculate performance values based on the theory of regret; Stage IV is designed to determine the weight vector of the criteria; and the purpose of step V is to identify the order of the alternative items with QUALIFLEX.

9. ONTOLOGY FOR E-COMMERCE

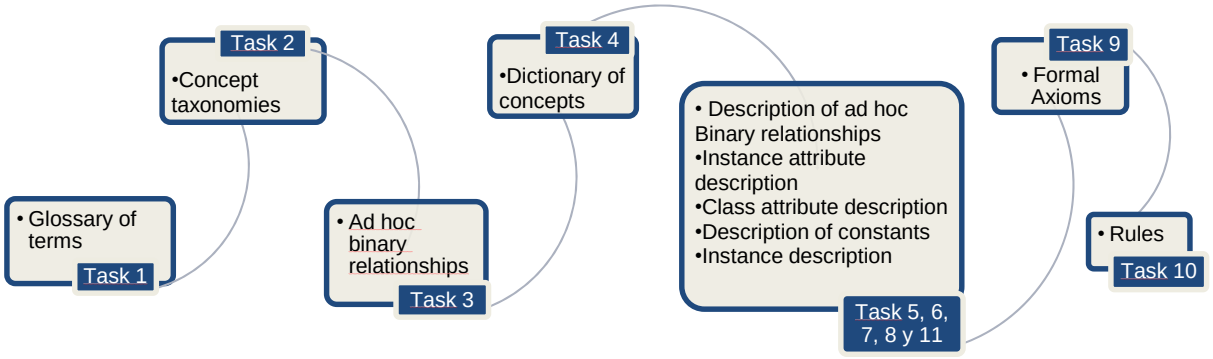
For this work, a metadata ontology is constructed that describes and identifies the main topics on electronic commerce found in the literature and in publications on the social network Facebook of electronic commerce platforms. The methodology established by METHONTOLOGY [56] is used, likewise, open source software is used for the development of ontologies and intelligent systems, Protégé, developed by Stanford University [105].

The purpose of constructing this ontology is to provide electronic commerce with a context in an organized manner based on the main elements that are related to it and formalize them into logical components, starting with a conceptual model and ending with the structuring of a practical model that allows a subsequent integration with other related ontologies and application in meta models of search, collection and analysis of large amounts of information online.

9.1 ONTOLOGICAL CONCEPTUAL MODEL

Methontology suggests 11 tasks to carry out ontologies, which were developed by the author in the following order:

Figure 17. Tasks included within the Methontology procedure



Source: Author based on [56]

9.1.1 Task 1: Construction of the Glossary of terms. All relevant domain terms (concepts, instances, attributes, relationships between concepts, etc.) must be included here, including descriptions, synonyms and acronyms [56].

The main concepts for the construction of the electronic commerce ontology were taken from the exercise of technological surveillance presented in previous chapters and additionally, as a result of an initial approach with an electronic commerce platform. Below is a part of the developed glossary:

Table 10. Glossary of Terms for Ontology

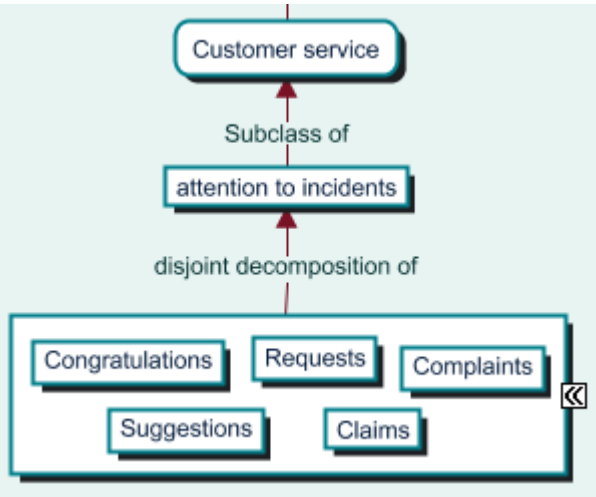
Term	Synonym	Acronym	Description	Type	Concept Base
Electronic commerce	--	e-commerce	purchase and sale of services or products through devices connected to the internet or other computer networks	Domain	Electronic commerce
Commercial agent	--	--	Person or company. Its function is to generate and carry out business in an area related to the transaction of goods and services	Class	Electronic commerce
Buy	--	--	Action	Relationship	Commercial agent
Client	Customer Buyer	--	Who acquires a product or service through the internet	Sub Class	Commercial agent
Sell		--	Action	Relationship	Commercial agent
Supplier	Store	--	Who is in charge of selling products	Sub Class	Commercial agent
Producer	Brand	--	Who manufactures and / or produces the product	Sub Class	Commercial agent
Name or company name	--	--	Name given to a natural or legal person	Class attribute	Commercial agent
Identification	--	--	Unique number assigned to a natural or legal person	Class attribute	Commercial agent
Address	--	--	Residence data	Class attribute	Commercial agent
Transporter	Courier company Parcel company	--	Company that commercially transports goods to their destinations	Sub Class	Commercial agent
Shipping guide	--	--	Number assigned by the transport company that allows control of the route or final destination of the shipment	Instance	Transporter
Deprisa	--	--	Transportation company	Instance	Transporter
Envía	--	--	Transportation company	Instance	Transporter
Servientrega	--	--	Transportation company	Instance	Transporter

Source: Author

9.1.2 Task 2: Construct taxonomies of concepts. Those terms that are concepts are selected from the glossary of terms and are classified into four taxonomic relationships: Subclass-of: A C1 concept is Subclass-of another C2 concept if and only if all instances of C1 are also instances of C2; Decomposition-Disjoint: It is a set of sub concepts of C that do not have common instances and that do not cover C, that is, there may be instances of the C concept that are not instances of any of the concepts that make up the decomposition; Exhaustive-decomposition: it is a set of sub-concepts of C that cover it, that is, such that there is no instance of C that is not an instance of at least one of the concepts of the decomposition; Partition: It is a set of sub concepts of C that have no common instances or sub concepts and that cover C [56].

For the E-commerce domain ontology, the base or parent concepts are established and then they begin to be broken down to establish their hierarchies, which are increasingly developed at their lower levels.

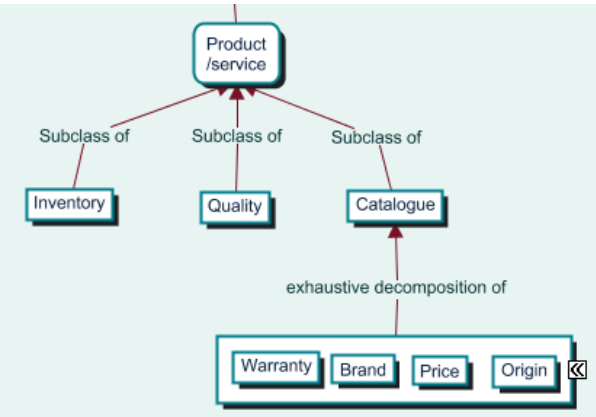
Figure 18. Taxonomic relationship of the concept of attention to incidents



Source: Author

The previous figure represents the disjoint decomposition of the concept attention to incidents, since its sub-concepts do not have common instances. Additionally, the elements of the subgroup cannot be simultaneously another element, for example, a complaint cannot be at the same time a congratulation.

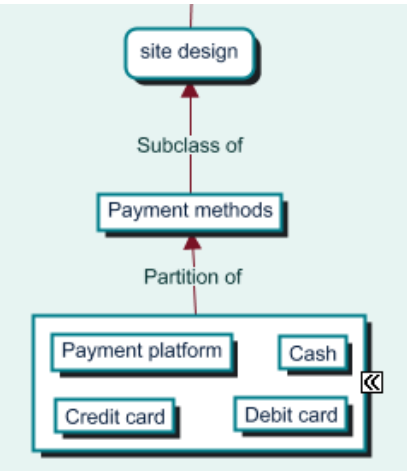
Figure 19. Taxonomic relationship of the Catalog concept



Source: Author

An example of exhaustive decomposition in the developed ontology is presented with the catalog concept, where all or at least one of the elements of the subgroup are found in a product instance and can have common subclasses.

Figure 20. Taxonomic relationship of the concept Payment methods



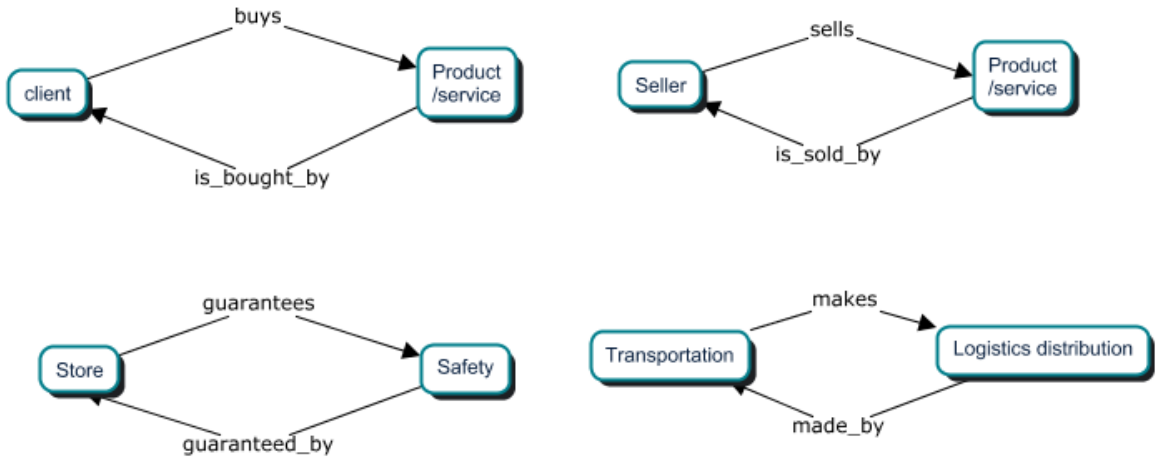
Source: Author

With the concept of payment methods, a partition is established in its taxonomic relationship, in such a way that its sub-concepts do not have common instances, but they cover all possible subclasses of the main concept (Payment methods).

9.1.3 Task 3: Build ad hoc binary relationship diagrams. Once the taxonomy is identified, the binary relationships are established, the objective of which is to establish the ad hoc relationships existing between concepts of the same or of different taxonomies of concepts [56].

Next, some diagrams of the electronic commerce ontology developed in the present investigation are represented.

Figure 21. Ad Hoc Binary Relations Diagram



Source: Author

9.1.4 Task 4: Build the concept dictionary. The concept dictionary contains all the concepts in the domain, their relationships, their instances, and their class and instance attributes. The relationships specified for each concept are those in which the concept is its origin [56], a part of the dictionary is shown below.

Table 11. Dictionary of concepts

Concept name	Instances	Class attributes	Instance attributes	Relationships
Client	--	Client type Rating	Name or company name Identification No. Direction Email Profile or account Card No. Password	Buy from Buy in Receive from Buys Requires
Seller	--	Sales Category Rating	Name or company name Identification No. Direction Email Profile or account Card No. Password	Seller of Sell to Sell in
Store	Amazon Cuponatic Mercado Libre Linio EBay Rappy Dafiti	--	Name or company name Identification No. Direction Email Profile or account Card No. Password	Guarantees Design contains publishes
Transport company	Deprisa Envía Interrapidísimo Servientrega Mellogistica	--	Name or company name Identification No. Direction Email Profile or account Card No. Password	Makes Deliver to

Source: Author

9.1.5 Task 5: Describe ad hoc binary relationships. All ad hoc binary relationships previously identified in the binary relationships diagram and included in the dictionary of concepts are described in detail. The following table specifies the name of the relationship, the name of the source and destination concepts, the cardinality, and if it exists, the inverse relationship [56]:

Table 12. Ad hoc binary relationships

Relation name	Origin concept	Maximum cardinality	Destination concept	Inverse relationship
Buy_from	Client	N	Seller	Sell_to
Buy_in	Client	N	Store	
Receive_from	Client	N	Transport company	Delivered_to
Buy	Client	N	Product/service	Is_bought_by
Requires	Client	N	Customer service	Is_required_by
Is_a_seller_of	Seller	N	Product/service	Is_sold_by
Sell_in	Seller	N	Store	
Guarantees	Store	N	safety	Is_guaranteed_by
Design	Store	1	Site Design	Is_designed_by
publishes	Store	N	Information	Is_published_by
Makes	Transport company	N	Logistics Distribution	Is_maid_by
Adapts	Store	1	Usability	Is_adapted_by

Source: Author

9.1.6 Task 6: Describe instance attributes. All the instance attributes included in the concept dictionary are described, specifying the name, the concept to which the attribute belongs, type of value, range of values (in the case of numeric attributes), and minimum and maximum cardinalities [56]. The following are the instance attributes for the business agent concept.

Table 13. Instance attributes

Instance attribute name	Concept	Value type	Value range	Cardinality
Name or company name	Commercial agent	Character string	--	(1:1)
Identification	Commercial agent	Entire	>1	(1:1)
Address	Commercial agent	Character string	--	(1:1)
E-mail	Commercial agent	Character string	--	(1:1)
Profile or account	Commercial agent	Character string	--	(1:1)
Card No.	Commercial agent	Entire	>1	(1:1)
Passwords	Commercial agent	Character string	--	(1:1)

Source: Author

9.1.7 Task 7: Describe class attributes. As in the previous one, all the class attributes included in the concepts dictionary are described in detail, specifying: attribute name, name of the concept where the attribute is defined, type of value, cardinality and values [56]. Here are some of the attributes identified:

Table 14. Class attributes

Class attribute name	Concept	Value type	Cardinality	Values
Score	Client	Integer	(1:1)	--
Sale Category	Seller	[product,service]	(1:2)	--
Score	Seller	Integer	(1:1)	--
Condition	Seller	[active, inactive]	(1:2)	--
Condition	Client	[active, inactive]	(1:2)	--

Source: Author

9.1.8 Task 8: Describe the constants. The goal of this task is to describe in detail each of the constants identified in the glossary of terms. For each constant, the ontology developer must specify its name, type of value, value and unit of measure in the case of numeric constants [56]. Some identified constants are presented:

Table 15. Constants of ontology

Name	Value	Unit of measure
Response time to an information request	<=10	days
Response time to a petition right	<=30	days
Right of withdrawal	<=5	days
*VAT of services	5	%
*VAT of goods	5	%
*VAT general	19	%
*VAT of exempt goods and services	0	%

* VAT: value added tax

Source: Author

9.1.9 Task 9: Define formal axioms. The formal axioms required for the ontology are identified and described by specifying the following information: name, natural language description, logical expression that formally defines the axiom using first-order logic, and the ad hoc concepts, attributes, and relationships used in the axiom, as well as the variables used [56]. Some examples of the axioms are listed in the following table:

Table 16. Formal axioms of ontology

Axiom name	Description	Expression	Concepts	Relationships	Variables
Buyer-seller incompatibility	A customer cannot be a buyer and seller in the same business transaction	no(exists(?X,?Y)(client(?X) and seller (?Y) and buys_to(?Y,?X) and sells_to(?Y,?X)))	Client Seller	buys_to sells_to	?X ?Y
Payment methods	You can pay with any means of payment	exists(?A,?B,?C,?D)(cash(?A) and credit card (?B) and debit card(?C) and payment platform (?D) and pay_with (?D,?C,?B,?A))	Cash Credit card Debit card Payment Platform	Pay_with	?A ?B ?C ?D

Source: Author

9.1.10 Task 10: Define rules. The necessary rules are identified, for each one the following information is entered: name of the rule, description in natural language, expression that formally describes the rule, concepts, attributes and ad hoc relationships used in the rule, and the variables that have been used [56]. Here are some rules:

Table 17. Rules of e-commerce ontology

Rule name	Description	Expression	Concepts	Attributes	Relations	Variables
Request response terms	An incident where the topic is a request must be answered to the client within the established legal term	If (incidence (? I) = [request] (? P) (client (? X) and time (? T) then is_answered_in (? X,? R,? T <30))	Client Incidence Request	Time	Required is_answered _in	?X ?I ?P
Product stock	A product displayed in the virtual store must have inventory stock	If [display_window] (? V) and (product (? P) and inventory (? I)> 1 then mentions (? V,? p,? V) and is_mentioned_in (? V,? p,? V)))	Display window Product Inventory	quantity	mentions is_mentioned _in	?V ?p ?I

Source: Author

9.1.11 Task 11: Describe instances. Instances are extracted from the dictionary of concepts, which are defined with: name, the concept to which it belongs and the values of its instance attributes, if they are known [56]. Here are some instances of the Conveyor concept:

Table 18. Instances of the e-commerce ontology

Instance name	Concept name	Attribute	Values
Deprisa	Conveyor	Identification No. Address Email Profile or account Passwords Bank information	--
Envía	Conveyor	Identification No. Address Email Profile or account Passwords Bank information	--
Servientrega	Conveyor	Identification No. Address Email Profile or account Passwords Bank information	--
Interapidísimo	Conveyor	Identification No. Address Email Profile or account Passwords Bank information	--
Mellogistica	Conveyor	Identification No. Address Email Profile or account Passwords Bank information	--

Source: Author

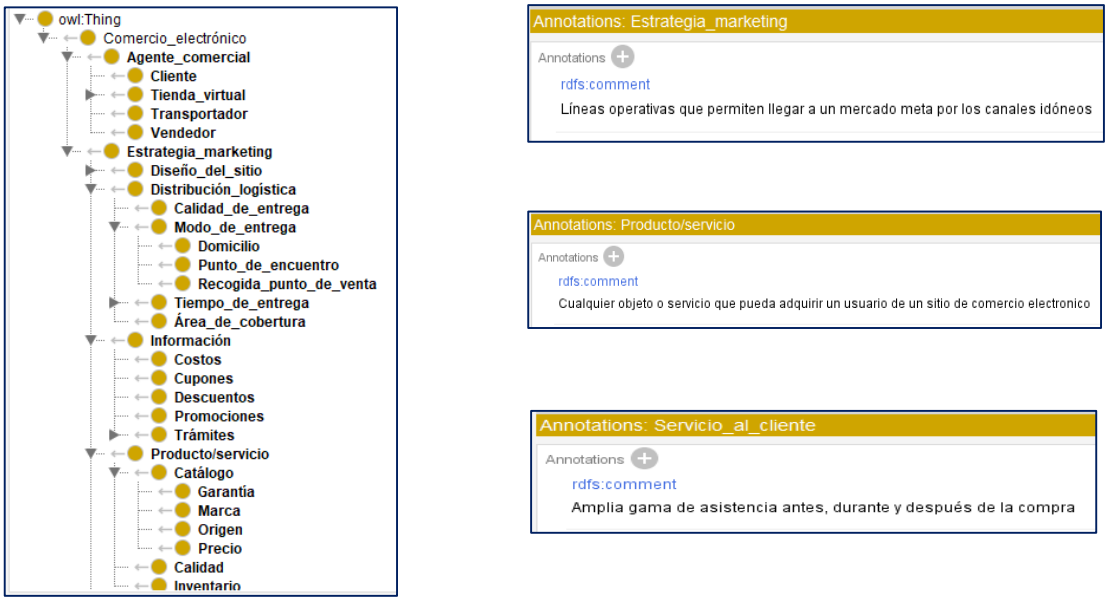
9.2 PRACTICAL MODEL

For the implementation of the electronic commerce ontology, the free open source software Protégé was used, which is an ontology editor for the creation of intelligent systems. It was developed at Stanford University and has been used to create knowledge-based solutions in areas as diverse as biomedicine, e-commerce, and organizational modeling. [105].

For the construction of the practical model, the model generated through Metonthology is taken as a basis, therefore, the result of the tasks carried out previously is taken into account and the following activities are carried out:

9.2.1 Entry of concepts in protégé. The concepts of the dictionary of terms are taken and they are entered hierarchically to protégé through the classes option. Each concept or sub-concept has an annotation that contains the meaning of that term in the ontology. Below is a part of the ranking result:

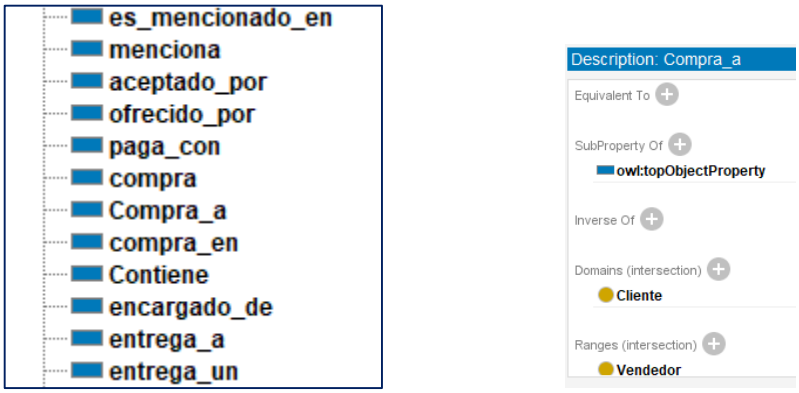
Figure 22. Concept hierarchy map



Source: Author

9.2.2 Entering and setting up relationships in protégé. The existing relationships between the classes are entered, indicating the name of the instance and relating them to each concept of domain and range, as well as their cardinality and inverse relationship if it exists. Some of the relationships are shown below:

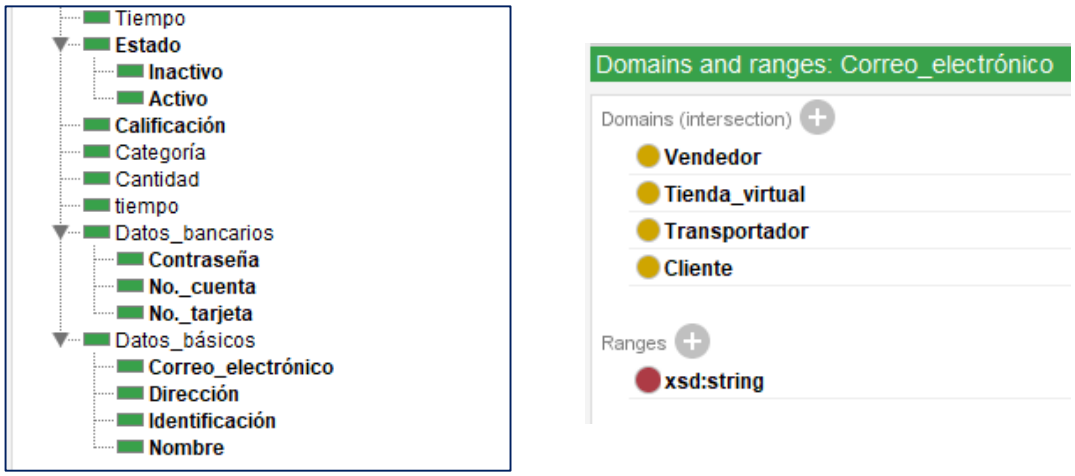
Figure 23. Ad hoc relationships



Source: Author

9.2.3 Entering and describing attributes in protégé. The attributes that describe the concepts and instances are entered, indicating their name, type, cardinality, domain and range.

Figure 24. Concept and instance attributes



Source: Author

9.2.4 Statement instance protégé. The existing instances for each class and their respective values are declared, then some of the instances created in the ontology:

Figure 25. Ontology instances

Source: Author

9.2.5 Design and final result. As a last step, the organization of the information is extracted regarding the data groups registered in protégé (classes, relationships, attributes, instances, axioms), whose metrics are listed in the following figure:

Figure 26. Components of the developed ontology

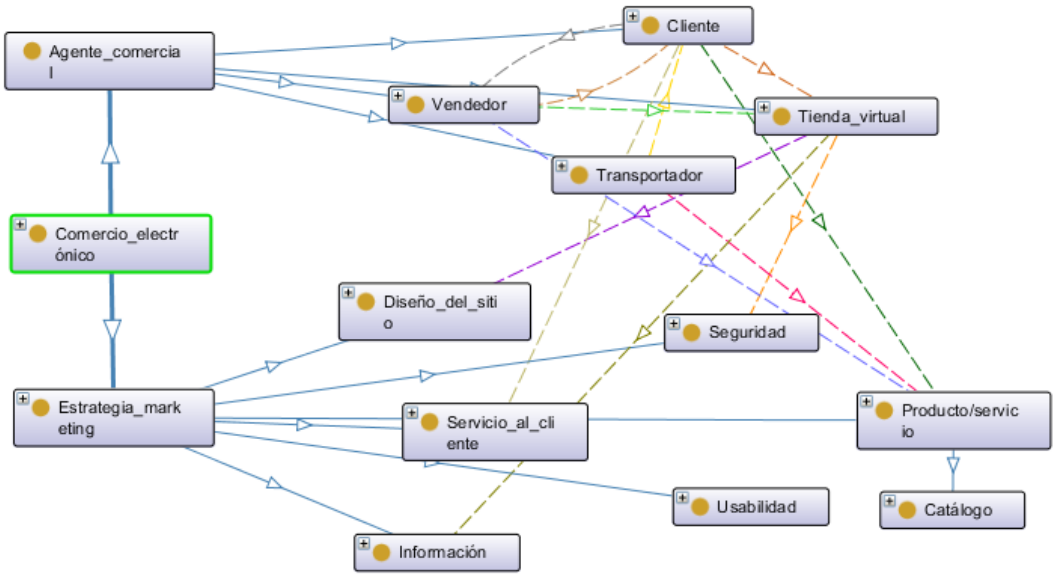
Metrics

Axiom	385
Logical axiom count	216
Declaration axioms count	155
Class count	89
Object property count	22
Data property count	18
Individual count	28

Source: Author

Using Ontograf (one of the Protégé complements) the final graph of the main concepts of the ontology is made, in which the general structure of the ontology can be visualized, showing only the first and second level concepts and the relationships in interactions between concepts each represented a different color. The symbol "+" represents an expansion of subconcepts of each of the parent or base concepts, as can be seen below:

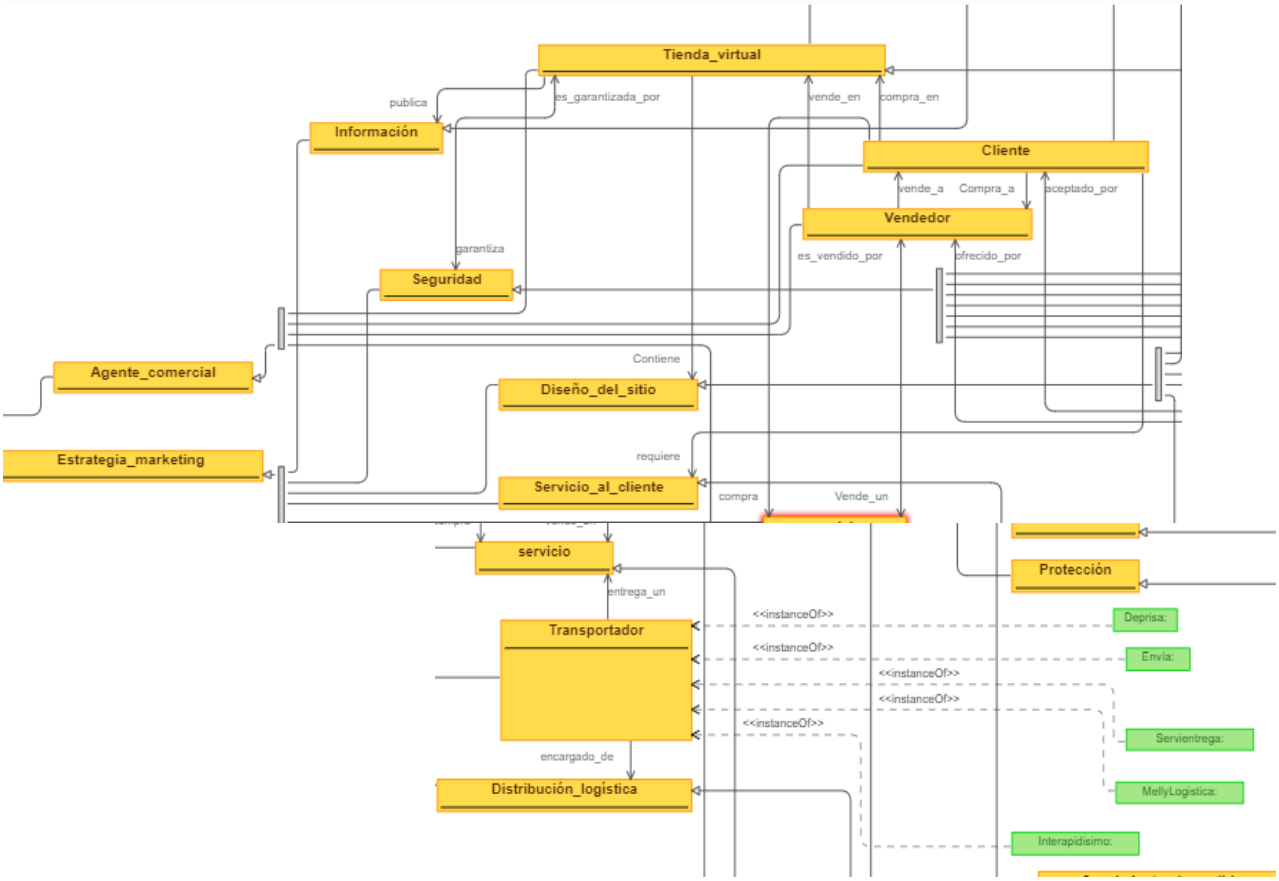
Figure 27. Interaction map between concepts



Source: Author

The figure shown below corresponds to a part of the representation of the metamodeling, using the “owlgred” diagram creation tool that allows, among other things, to see the graphical notation of the developed ontology. This can be consulted in its entirety in the following link: http://owlgred.lumii.lv/online_visualization/ai43#

Figure 28. E-commerce metamodeling



Source: Author

In this metamodeling you can see the interoperability between the seven factors that intervene in customer satisfaction: security, information, customer service, site design, usability, product or service and logistics distribution, its sub-concepts and the main commercial agents that exist in an e-commerce transaction.

10. RESULTS

10.1 FACTORS EVALUATION BASED ON THE AHP METHOD

Taking into account the variety of factors that the literature presents as indicators that affect customer satisfaction in electronic commerce, in this work the analytical hierarchy process (AHP) is applied, as it is a simple method to make decisions about complex problems, especially for those problems that are difficult to analyze quantitatively [66]

10.1.1 Structuring the Hierarchical Model. At this stage, the problem is broken down into the most relevant components, found in the literature:

- **Identification of the Problem:** Within the literature, there is no consensus on the factors that generate satisfaction for a customer when acquiring a product or service through electronic commerce.

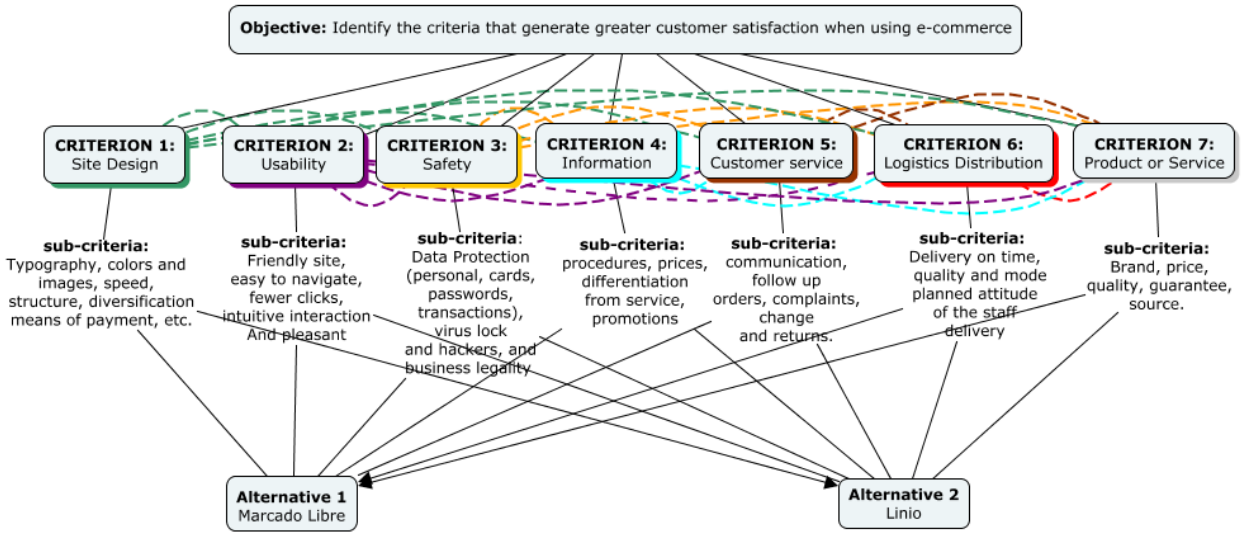
- **Definition of the Objective**: Classify the factors that generate greater customer satisfaction when using electronic commerce.

- **Identification of criteria:** Taking as reference the authors [25], [68], [96], [89], [90], [6], and [49], 7 criteria are established to be analyzed: Site design , Usability, Security, Information, Customer Service, Logistics Distribution and Product or Service.

- **Identification of alternative:** For this study, two of the most successful electronic commerce platforms in Colombia are established as alternatives.

- **Elaboration of the hierarchical tree:** The following figure shows the hierarchical tree designed for the multi-criteria analysis to be carried out, in which the objective is displayed in the first layer, in the second the criteria to buy, in the third the identified sub-criteria in the ontology and that strengthen the criteria, in the fourth and last layer the proposed alternatives. Likewise, it is visualized how the paired comparison between criteria and the analysis of the alternatives will be made.

Figure 29. Hierarchies Tree



Source: Author

10.1.2 Model evaluation. The evaluation items are examined separately the problem by pairwise comparisons. The evaluations must be issued according to the judgment of the analyst or interest group, for which attention must be paid since the success of this stage is in the hands of the selected person (s) [69]:

- **Establishment of priorities:** The priority measures of the criteria are established, as follows:

Table 19. AHP benchmark score and judgment

Numerical score	Preference judgment	Description
1	Equal	Equal preference between one element and another
2	Intermediate	Between equal and low preference
3	Low	Low preference of one element over the other
4	Intermediate	Low to moderate preference
5	Moderate	Moderate preference of one element over the other
6	Intermediate	Between moderate and strong preference
7	Strong	Strong preference of one element over the other
8	Intermediate	Between strong and extreme preference
9	Extreme	Clear and absolute preference of one element over the other

Source: Author based on [67]

- **making judgments and assessments:** As mentioned above, in literature there is no consensus as the basis for establishing the importance of one criterion over another and thus assign the score you should each, so in the This work proceeds to design a survey to be able to extract from the clients or potential clients of electronic commerce, the opinion regarding the level of importance of each one of the criteria.

- **Sample design:** This study was carried out in the city of Bogotá - Colombia, establishing the population universe as the people who make purchases through electronic commerce. The sample population comprised 2,933 students from the law school of the Catholic University of Colombia, the sample size was computed using the sample calculator, obtaining as a result a sample of 382 with a confidence level of 95% and a margin of error. 5%. It is a representative sample, not probabilistic, for convenience (volunteers).

- **Instrument Design:** An electronic survey was designed using Google's survey management software (Google Forms), which had a total of 46 mandatory questions, of which 4 were closed questions and were focused on the basic information of the respondent and 42 were of the scale type and aimed at the classification of the factors to be evaluated, with a response time of approximately 5 minutes.

Table 20. Survey data sheet

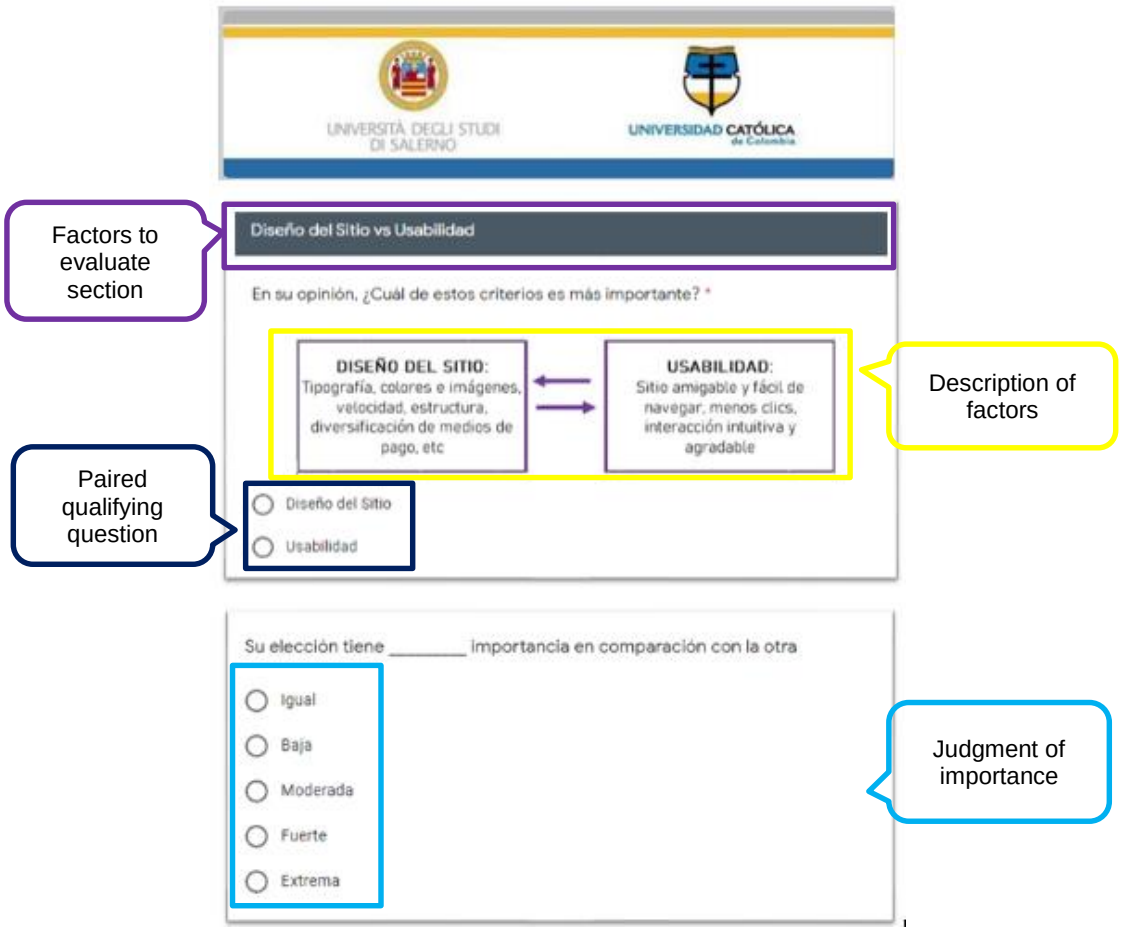
Survey data sheet	
DESIGNED BY	Yuly Milena Espinosa Neisa - Master of Engineering and Innovation Management Candidate
SURVEY NAME	Factors that generate customer satisfaction in electronic commerce
UNIVERSE	Population that makes purchases through electronic commerce
SAMPLING UNIT	Students at the Law School of the Catholic University of Colombia
CREATION DATE	February 25, 2021
COVERAGE AREA	National (Bogotá D.C. - Colombia)
DATA COLLECTION TECHNIQUE	Electronic survey
OBJECTIVE OF THE SURVEY	Know the level of importance that customers give to the factors that generate satisfaction in electronic commerce
No. QUESTIONS ASKED	46
DURATION	Approx. 5 minutes
TYPE OF QUESTIONS APPLIED	Closed and scale
SCALE USED FOR MEASUREMENT:	Semantics and punctuation

Source: Author

- **Execution of the survey:** With the approval of the dean of the Faculty of Law, the survey was sent by institutional email to each student. The survey was available for three weeks (from March 9 to March 26, 2021). Student participation in this study was voluntary.

  Each person had to make the comparison between pairs, on the factors that were shown in the question, likewise, they had to evaluate a third element that was the level of importance of one criterion against the other

Figure 30. Survey design



Source: Author

- **Processing of the collected information:** A review was made of the database delivered by the software, to guarantee the quality of the answers, validating possible duplication of answers, for which it was checked that there was only one answer for

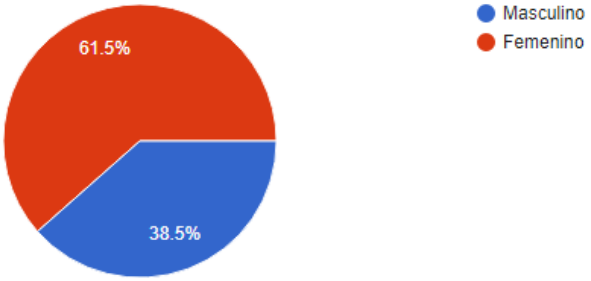
each student; It was also checked that the responses corresponded to the students' emails.

10.1.3 Analysis of the results

- **Statistical analysis:** In total 382 students responded to the survey, with which, the analysis of demographic factors (sex and age), intrinsic factors or preferences (purchases in electronic commerce) and satisfaction factors (factors to be evaluated) were carried out.

  Sex: Most of the respondents correspond to women with 61.5% and the remaining 38.5% are men.

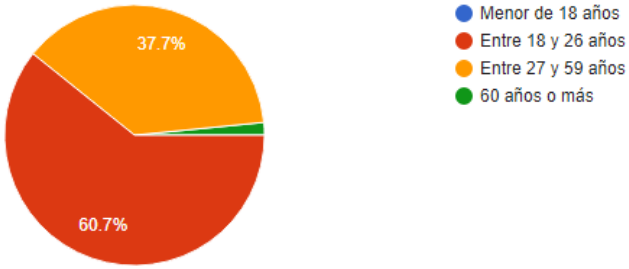
  Figure 31. sex of respondents



  Source: Author based on survey results

  Age: In accordance with the Ministry of Health and Social Protection of Colombia [106] Respondents are classified into the following age groups: minors, between 0 and 18 years of age, without participation 0%; Young people between 18 to 27 years old, have the highest participation with 61.7%; followed by adults between 27 and 59 years old, with 37.7%; and older adults aged 60 and over represent 1.6%.

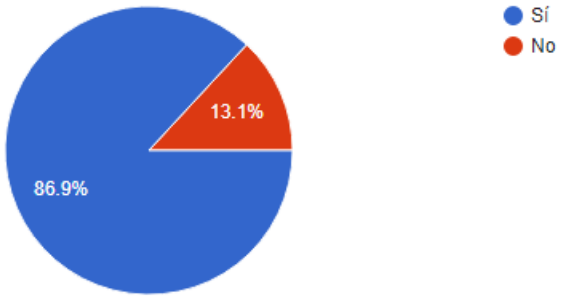
  Figure 32. Age of respondents



  Source: Author based on survey results

  E-Commerce purchases: 86% of respondents have purchased products and / or services through the internet

Figure 33. E-commerce Respondent Purchases



Source: Author based on survey results

Satisfaction factors: Respondents evaluated each of the factors in a paired manner, that is, one factor against another. The results of the comparison are listed in the following table:

Table 21. Criteria comparison result

CRITERIA A	CRITERIA B	CHOSEN CRITERIA
SD	U	U
SD	S	S
SD	I	I
SD	CS	CS
SD	LD	LD
SD	P/S	P/S
U	S	S
U	I	I
U	CS	CS
U	LD	LD
U	P/S	P/S
S	I	S
S	CS	S
S	LD	S
S	P/S	S
I	CS	CS
I	LD	I
I	P/S	P/S
CS	LD	CS
CS	P/S	P/S
LD	P/S	P/S

SD	Site design
U	Usability
S	Safety
I	Information
CS	Customer service
LD	Logistics distribution
P/S	Product or Servicio

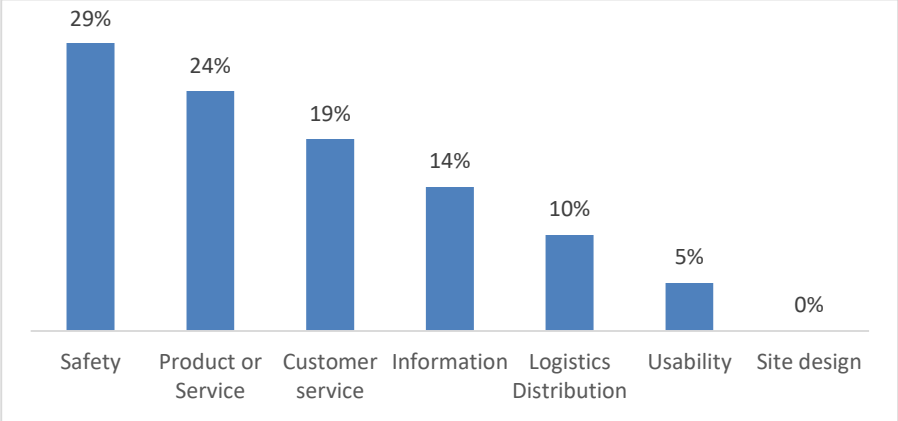
Source: Author

In general, these perceptions are maintained in all age groups, the only difference found was in the comparison of Information and customer service, all groups rated customer service as more important, except those over 60 who said it was more important information.

The factors that generate customer satisfaction in electronic commerce were organized and according to the classification made by the respondents, it was found that the first place is

occupied by security 29%, in second place, the product or service 24%, in third place, the customer service 19%, followed by logistics distribution 14%, then information 10% and finally usability 5%. Site design was not more important when compared to the other 0% factors.

Figure 34. Statistical result - Satisfaction factors



Source: Author based on survey results

- **AHP analysis**

Let A be an nxn matrix, where n ª Z +. Let aij be the element (i, j) of A, for i = 1, 2,… n, y, j = 1, 2,… n. We say that A is a matrix of paired comparisons of n alternatives, if aij is the measure of the preference of the alternative in row i when compared with the alternative in column j. When i = j, the value of aij will be equal to 1, since the alternative is being compared with itself [69], that is,

$$\mathbf{A} = \begin{pmatrix} 1 & a_{12} & \dots & a_{1n} \\ a_{21} & 1 & \dots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & \dots & 1 \end{pmatrix} \quad (1)$$

Furthermore, it is true that: aij.aji = 1; namely:

$$\mathbf{A} = \begin{pmatrix} 1 & a_{12} & \dots & a_{1n} \\ 1/a_{12} & 1 & \dots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ 1/a_{1n} & 1/a_{2n} & & 1 \end{pmatrix} \quad (2)$$

Additionally, the priorities of each criterion are considered in terms of the global goal:

$$\begin{array}{ll} & Global\ goal \\ Criteria\ 1 & \begin{bmatrix} P'_1 \\ P'_2 \\ \dots \\ P'_m \end{bmatrix} \\ Criteria\ 2 & \\ \dots & \\ Criteria\ m & \end{array} \quad (3)$$

Where m is the number of criteria and P'i is the priority of criterion i with respect to the global goal, for i = 1, 2,…, m [69].

To rank the criteria, we proceed to take the total results of the survey and according to the judgments made within the Saaty scale [67], which are found in table 21, the results are located in the matrix of paired comparisons and each criterion is evaluated.

Table 22. Priority matrix

Criteria	Site design	Usability	Safety	Information	Customer Service	Logistic Distribution	Product or Service
Usability	1	0,20	0,14	0,14	0,14	0,17	0,14
Usabilidad	5	1	0,13	0,17	0,17	0,17	0,14
Safety	7	8	1	7	7	7	7
Information	7	6	0,14	1	0,17	5	0,17
Customer Service	7	6	0,14	6	1	5	0,20
Logistic Distribution	6	6	0,14	0,20	0,20	1	0,20
Product or Service	7	7	0,14	6	5	5	1

Source: Author based on survey results

Subsequently, the results are normalized and the priority vector is obtained. Consistency validated. Thus, a comparison matrix A nxn is consistent if: aij.ajk = aik, for i, j, k = 1, 2,…, n finding that a consistency ratio is less than 0.1, therefore, it is evident that you have reasonably weighted the criteria in the matrix. To determine whether or not a consistency level is "reasonable", a quantifiable measure is developed for the comparison matrix A nxn (where n is the number of alternatives a compared). It is known that if matrix A is perfectly consistent, it produces a normalized N nxn matrix, of elements wij (for i, j = 1, 2,…, n), such that all columns are identical, that is, w12 = w13 = … = W1n = w1; w21 = w23 =… = w2n = w2; wn1 = wn2 =… = wnn = wn [69].

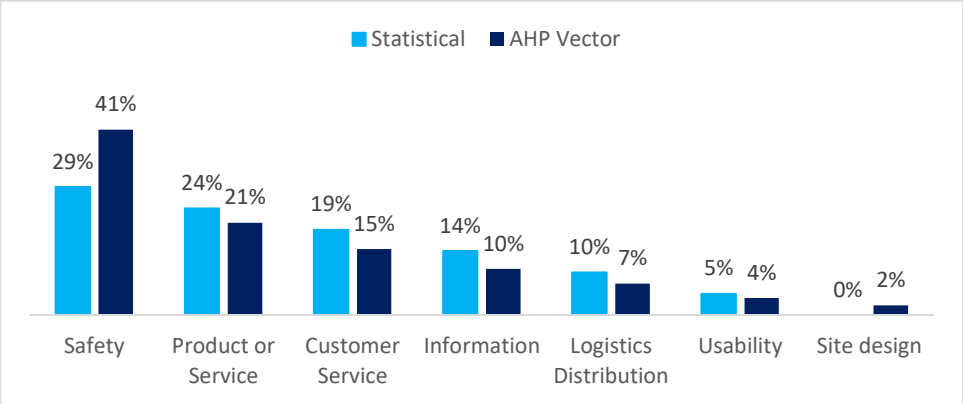
Table 23. Comparison matrix

MATRIZ NORMALIZADA								
Criteria	**Site design**	**Usability**	**Safety**	**Information**	**Customer Service**	**Logistic Distribution**	**Product or Service**	**Vector de prioridades**
Usability	0,025	0,006	0,078	0,007	0,010	0,007	0,016	**0,021**
Usabilidad	0,125	0,029	0,068	0,008	0,012	0,007	0,016	**0,038**
Safety	0,175	0,234	0,544	0,341	0,512	0,300	0,791	**0,414**
Information	0,175	0,175	0,078	0,049	0,012	0,214	0,019	**0,103**
Customer Service	0,175	0,175	0,078	0,293	0,073	0,214	0,023	**0,147**
Logistic Distribution	0,150	0,175	0,078	0,010	0,015	0,043	0,023	**0,070**
Product or Service	0,175	0,205	0,078	0,293	0,366	0,214	0,113	**0,206**

Source: Author based on survey results

As shown in the following figure, the factors that generate customer satisfaction continue in the same position both in the statistical analysis and in the multicriteria analysis, however, the difference between the first and the second analysis lies in the distribution of the percentages of importance. For example, the site design obtained 0% participation in the first analysis, while in the second it obtained a result of 2%, likewise, the Safety factor obtained 10 percentage points higher in the second analysis. The other factors were lower in the second analysis.

Figure 35. Statistical result vs AHP



Source: Author based on survey results

It is then evident that security represents almost half (41%) of the customer satisfaction indicator, therefore, it is a factor that more management must have. These results agree with other authors in the sense that, currently, the most important concerns of people with respect to electronic commerce are security issues, in terms of privacy, consumer protection [88], security of online payments, reliability of companies and the lack of a privacy policy [92]; It is even said that security is a prerequisite to the purchase since, when evidencing the lack of this, the person could not carry out the transaction [68].

This shows that a multi-criteria method for decision-making such as AHP reflects the perceptions and proposed values with greater precision, which allows a better decision to be made in the right direction [69] As shown in the previous figure, if there is made a decision based only on the statistical analysis, an error could have been incurred by completely disregarding the Site Design factor, due to its result of 0% compared to the other factors. While the analysis carried out with AHP, allows us to analyze that, although it is true, site design is the least important, it is also true that, by not taking it into account, compared to the judgment of a client, it would be equivalent to 2% of a possible dissatisfaction.

10.2 DATA EXTRACTION BASED ANALYSIS OF SOCIAL NETWORKS AND SEMANTIC MODEL OF E-COMMERCE

Taking into account that customer opinions are recognized as fruitful sources of information to monitor and improve customer satisfaction levels, particularly because they convey the real voices of customers expressing relatively unequivocal opinions [6]. An analysis exercise of social networks is carried out, taking 100 comments from the Mercado Libre fan page [107] and 100 from Linio's fan page [108], o place them within the semantic model developed for electronic commerce.

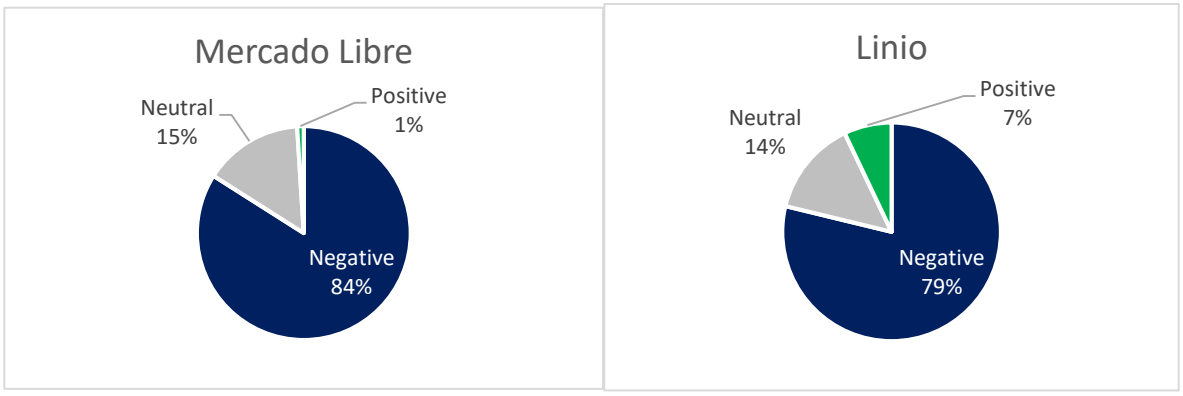
MercadoLibre is a Marketplace from Argentina with a presence in Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Uruguay and Venezuela. one of the main electronic businesses in the world [109]. For its part, Linio is the main Marketplace of the Falabella group, it has a presence in Latin America: Argentina, Chile, Colombia, Mexico, Peru and offices in Venezuela, China and the United States. It has an online catalog with more than 7 million products [110].

These two stores were chosen because they are among the first e-commerce platforms in Colombia, since Mercado Libre and Linio have a stronger positioning of a segment that, although still small compared to other regions of the world, is growing vigorously year after year [111]. The extraction of the comments was carried out using the Octoparse software, which allowed easy access to the data, saving them in a structured and clean way and allowed choosing the xls format for subsequent analysis.

In both cases, most of the comments have negative polarity or sentiment (84% for Mercado Libre and 79% for Linio); Neutral comments occupied 15% and 14% respectively and a

minimum percentage represent positive comments, thus, only 1% in Mercado Libre and a little more in line, with 7%.

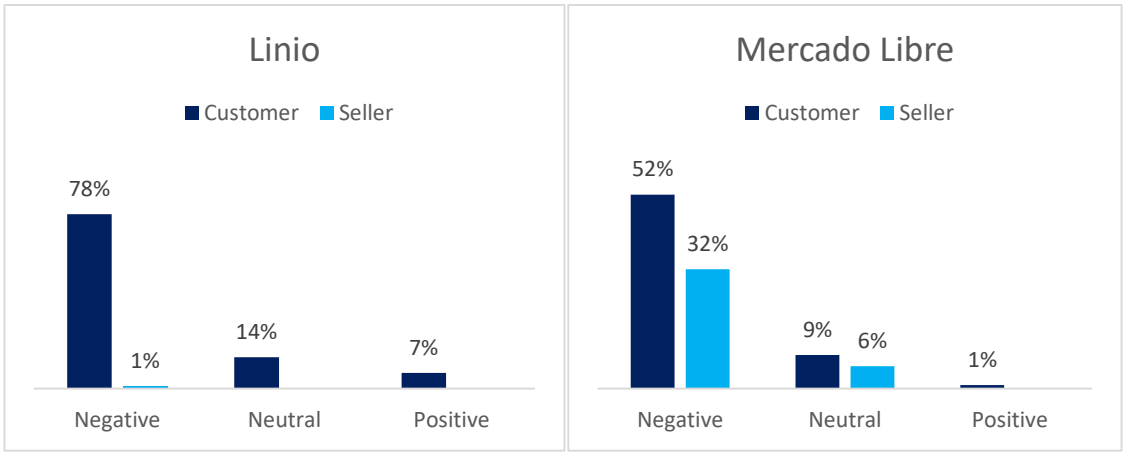
Figure 36. Polarity comments



Source: Author based on [107] and [108]

In Mercado Libre, 62% of the opinions were registered by customers, while the remaining 38% correspond to the platform's sellers. For its part, in Linio 99% corresponds to customers and 1% to sellers.

Figure 37. Customer Vs Seller Feedback Relationship



Source: Author

The comments received were analyzed with the support of the semantic model developed with the electronic commerce ontology, classifying said comments into second-level (columns) and third-level (rows) classes. Comments were grouped in a frequency table for analysis. Some comments made reference to more than one sub-concept.

In general, 27% of the comments captured on Mercado Libre's fan page refer to information, especially on procedures, costs and promotions; security with 25%, related to the protection, account management and legality of the business; customer service is also among the first with 23%, due to the attention to requests, complaints, claims, suggestions and congratulations, additionally, diversification in communication channels or media and follow-up of orders; logistics distribution was mentioned with 11%, mainly on the way, quality and coverage to make deliveries; comments on the product or service occupied 6%, which focused on quality, catalog and inventory; usability with 5%, where data processing, functionality and navigation issues were mentioned and finally the least mentioned factor was the design of the site with 2%, which was related to options of payment methods and the content in the website.

Table 24. Comparison of Mercado Libre variables

Sub-concepts	Site design	Logistic Distribution	Information	Product or Service	Safety	Customer Service	Usability	Grand total	%
Coverage area		6						6	3%
Attention to incidents						15		15	9%
Delivery quality		2						2	1%
Quality_Product				6				6	3%
Catalogue				4				4	2%
Contents	1							1	1%
Costs			4					4	2%
Functionality							2	2	1%
Account management					19			19	11%
Inventory				1				1	1%
Business legality					2			2	1%
Communication media						18		18	10%
Payment methods	3							3	2%
Delivery mode		7						7	4%
Navigation							1	1	1%
Prosecutions							6	6	3%
Promotions			2					2	1%
Protection (purchases, sales, data)					22			22	13%
Track orders						7		7	4%
Delivery time		5						5	3%
Formalities			42					42	24%
Grand total	**4**	**20**	**48**	**11**	**43**	**40**	**9**	**175**	**100%**
%	2%	11%	27%	6%	25%	23%	5%	100%	

Source: Author based on [107]

Now, the comments captured on the Linio Fanpage refer mostly to customer service with 27%, mainly through channels or media, follow-up on orders and attention to requests, complaints, claims, suggestions and congratulations ; followed by logistics distribution with 26%, mainly on time, mode, coverage and quality at the time of making deliveries; later the information with 17%, on procedures, costs and promotions; security with 13%, related to the protection, account management and legality of the business; about the product or service, comments occupied 10%, which focused on quality, catalog and inventory; usability with 4%, where data processing and navigation issues were mentioned and as in the previous one, the least mentioned factor was the design of the site with 3%, which was related to options of payment methods and the content on the website.

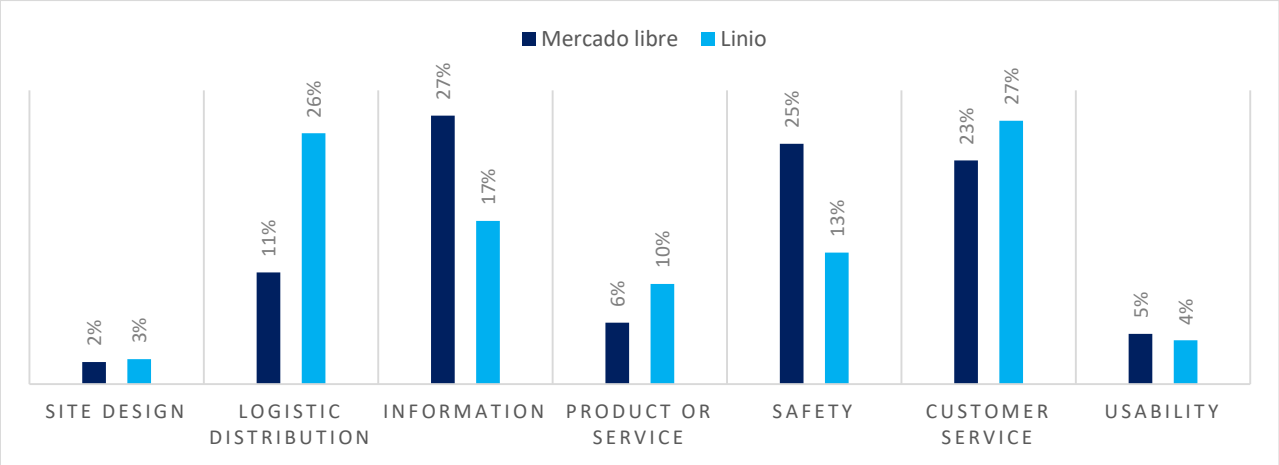
Table 25. Comparison of Linio variables

Sub-concepts	Site design	Logistic Distribution	Information	Product or Service	Safety	Customer Service	Usability	Grand total	%
Coverage area		4						4	3%
Attention to incidents						6		6	4%
Delivery quality		3						3	2%
Quality_Product				6				6	4%
Catalogue				6				6	4%
Contents	1							1	1%
Costs			3					3	2%
Functionality							0	0	0%
Account management					2			2	1%
Inventory				4				4	3%
Business legality					2			2	1%
Communication media						22		22	14%
Payment methods	3							3	2%
Delivery mode		6						6	4%
Navigation							1	1	1%
Prosecutions							6	6	4%
Promotions			2					2	1%
Protection (purchases, sales, data)					17			17	11%
Track orders						14		14	9%
Delivery time		27						27	17%
Formalities			21					21	13%
Grand total	**4**	**40**	**26**	**16**	**21**	**42**	**7**	**156**	**100%**
%	3%	26%	17%	10%	13%	27%	4%	100%	

Source: Author based on [108]

As can be seen in the following figure, the comments retrieved in the two e-commerce platforms vary, for example, for Mercado Libre the first three positions focused on information, security and customer service, while for Linio, the first three topics that customer feedback focused on were: customer service, logistics distribution and information.

Figure 38. Organization of extracted comments



Source: Author

10.3 ALTERNATIVES EVALUATION BASED ON THE AHP METHOD

Following the AHP methodology, the priority matrix is normalized as previously done, but now with the two alternatives selected, the first is the Mercado Libre e-commerce store and the second is the Linio store.

The judgments are synthesized according to the results obtained from the comments extracted from Facebook, the matrices are normalized and the following results are obtained:

- **Site design criteria:** Mercado libre obtained a higher vector with 75% compared to Linio who had 25%.

Table 26. Site design comparison for alternatives

CRITERIA: Site design					
Alternatives	**Mercado Libre**	**Linio**	**NORMALIZED MATRIX**		**AVERAGE VECTOR**
Mercado Libre	1	3	0,75	0,75	0,75
Linio	0,33	1	0,25	0,25	0,25
TOTAL	1,33	4			

Source: Author

- **Usability criterion:** for this criterion Linio had a higher resultant vector with 75%, while Mercado Libre obtained 25%

Table 27. Usability comparison for alternatives

CRITERIA: Usability					
Alternatives	**Mercado Libre**	**Linio**	**NORMALIZED MATRIX**		**AVERAGE VECTOR**
Mercado Libre	1	0,33	0,250	0,250	0,250
Linio	3	1	0,750	0,750	0,750
TOTAL	4	1,33			

Source: Author

- **Safety Criterion:** Linio in this criterion presented a higher result with a vector of 87.5%, compared to Mercado Libre, which obtained 12.5%

Table 28. Safety comparison for alternatives

CRITERIA: Safety					
Alternatives	**Mercado Libre**	**Linio**	**NORMALIZED MATRIX**		**AVERAGE VECTOR**
Mercado Libre	1	0,143	0,125	0,125	0,125
Linio	7	1	0,875	0,875	0,875
TOTAL	8	1,143			

Source: Author

- **Information Criterion:** In this criterion, Linio also obtains a better average vector with 86%, while Mercado Libre obtained 14%.

Table 29. Comparison of information for alternatives

CRITERIA: Information					
Alternatives	**Mercado Libre**	**Linio**	**NORMALIZED MATRIX**		**AVERAGE VECTOR**
Mercado Libre	1	0,167	0,143	0,143	0,143
Linio	6	1	0,857	0,857	0,857
TOTAL	7	1,167			

Source: Author

- **Customer service criterion:** In this criterion Mercado Libre presented the best average vector with 83%, while Linio had 17%

Table 30. Comparison of customer service for alternatives

CRITERIA: customer service					
Alternatives	**Mercado Libre**	**Linio**	**NORMALIZED MATRIX**		**AVERAGE VECTOR**
Mercado Libre	1	5	0,833	0,833	0,833
Linio	0,20	1	0,167	0,167	0,167
TOTAL	1,2	6,0			

Source: Author

- **Criteria for logistics distribution:** Mercado Libre presented the best average vector with 87.5%, while Linio 12.5%

Table 31. Comparison of logistic distribution for alternatives

CRITERIA: Logistics Distribution					
Alternatives	**Mercado Libre**	**Linio**	**NORMALIZED MATRIX**		**AVERAGE VECTOR**
Mercado Libre	1	7	0,875	0,875	0,875
Linio	0,14	1	0,125	0,125	0,125
TOTAL	1,143	8,000			

Source: Author

- **Product or service criterion**: regarding this criterion, Mercado Libre presented the best average vector with 83%, while Linio had 17%

Tabla 32. Comparison of product or service for alternatives

CRITERIA: Product or Service					
Alternatives	**Mercado Libre**	**Linio**	**NORMALIZED MATRIX**		**AVERAGE VECTOR**
Mercado Libre	1	5	0,833	0,833	0,833
Linio	0,20	1	0,167	0,167	0,167
TOTAL	1,200	6,000			

Source: Author

Making an early review, it is evident that Mercado Libre had better scores in 4 criteria, while Linio in 3 criteria. However, it is necessary to carry out the last mathematical calculation that the AHP method presents and it is the weighting of the alternative vectors against the priority vectors of each criterion.

The global priority for each decision alternative is summarized in the column vector that results from the product of the priority matrix of the criteria with the vector of alternatives. Where Pg1 is the global priority (with respect to the global goal) of alternative i (i = 1, 2,…, n) [69].

$$\begin{pmatrix} P_{11} & P_{12} & \dots & P_{1m} \\ P_{21} & P_{22} & \dots & P_{2m} \\ \dots & \dots & \dots & \dots \\ P_{n1} & P_{n2} & \dots & P_{nm} \end{pmatrix} \begin{pmatrix} P'_1 \\ P'_2 \\ \dots \\ P'_m \end{pmatrix} = \begin{pmatrix} Pg_1 \\ Pg_2 \\ \dots \\ Pg_n \end{pmatrix} \quad (4)$$

Although the comments expressed by the clients of the two platforms mostly presented a polarity of negative sentiment, it is important to specify that the results obtained by this study comparatively show which of the two had a better measurement in the 7 established criteria.

Table 33. Global priority versus alternatives

Criteria vs Alternatives	Site design	Usability	Safety	Information	Customer Service	Logistic Distribution	Product or Service	Vector Alternatives
Mercado Libre	0,750	0,250	0,125	0,143	0,833	0,875	0,833	0,448
Linio	0,250	0,750	0,875	0,857	0,167	0,125	0,167	0,552
Priorities vector	0,021	0,038	0,414	0,103	0,147	0,070	0,206	

Source: Author

The results of the global priority show that the two stores had a fairly close resultant vector, however, the Linio e-commerce platform is the best alternative with a final weight of 55%. In other words, by validating the criteria that generate customer satisfaction, Linio presents a better perception by customers according to the opinions registered on the Facebook social network.

This result could be explained by analyzing the weight of each criterion within the priority vector, since, although it is true that Mercado Libre had better results in 4 criteria against 3 than Linio had, it is also true that the criteria where Linio it was better evaluated. For example, in the safety criterion, which is the criterion that has the greatest weight with 41% over the others. Linio had a significant difference over Mercado Libre (87.5% vs 12.5%).

11. CONCLUSIONS

In response to the research question, a detailed study of related research was carried out, which allowed identifying the main factors that generate customer satisfaction, however, in the literature no consensus was found regarding the identification of the variables and their level of importance, however, it was possible to have an overview of the factors, methods, tools and procedures used by other authors that allowed a correct choice to carry out the model proposed in the present work.

Were determined variables indexed on the satisfaction of the client e-commerce and nested according to their importance as well: the first place was security with nearly half of the weight on the other (41%); in second place is the product or service with 21%; the third place is the customer service with 15%; the fourth is the information with 10%; the fifth is logistics distribution with 7%; the sixth is the usability with 4% and the last place went designing the site with 2%.

Within the research work, a semantic model was carried out by means of an ontology on the concepts of electronic commerce, showing that, by locating the terms in logical components, hierarchically organized into classes, subclasses and linked to the different relationships that they may have in common. variables and other actors involved in an online business transaction, the process of collecting, processing and analyzing customer opinions is much easier and more useful for decision making.

The customer satisfaction evaluation measurement that was deployed to the comments extracted from the fanpages belonging to the Mercado Libre and Linio e-commerce platforms, allows us to identify that, comparatively, Linio has a better perception of its customers (buyers and sellers) with a 55 % against the objective evaluation criteria established. Likewise, it was possible to identify the criteria in which a store has the greatest advantage and in which it has a disadvantage compared to its competitor, and specifically in which aspects it should pay more attention.

It was identified that shoppers give the most feedback to a store about their experience, generally expressing their feelings in negative comments, which agrees with [61] in the sense that many interactions on social networks have a negative feeling. The dissatisfaction of the clients of the two platforms is mainly concentrated in the process for money refund procedures; greater protection for purchases and sales, enabling communication means, such as mail, telephones and personalized attention; agile process for creating, blocking, suspension and other procedures related to account management; timely attention to PQRSF incidents, especially complaints; and agreed time for product deliveries

After analyzing the results, it was possible to demonstrate that the present research work achieved the general objective that was to formalize a model to evaluate customer satisfaction in electronic commerce through multicriteria and semantic analysis in social networks. The analysis of social networks provided the opinions of customers and their

relationship with the store, the semantic model made it easier to understand the main issues that are on the minds of customers and motivated them to express themselves publicly, the analytical hierarchy process allowed to compare and estimate mathematically the opinions of the users against duly identified factors and evaluate the levels of satisfaction.

One of the biggest obstacles during the development of this work was to easily access the comments left by customers and sellers on the Facebook page of the stores, especially in Linio, due to the fact that said comments were not fully visible. For this reason and taking into account that most of the comments were classified as negative, it could be deduced that the store's strategy is to hide negative comments so as not to generate a bad image for its brand.

The proposed model allows making decisions objectively, using the AHP multi-criteria method, measuring the identified variables, according to the estimated weights for each one, against unstructured comments freely expressed by customers on a social network. This gives a new approach to the measurement of customer satisfaction and sentiment analysis, since not only is the sentiment of the messages examined based on their polarity (positive, negative or neutral) but it goes further and proposes a measurement comparative, structured and analytical, whose results are more nourished compared to an indicator that only reveals data trends.

12. FUTURE WORKS

Given the contributions provided by this research and the constant increase in the use of social networks by clients and potential e-commerce clients, the need arises to continue with this line of research, in such a way that the analysis is increasingly enriched. of customer satisfaction as an input for making business decisions.

For future works, the semantic and ontological metadata model developed in this research should be linked to a machine learning model to carry out the procedure in an automated way that allows the evaluation of a greater number of comments. The alignment between the dictionary of terms provided in this research and the existing sentiment lexicons should also be sought, so that future semantic studies can continue.

Considering that this study took as an example two electronic commerce platforms whose software is developed by third parties providing a web structure so that other people can carry out commercial transactions digitally and where the seller depends heavily on the conditions of said platform, it would be interesting carry out a customer satisfaction evaluation exercise to an own electronic commerce, where the satisfaction factors depend directly on the seller.

Finally, and not least, the development of this research work will form the knowledge base for the development of business consulting projects focused on solving specific problems on customer relations, digital marketing, return on investment in social networks, among many other lines of advice that can be raised from the results obtained.

13. REFERENCES

[1] CÁMARA COLOMBIANA DE COMERCIO ELECTRÓNICO. INFORME: COMPORTAMIENTO DEL ECOMMERCE EN COLOMBIA DURANTE 2020 Y PERSPECTIVAS PARA 2021. *2020* [online]. [accessed. 2021-03-15]. Available at: https://www.ccce.org.co/wp-content/uploads/2020/10/informe-comportamiento-y-perspectiva-ecommerce-2020-2021.pdf

[2] CRAMER, Ethan. *Global Ecommerce Update 2021- Insider Intelligence Trends, Forecasts & Statistics* [online]. 13. January 2021 [accessed. 2021-03-22]. Available at: https://www.emarketer.com/content/global-ecommerce-update-2021

[3] OBSERVATORIO ECOMERCE EN COLOMBIA. *Medición de Indicadores de consumo del Observatorio eCommerce*. 2019.

[4] YAFOOZ, Wael M S, Zainab BINTI, Abu BAKAR, S K Ahammad FAHAD and Ahamed M MITHUN. Business Intelligence Through Big Data Analytics, Data Mining and Machine Learning. In: Neha SHARMA, Amlan CHAKRABARTI and Valentina Emilia BALAS, eds. [online]. Singapore: Springer Singapore, 2020, p. 217–230 [accessed. 2020-06-03]. Advances in Intelligent Systems and Computing. ISBN 9789811393648. Available at: doi:10.1007/978-981-13-9364-8

[5] DELOITTE. *Ventajas competitivas sostenibles con datos y analítica | Deloitte España | Deloitte Digital* [online]. [accessed. 2020-06-03]. Available at: https://www2.deloitte.com/es/es/pages/operations/articles/generacion-ventajas-competitivas-sostenibles-datos-analitica.html

[6] KANG, Daekook and Yongtae PARK. Review-based measurement of customer satisfaction in mobile service: Sentiment analysis and VIKOR approach. *Expert Systems with Applications* [online]. 2014, 41(4 PART 1), 1041–1050. ISSN 09574174. Available at: doi:10.1016/j.eswa.2013.07.101

[7] KUMAR, Sudhanshu, Mahendra YADAVA and Partha Pratim ROY. Fusion of EEG response and sentiment analysis of products review to predict customer satisfaction. *Information Fusion* [online]. 2019, 52, 41–52. ISSN 15662535. Available at: doi:10.1016/j.inffus.2018.11.001

[8] DÍAZ-MENDIVELSO, J D and M J SUAREZ-BARÓN. Avances y desafíos de métodos y modelos computacionales aplicados al análisis de información en redes sociales. *Vínculos: Ciencia, Tecnología y Sociedad* [online]. 2019, 16(2), XX–XX. Available at: doi:10.14483/2322939X.14714

[9] AL-OTAIBI, S., A. ALNASSAR, A. ALSHAHRANI, A. AL-MUBARAK, S. ALBUGAMI, N. ALMUTIRI and A. ALBUGAMI. Customer satisfaction measurement using sentiment analysis. *International Journal of Advanced Computer Science and*

Applications [online]. 2018, 9(2), 106–117 [accessed. 2021-03-22]. Available at: https://www-scopus-com.ucatolica.basesdedatosezproxy.com/record/display.uri?eid=2-s2.0-85049530618&origin=resultslist&sort=plf-f&src=s&st1=&st2=&sid=87044944890f2b74a965781b802a386a&sot=b&sdt=b&sl=67&s=TITLE%28%22Customer+Satisfaction+Measurement+using+Sentiment+Analysis%22%29&relpos=0&citeCnt=3&searchTerm=

[10] DINERO. *Estas son las ventajas del comercio electrónico en Colombia* [online]. 2018 [accessed. 2020-05-05]. Available at: https://www.dinero.com/empresas/articulo/estas-son-las-ventajas-del-comercio-electronico-en-colombia/258979

[11] COMMERCE, Nube. *Informe anual de comercio electrónico durante 2019 y perspectivas para 2020*. 2020.

[12] GARCÍA, Vicente. Niveles de satisfacción de las empresas que utilizan el comercio electrónico como un canal de ventas en el estado Zulia [online]. 2003, 91–104 [accessed. 2020-05-05]. Available at: http://ojs.urbe.edu/index.php/telos/article/view/1114

[13] VELASQUEZ, Karina. Marketing multicanal o 360: gran potencial para tu eCommerce. *1 ABRIL, 2016* [online]. 2016 [accessed. 2020-05-07]. Available at: https://marketing4ecommerce.mx/marketing-multicanal-o-360-gran-potencial-para-tu-ecommerce/

[14] CISION. This Upfront Season Digital Dollars Could Jump By As Much As 50% Says Nielsen's New Annual CMO Report. *06 de junio de 2018* [online]. 2018 [accessed. 2020-05-09]. Available at: https://www.prnewswire.com/news-releases/this-upfront-season-digital-dollars-could-jump-by-as-much-as-50-says-nielsens-new-annual-cmo-report-300660223.html

[15] MARKETINGDIVE. Estudio: el 64% de los especialistas en marketing planean impulsar los presupuestos digitales "marginalmente" en 2019 | Inmersión de marketing. *22 de octubre de 2018* [online]. 2018 [accessed. 2020-05-09]. Available at: https://www.marketingdive.com/news/study-64-of-marketers-plan-to-boost-digital-budgets-marginally-in-2019/540195/

[16] MARKETING CHARTS. Los especialistas en marketing ven la utilidad de las tácticas de investigación, pero se retrasan en los conjuntos de habilidades autoinformadas - Gráficos de marketing. *8 de mayo de 2020* [online]. 2020 [accessed. 2020-05-09]. Available at: https://www.marketingcharts.com/industries/market-research-112966

[17] UNIVERSIDAD DE LA SABANA and THE EXPERIENCE DESIGN COMPANY. *Estudio sobre la Estrategia de Customer Experience Management en Colombia*

2020. 2020.

[18] LEE, In. Social media analytics for enterprises: Typology, methods, and processes. *Business Horizons* [online]. 2018, 61(2), 199–210. ISSN 00076813. Available at: doi:10.1016/j.bushor.2017.11.002

[19] EMPRENDEDORES. Para qué sirve un estudio de satisfacción de clientes. *18/01/2020* [online]. 2020 [accessed. 2020-05-09]. Available at: https://www.emprendedores.es/gestion/a45127/para-que-sirve-como-hacer-estudio-satisfaccion-clientes/

[20] JÓNÁS, Tamás and János KÖVESI. Reliability based customer satisfaction evaluation. *Periodica Polytechnica Social and Management Sciences* [online]. 2010, 18(1), 3–9 [accessed. 2020-10-11]. ISSN 15873803. Available at: doi:10.3311/pp.so.2010-1.01

[21] GAO, Jinsong, Jinhui XU and Weijun WANG. Customer satisfaction evaluation for mobile commerce services based on grey clustering relational method. In: *IFIP Advances in Information and Communication Technology* [online]. Boston, MA: Springer New York LLC, 2007, p. 265–273 [accessed. 2020-10-11]. ISBN 9780387754659. Available at: doi:10.1007/978-0-387-75466-6_30

[22] KASSIM, Norizan and nor ASIAH ABDULLAH. The effect of perceived service quality dimensions on customer satisfaction, trust, and loyalty in e-commerce settings: A cross cultural analysis. *Asia Pacific Journal of Marketing and Logistics* [online]. 2010, 22(3), 351–371 [accessed. 2020-10-13]. ISSN 17584248. Available at: doi:10.1108/13555851011062269

[23] BRANTHWAITE, Alan and Simon PATTERSON. *The power of qualitative research in the era of social media* [online]. 6. September 2011 [accessed. 2020-10-11]. ISSN 13522752. Available at: doi:10.1108/13522751111163245

[24] MITTAL, Vikas and Wagner A. KAMAKURA. Satisfaction, repurchase intent, and repurchase behavior: Investigating the moderating effect of customer characteristics. *Journal of Marketing Research* [online]. 2001, 38(1), 131–142 [accessed. 2020-10-11]. ISSN 00222437. Available at: doi:10.1509/jmkr.38.1.131.18832

[25] SUCHÁNEK, Petr and Maria KRÁLOVÁ. Customer satisfaction and different evaluation of it by companies. *Economic Research-Ekonomska Istrazivanja* [online]. 2018, 31(1), 1330–1350 [accessed. 2020-10-11]. ISSN 1331677X. Available at: doi:10.1080/1331677X.2018.1484786

[26] FRESNO, Miguel. El consumidor social. Reputación online y 'social media.' *El siervo* [online]. 2012 [accessed. 2020-05-24]. ISSN 1133-6870. Available at: https://books.google.es/books?hl=es&lr=&id=MlYNLkuRMVYC&oi=fnd&pg=PA9

&dq=cliente+online&ots=2EW4vTDH5h&sig=oOzPOWfjXMjmT5Dkpan8QQ7JPbE#v=onepage&q=cliente online&f=false

[27] DRUCKER, Peter F. Marketing and Economic Development. *Journal of Marketing* [online]. 1958, 22(3), 252–259 [accessed. 2020-05-12]. ISSN 0022-2429. Available at: doi:10.1177/002224295802200302

[28] KOTLER, Philip and Gary ARMSTRONG. *Fundamentos de marketing* [online]. 2003 [accessed. 2020-05-11]. Available at: https://books.google.es/books?hl=es&lr=&id=sLJXV_z8XC4C&oi=fnd&pg=PR19&dq=marketing+concepto&ots=IeOp3dD6Ut&sig=Rm0buQh38EdNNZqh4puv_T8MSj8#v=onepage&q=marketing concepto&f=false

[29] TIRADO, Diego Monferrer. *Fundamentos de marketing* [online]. 2013 [accessed. 2020-05-12]. ISBN 978-84-695-7093-7. Available at: doi:10.6035/Sapientia74

[30] SELMAN, Habyb. *Marketing Digital* [online]. 2017 [accessed. 2020-05-12]. Available at: https://books.google.es/books?hl=es&lr=&id=kR3EDgAAQBAJ&oi=fnd&pg=PT10&dq=marketing&ots=KHoJLq02lW&sig=lMNki6GHRS73At-TYpCTI6GRDcU#v=onepage&q=marketing&f=false

[31] PEÑALOZA, Marlene. El Mix de Marketing: Una herramienta para servir al cliente. *Actualidad Contable Faces* [online]. 2005 [accessed. 2020-05-12]. ISSN 1316-8533. Available at: http://www.redalyc.org/articulo.oa?id=25701007

[32] MARTÍNEZ, José and Fernando ROJAS. *Comercio electrónico* [online]. 2016 [accessed. 2020-05-14]. Available at: https://books.google.es/books?hl=es&lr=&id=nCylDAAAQBAJ&oi=fnd&pg=PR1&dq=comercio+electrónico&ots=XcieFasg-c&sig=8WMk0eE9lcNL_7tdyju93lqU2Oc#v=onepage&q=comercio electrónico&f=false

[33] FLEMING, Paul and Maria ALBERDI. *Hablemos de marketing interactivo: reflexiones sobre marketing digital* [online]. 2000 [accessed. 2020-05-14]. Available at: https://books.google.es/books?hl=es&lr=&id=Fj-I5ZXro_sC&oi=fnd&pg=PA17&dq=marketing+digital&ots=pTy7pxSolL&sig=UDFHujeN_8hgwacHcyTSzDYf9kA#v=onepage&q=marketing digital&f=false

[34] AMERICAN MARKETING ASSOCIATION. *Digital Marketing Archives* [online]. [accessed. 2020-05-11]. Available at: https://www.ama.org/topics/digital-marketing/

[35] LAREPÚBLICA. Todas las ventajas del Marketing 360: conócelas. *19/03/2019* [online]. 2019 [accessed. 2020-05-14]. Available at: https://larepublica.es/2019/03/19/todas-las-venatajas-del-marketing-360-

conocelas/

[36] STRATUM. ¿En qué consiste una estrategia de marketing 360? *07 Ago 2019* [online]. 2019 [accessed. 2020-05-14]. Available at: https://stratumagency.com/estrategia-de-marketing-360/

[37] DIECISEISNOVENOS. Marketing 360 grados: así se comunica en el siglo XXI. *9 agosto 2017* [online]. 2017 [accessed. 2020-05-14]. Available at: https://dieciseisnovenos.com/blog/marketing-360-grados-asi-se-comunica-siglo-xxi/

[38] MALCA, Oscar. *Comercio electrónico* [online]. 2001 [accessed. 2020-04-27]. ISBN 9972-603-65-2. Available at: http://srvdspace-pub.up.edu.pe/bitstream/handle/11354/76/AE40.pdf?sequence=1&isAllowed=y

[39] GARIBOLDI, Gerardo. Comercio electrónico: conceptos y reflexiones básicas. *1999* [online]. 1999 [accessed. 2020-05-14]. Available at: https://books.google.es/books?hl=es&lr=&id=bdBuE46EmFMC&oi=fnd&pg=PA8&dq=comercio+electrónico&ots=vEOjzTyjHr&sig=yhpWEG1m1qsCI79OLIyR2mwB5Fo#v=onepage&q=comercio electrónico&f=false

[40] JIMÉNEZ, Jose, Ana AGUILA and Antonio PADILLA. *IMPLICACIONES ESTRATEGICAS DEL COMERCIO ELECTRONICO BASADO EN INTERNET: MODELOS DE NEGOCIO Y NUEVOS INTERMEDIARIOS* [online]. 2000 [accessed. 2020-05-14]. Available at: https://www.researchgate.net/publication/28050901

[41] FERNÁNDEZ, Antonio, Maricruz SÁNCHEZ, Héctor JIMÉNEZ and Ricardo HERNÁNDEZ. *La importancia de la Innovación en el e-commerce*. 2015.

[42] KAPLAN, Andreas M. and Michael HAENLEIN. Users of the world, unite! The challenges and opportunities of Social Media. *Business Horizons* [online]. 2010, 53(1), 59–68. ISSN 00076813. Available at: doi:10.1016/j.bushor.2009.09.003

[43] KIETZMANN, Jan H., Kristopher HERMKENS, Ian P. MCCARTHY and Bruno S. SILVESTRE. Social media? Get serious! Understanding the functional building blocks of social media. *Business Horizons* [online]. 2011, 54(3), 241–251. ISSN 00076813. Available at: doi:10.1016/j.bushor.2011.01.005

[44] HAMARI, Juho, Mimmi SJÖKLINT and Antti UKKONEN. The sharing economy: Why people participate in collaborative consumption. *Journal of the Association for Information Science and Technology* [online]. 2016, 67(9), 2047–2059. ISSN 23301643. Available at: doi:10.1002/asi.23552

[45] STIEGLITZ, Stefan and Linh DANG-XUAN. Emotions and information diffusion in

social media - Sentiment of microblogs and sharing behavior. *Journal of Management Information Systems* [online]. 2013, 29(4), 217–248. ISSN 07421222. Available at: doi:10.2753/MIS0742-1222290408

[46] CHU, Shu Chuan and Yoojung KIM. Determinants of consumer engagement in electronic Word-Of-Mouth (eWOM) in social networking sites. *International Journal of Advertising* [online]. 2011, 30(1). ISSN 02650487. Available at: doi:10.2501/IJA-30-1-047-075

[47] KUMAR, Sudhanshu, Mahendra YADAVA and Partha Pratim ROY. Fusion of EEG response and sentiment analysis of products review to predict customer satisfaction. *Information Fusion* [online]. 2019, 52, 41–52 [accessed. 2020-09-28]. ISSN 15662535. Available at: doi:10.1016/j.inffus.2018.11.001

[48] BAKER, Dwayne A. and John L. CROMPTON. Quality, satisfaction and behavioral intentions. *Annals of Tourism Research* [online]. 2000, 27(3), 785–804 [accessed. 2020-10-11]. ISSN 01607383. Available at: doi:10.1016/S0160-7383(99)00108-5

[49] LI, Xiaorong and You Jing GU. Fuzzy comprehensive evaluation model of customer satisfaction degree. In: *Proceedings of the International Conference on E-Business and E-Government, ICEE 2010* [online]. B.m.: IEEE, 2010, p. 3111–3114 [accessed. 2020-10-11]. ISBN 9780769539973. Available at: doi:10.1109/ICEE.2010.784

[50] KIM, Dan J., Donald L. FERRIN and H. RAGHAV RAO. Trust and satisfaction, two stepping stones for successful e-commerce relationships: A longitudinal exploration. *Information Systems Research* [online]. 2009, 20(2), 237–257 [accessed. 2020-10-11]. ISSN 15265536. Available at: doi:10.1287/isre.1080.0188

[51] RUIZ, Martha, Francisco PALACÍ, Alejandro SALCEDO and Javier GARCÉS. E-satisfacción: Una aproximación cualitativa. *Acción Psicológica*. 2010, 7(ISSN1578-908x), 75–85.

[52] RUST, Roland T. and Anthony J. ZAHORIK. Customer satisfaction, customer retention, and market share. *Journal of Retailing* [online]. 1993, 69(2), 193–215 [accessed. 2020-10-11]. ISSN 00224359. Available at: doi:10.1016/0022-4359(93)90003-2

[53] CRONIN, J. Joseph, Michael K. BRADY and G. Tomas M. HULT. Assessing the effects of quality, value, and customer satisfaction on consumer behavioral intentions in service environments. *Journal of Retailing* [online]. 2000, 76(2), 193–218. ISSN 00224359. Available at: doi:10.1016/S0022-4359(00)00028-2

[54] CABALLERO, Juan. *Indexador web a partir de una ontología en el dominio de la*

PYME [online]. Guatemala, 2008 [accessed. 2021-03-30]. UNIVERSIDAD DE SAN CARLOS DE GUATEMALA. Available at: http://biblioteca.usac.edu.gt/tesis/08/08_0370_CS.pdf

[55] BILBAO BERNALES, Andrés Eduardo. *Buscador Semántico para Comercio Electrónico* [online]. B.m.: Universidad de Chile. 2010 [accessed. 2021-03-30]. Available at: http://repositorio.uchile.cl/handle/2250/102470

[56] CORCHO, Óscar, M. FERNÁNDEZ-LÓPEZ, A. GÓMEZ-PÉREZ and Angel LÓPEZ-CIMA. Construcción de ontologías legales con la metodolog'ia METHONTOLOGY y la herramienta WebODE. *undefined*. 2005.

[57] ALVAREZ, Nestor. *Diseño de una arquitectura de cooperación horizontal basada en metamodelos, enfocada a plataformas de e-commerce para dispositivos móviles: caso de estudio pymes en el sector textil en Bogotá* [online]. Bogotá, no date [accessed. 2021-04-26]. Universidad Distrital Francisco José de Caldas. Available at: https://repository.udistrital.edu.co/bitstream/handle/11349/13915/ÁlvarezGómez NestorFernando2018.pdf?sequence=1&isAllowed=y

[58] GELVEZ, Susana. *ESTADO DEL ARTE DE MODELOS DE MEDICIÓN DE LA SATISFACCIÓN DEL CLIENTE*. 2010.

[59] OSPINA, Santiago and Irene GIL. National index of consumer satisfaction. A proposal for a review of literature. *Cuadernos de Administracion*. 2011, 24(43), 35–57. ISSN 1900-7205.

[60] CAMPAMÀ, Guillermo. *10 Métodos para medir la satisfacción de los clientes*. 2005.

[61] EL-DIRABY, Tamer, Amer SHALABY and Moein HOSSEINI. Linking social, semantic and sentiment analyses to support modeling transit customers' satisfaction: Towards formal study of opinion dynamics. *Sustainable Cities and Society* [online]. 2019, 49. ISSN 22106707. Available at: doi:10.1016/j.scs.2019.101578

[62] KHATTAK, Asad, Waqas Tariq PARACHA, Muhammad Zubair ASGHAR, Nosheen JILLANI, Umair YOUNIS, Furqan Khan SADDOZAI and Ibrahim A. HAMEED. Fine-grained sentiment analysis for measuring customer satisfaction using an extended set of fuzzy linguistic hedges. *International Journal of Computational Intelligence Systems* [online]. 2020, 13(1), 744–756 [accessed. 2021-04-03]. ISSN 18756883. Available at: doi:10.2991/ijcis.d.200513.001

[63] BOLIVAR, Holman, Hector Dario JAIMES PARADA, Olga ROA and John VELANDIA. Multi-criteria Decision Making Model for Vulnerabilities Assessment in Cloud Computing regarding Common Vulnerability Scoring System. In: *2019 Congreso Internacional de Innovacion y Tendencias en Ingenieria, CONIITI 2019 - Conference Proceedings* [online]. B.m.: Institute of Electrical and Electronics Engineers Inc.,

2019. ISBN 9781728147468. Available at: doi:10.1109/CONIITI48476.2019.8960909

[64] GRAJALES, Alberto, Edgar SERRANO and Christine HAHN. Los métodos y procesos multicriterio para la evaluación. *Lina Azul* [online]. 2013 [accessed. 2021-04-27]. ISSN 1909-2474. Available at: http://www.scielo.org.co/pdf/luaz/n36/n36a14.pdf

[65] GONZÁLEZ, Blázquez. *Análisis de tiendas online para la comercialización de los aceites de oliva*. 2011.

[66] HE, Fu Bao, Yi Lai ZHANG, Tong Jun GUO and Hong CHEN. Customer satisfaction evaluation of ceramic E-commerce platform. In: *Applied Mechanics and Materials* [online]. 2013, p. 2681–2684. ISBN 9783037858431. Available at: doi:10.4028/www.scientific.net/AMM.397-400.2681

[67] SAATY, Thomas L. How to make a decision: The analytic hierarchy process. *European Journal of Operational Research* [online]. 1990, 48(1), 9–26. ISSN 03772217. Available at: doi:10.1016/0377-2217(90)90057-I

[68] LIN, Qian. Construction and evaluation of customer satisfaction index system in E-shopping. In: *Proceedings - 5th International Conference on Instrumentation and Measurement, Computer, Communication, and Control, IMCCC 2015* [online]. B.m.: Institute of Electrical and Electronics Engineers Inc., 2016, p. 306–309 [accessed. 2020-10-11]. ISBN 9781467377232. Available at: doi:10.1109/IMCCC.2015.71

[69] TOSKANO HURTADO and Gérard BRUNO. *El Proceso de Análisis Jerárquico (AHP) como Herramienta para la Toma de Decisiones en la*. no date.

[70] FERNDNDEZ, Mariano, Asunci6n G6MEZ-P~REZ and Natalia JURISTO. *METHONTOLOGY: From Ontological Art Towards Ontological Engineering* [online]. 1997 [accessed. 2021-04-21]. Available at: www.aaai.org

[71] RAMOS, ESMERALDA, PEREIRA, YIMMY, NÚÑEZ, HAYDEMAR, CASTRO, MARCEL, CASAÑAS and ROBERTO. *Aplicación de visualización de una ontología para el dominio del análisis del semen humano* [online]. B.m.: Universidad EAFIT. 2007 [accessed. 2021-04-26]. Available at: http://repository.eafit.edu.co/handle/10784/14543

[72] VÁZQUEZ-CASIELLES, Rodolfo, Ana Belén DEL RÍO-LANZA and Leticia SUÁREZ-ÁLVAREZ. Las agencias de viaje virtuales: ¿Cómo analizar la calidad de e-servicio y sus efectos sobre la satisfacción del cliente? *Universia Business Review* [online]. 2009, 24(ISSN: 1698-5117), 122–143 [accessed. 2020-05-24]. ISSN 16985117. Available at: http://www.redalyc.org/articulo.oa?id=43312278008

[73] CRISTÓBAL, Eduard and Frederic MARIMON. La gestión del supermercado virtual: Tipificación del comportamiento del cliente online. *Investigaciones Europeas de Direccion y Economia de la Empresa* [online]. 2011, 17(1), 93–112. ISSN 11352523. Available at: doi:10.1016/S1135-2523(12)60046-X

[74] SANCHEZ, M A, M A SCHMIDT, J I ZUNTINI and L OBIOL. LA INFLUENCIA DE LAS REDES SOCIALES INFORMACIÓN Y CONOCIMIENTO: ESTUDIO DE PYMES Esta obra está bajo una Licencia Creative Commons Atribución-NoComercial-CompartirIgual 2.5 Argentina https://creativecommons.org/licenses/by-nc-sa/2.5/ar [online]. 2017, 16(4), 69–90 [accessed. 2020-05-11]. Available at: doi:10.5585/riae.v16i4.2522

[75] LOZANO, Mauricio and Sergio CALDERÓN. *Estudio sobre inversión empresarial en redes sociales y mejora en indicadores de Gestión*. B.m., 2018. b.n.

[76] ERHART, George, Valentine MATULA and David SKIBA. Method of automatic customer satisfaction monitoring through social media Abstract. US20110276513A1. 2011.

[77] BROWN, I and R JAYAKODY. B2C e-Commerce Success: a Test and Validation of a Revised Conceptual Model. *The Electronic Journal Information Systems Evaluation* [online]. 2008, 11, 167–184 [accessed. 2020-04-28]. ISSN 1566-6379. Available at: www.ejise.com

[78] MEYER, Simon. *FACTORES DE ÉXITO DE SATISFACCIÓN DE CLIENTES EN EL E-COMMERCE EN ARGENTINA*. B.m., 2011. Universidad Católica de Córdoba Argentina.

[79] SANYAL, Shouvik. *Factors Affecting Customer Satisfaction with Ecommerce Websites-An Omani Perspective* [online]. 2019 [accessed. 2020-04-28]. Available at: www.ijbmi.org

[80] AGUADO GUADALUPE, Guadalupe. Repercusión de las métricas de audiencia online en la comercialización publicitaria del producto informativo. *Razón y palabra* [online]. 2017, 21(97), 142–158 [accessed. 2020-05-26]. ISSN 1605-4806. Available at: http://revistas.comunicacionudlh.edu.ec/index.php/ryp

[81] ASTI, Armando. *Metodología de la investigación* [online]. España: ATHENAICA Ediciones Universitarias, 2015 [accessed. 2021-05-06]. Available at: https://elibro-net.ucatolica.basesdedatosezproxy.com/es/ereader/ucatolica/43844

[82] HERNANDEZ S, Roberto, Carlos FERNANDEZ C, Maria BAPTISTA L, Sergio MENDEZ and Christian MENDOZA. *Metodología de la investigación* [online]. 6ta ed. México: McGraw-Hill / Interamericana Editores, S.A. DE C.V, 2014 [accessed. 2021-05-06]. ISBN 978-1-4562-2396-0. Available

at: http://observatorio.epacartagena.gov.co/wp-content/uploads/2017/08/metodologia-de-la-investigacion-sexta-edicion.compressed.pdf

[83] ROBERTO HERNÁNDEZ SAMPIERI, M C, Carlos FERNÁNDEZ COLLADO, Dra PILAR BAPTISTA LUCIO and Ma DE LA LUZ CASAS PÉREZ. *METODOLOGÍA DELA INVESTIGACIÓN*. México: McGraw - Hill Interamericana de México, 1991. ISBN 9684229313.

[84] MORCILLO ORTEGA, Patricio. Vigilancia e inteligencia competitiva: fundamentos e implicaciones. *Revista madri+d, ISSN-e 1579-9506, Nº. 17 (junio-julio de 2003), 2003 (Ejemplar dedicado a: Vigilancia tecnológica)* [online]. 2003, (17), 2 [accessed. 2021-04-01]. ISSN 1579-9506. Available at: https://dialnet.unirioja.es/servlet/articulo?codigo=638325&info=resumen&idioma=SPA

[85] UNE. *UNE 166006:2018 Gestión de la I+D+i: Sistema de vigilancia e i...* [online]. 2018 [accessed. 2021-04-01]. Available at: https://www.une.org/encuentra-tu-norma/busca-tu-norma/norma/?Tipo=N&c=N0059973

[86] *Scopus preview - Scopus - Welcome to Scopus* [online]. [accessed. 2021-04-05]. Available at: https://www.scopus.com/home.uri

[87] *OMPI – Búsqueda en las colecciones de patentes nacionales e internacionales* [online]. [accessed. 2021-04-13]. Available at: https://patentscope.wipo.int/search/es/search.jsf

[88] WANG, Chuanmei and Hengqing TONG. Research on psychological dimensions of e-commerce customer satisfaction. In: *Proceedings of the International Conference on E-Business and E-Government, ICEE 2010* [online]. B.m.: IEEE, 2010, p. 2105–2108 [accessed. 2020-10-13]. ISBN 9780769539973. Available at: doi:10.1109/ICEE.2010.532

[89] SZYMANSKI, David M. and Richard T. HISE. E-satisfaction: An initial examination. *Journal of Retailing* [online]. 2000, 76(3), 309–322 [accessed. 2020-10-11]. ISSN 00224359. Available at: doi:10.1016/S0022-4359(00)00035-X

[90] YI, Weiming, Peiwu DONG and Jing WANG. Customer satisfaction evaluation model of E-commerce website based on tensor analysis. In: *ACM International Conference Proceeding Series* [online]. New York, New York, USA: Association for Computing Machinery, 2017, p. 6–10 [accessed. 2020-10-11]. ISBN 9781450353670. Available at: doi:10.1145/3157754.3157766

[91] HUANG, Zhao and Morad BENYOUCEF. From e-commerce to social commerce: A close look at design features. *Electronic Commerce Research and Applications*

[online]. 2013, 12(4), 246–259 [accessed. 2020-10-11]. ISSN 15674223. Available at: doi:10.1016/j.elerap.2012.12.003

[92] GEFEN, David. E-commerce: The role of familiarity and trust. *Omega* [online]. 2000, 28(6), 725–737 [accessed. 2020-10-11]. ISSN 03050483. Available at: doi:10.1016/S0305-0483(00)00021-9

[93] MIRANDA, Marcelo Drudi and Renato José SASSI. Using sentiment analysis to assess customer satisfaction in an online job search company. *Lecture Notes in Business Information Processing* [online]. 2014, 183, 17–27 [accessed. 2021-04-03]. ISSN 18651348. Available at: doi:10.1007/978-3-319-11460-6_2

[94] SPRENG, Richard A., Scott B. MACKENZIE and Richard W. OLSHAVSKY. A reexamination of the determinants of consumer satisfaction. *Journal of Marketing* [online]. 1996, 60(3), 15–32 [accessed. 2020-10-11]. ISSN 00222429. Available at: doi:10.2307/1251839

[95] LIN, Mei Ju and Wei Tsong WANG. Examining E-Commerce Customer Satisfaction and Loyalty: An Integrated Quality-Risk-Value Perspective. *Journal of Organizational Computing and Electronic Commerce* [online]. 2015, 25(4), 379–401 [accessed. 2020-10-13]. ISSN 10919392. Available at: doi:10.1080/10919392.2015.1089681

[96] GIAO, Ha Nam Khanh. Customer satisfaction at Tiki. vn E-commerce platform. *Journal of Asian Finance, Economics and Business* [online]. 2020, 7(4), 173–183. ISSN 22884645. Available at: doi:10.13106/JAFEB.2020.VOL7.NO4.173

[97] JI, Pu, Hong Yu ZHANG and Jian Qiang WANG. A Fuzzy Decision Support Model with Sentiment Analysis for Items Comparison in e-Commerce: The Case Study of http://PConline.com. *IEEE Transactions on Systems, Man, and Cybernetics: Systems* [online]. 2019, 49(10), 1993–2004 [accessed. 2020-10-13]. ISSN 21682232. Available at: doi:10.1109/TSMC.2018.2875163

[98] MOUTHAMI, K., K. Nirmala DEVI and V. Murali BHASKARAN. Sentiment analysis and classification based on textual reviews. In: *2013 International Conference on Information Communication and Embedded Systems, ICICES 2013* [online]. B.m.: IEEE, 2013, p. 271–276 [accessed. 2020-10-11]. ISBN 9781467357869. Available at: doi:10.1109/ICICES.2013.6508366

[99] VANAJA, Satuluri and Meena BELWAL. Aspect-Level Sentiment Analysis on E-Commerce Data. In: *2018 International Conference on Inventive Research in Computing Applications (ICIRCA)* [online]. B.m.: IEEE, 2018, p. 1275–1279 [accessed. 2020-10-13]. ISBN 978-1-5386-2456-2. Available at: doi:10.1109/ICIRCA.2018.8597286

[100] SALAMPASIS, Michail, Georgios PALTOGLOU and Anastasia GIACHANOU. Using social media for continuous monitoring and mining of consumer behaviour. In: *International Journal of Electronic Business* [online]. B.m.: Inderscience Publishers, 2014, p. 85–96 [accessed. 2020-10-11]. ISSN 17415063. Available at: doi:10.1504/IJEB.2014.057905

[101] YANG, Li, Ying LI, Jin WANG and R. Simon SHERRATT. Sentiment Analysis for E-Commerce Product Reviews in Chinese Based on Sentiment Lexicon and Deep Learning. *IEEE Access* [online]. 2020, 8, 23522–23530 [accessed. 2020-10-13]. ISSN 21693536. Available at: doi:10.1109/ACCESS.2020.2969854

[102] PATIL, Lalit, Debasish DUTTA and Ram SRIRAM. Ontology-based exchange of product data semantics. *IEEE Transactions on Automation Science and Engineering* [online]. 2005, 2(3), 213–224 [accessed. 2020-10-11]. ISSN 15455955. Available at: doi:10.1109/TASE.2005.849087

[103] SCHAFER, J. Ben, Joseph A. KONSTAN and John RIEDL. E-commerce recommendation applications. *Data Mining and Knowledge Discovery* [online]. 2001, 5(1–2), 115–153 [accessed. 2020-10-11]. ISSN 13845810. Available at: doi:10.1007/978-1-4615-1627-9_6

[104] MADNICK, Stuart and Hongwei ZHU. Improving data quality through effective use of data semantics. *Data and Knowledge Engineering* [online]. 2006, 59(2), 460–475 [accessed. 2020-10-11]. ISSN 0169023X. Available at: doi:10.1016/j.datak.2005.10.001

[105] STANFORD JUNIOR UNIVERSITY. *protégé* [online]. [accessed. 2021-04-23]. Available at: https://protege.stanford.edu/products.php

[106] MINISTERIO DE SALUD Y PROTECCIÓN SOCIAL. *Páginas - Ciclo de Vida* [online]. [accessed. 2021-04-04]. Available at: https://www.minsalud.gov.co/proteccionsocial/Paginas/cicloVida.aspx

[107] MERCADO LIBRE. *Mercado Libre | Facebook* [online]. [accessed. 2021-05-02]. Available at: https://www.facebook.com/mercadolibrecol/?brand_redir=111542373916289

[108] LINIO. *Linio Facebook* [online]. Available at: https://www.facebook.com/LinioColombia/?brand_redir=364857373558635

[109] ELTIEMPO. *Mercado Libre: así nació y se convirtió en la empresa más valiosa de América Latina - Novedades Tecnología - Tecnología - ELTIEMPO.COM* [online]. [accessed. 2021-05-02]. Available at: https://www.eltiempo.com/tecnosfera/novedades-tecnologia/mercado-libre-asi-nacio-y-se-convirtio-en-la-empresa-mas-valiosa-de-america-latina-529684

[110] ANYMARKET. *Aumente sus ventas con el marketplace de Linio* [online]. [accessed. 2021-05-02]. Available at: https://anymarket.com.ar/blog/marketplaces/aumente-sus-ventas-con-el-marketplace-de-linio/

[111] PORTAFOLIO. *Tres grandes jugadores del 'e-commerce' en Cololombia | Negocios | Portafolio* [online]. [accessed. 2021-05-02]. Available at: https://www.portafolio.co/negocios/tres-grandes-jugadores-del-e-commerce-en-cololombia-539722