ACCOUNTING AND TAXATION. A LOOK FROM THE NEUTROSOPHY

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PREFACE

The contributions of the Neutrosophy in the accounting sciences correspond to the applications of managerial support, standing out the applications related to the accounting and production costs, where they are grouped works related to records and accounting valuation. Also classification works, placing themselves have applied to the neutrosophic logic and in particular for the provision of resources for the companies. Other works were carried out corresponding to the identification and measurement of intangible assets, through the use of the Neutrosophy, as well as works that guide the valuation of companies, finances, with the use of the Neutrosophic logic in making financial decisions. Financial risks and auditing are other works belonging to this area of knowledge, which apply Neutrosophy to implement controls to reduce financial and business risks.

Regarding taxation, all the works have been oriented to the use of the neutrosophic logic and in particular in relation to tax planning and management. The information systems that support taxation, use the neutrosophic logic, at present due to the benefits.

CHAPTER 1. FUNDAMENTALS OF NEUTROSOPHIC LOGIC IN ACCOUNTING AND TAXATION. GENERAL ELEMENTS

1. Introduction

In this chapter we present the foundations of the neutrosophic logic in accounting and taxation, as well as the general elements. Logic is the study of the validity of an argument. Classical or bivalent logic was developed by Aristotle and recognizes only the values of true or false truth for any proposition. In 1920 Jan Lukasiewicz, proposed a trivalent logic to include true, false and indeterminate propositions. Then in the early 1930s he developed a logic of infinite values and after that effort the polyvalent or multivalued logics were developed.

One of these polyvalent logics is the fuzzy logic developed in 1965 by Lofti Zadeh [1], who assigns to a proposition degrees of truth, which can be absolutely true, absolutely false or with some degree of intermediate truth. Zadeh defined it as "a system that provides a natural way to deal with problems in which the source of inaccuracy is the absence of clearly defined criteria of types of belonging".

Based on the fuzzy logic defined Zadeh, emerges the neutrosophic logic created by Professor Florentin Smarandache [2], which is characterized as a special polyvalent logic that addresses the phenomenon of vagueness. This logic tries to preserve the properties of classical logic, such as vagueness (inaccuracy), a concept opposed to the accuracy that emerges from the way the world and the phenomena are seen.

In the neutrosophic logic the conceptualization of the ideas realizes by means of idealizations, nevertheless, the reality overflows any conceptual approximation that envelope she is had. Through the neutrosophic logic it is possible to distinguish small numbers from large numbers, but it is not possible to affirm whether there is ambiguity in each small number or not. The "small" property is vague and is defined accordingly to a certain context. To measure the confidence index and the business climate index, which is obtained from imprecise information, the neutrosophic logic that has an isomorphism correspondence with the set theory is used.

1.1. The neutrosophic logic. Conceptualization

Neutrosophy is a new branch of philosophy [3] that studies the origin, nature and scope of neutralities, as well as their interactions with different ideational spectra where; (A) is an idea, proposition, theory, event, concept or

entity; anti (A) is the opposite of (A); and (neut-A) means neither (A) nor anti (A), that is, the neutrality between the two extremes [4]. Etymologically neutron-sofía [French neutre <Latin neuter, neutral, and Greek sophia, knowledge] means knowledge of neutral thoughts and began in 1995. His fundamental theory states that every idea <A> tends to be neutralized, diminished, balanced by <noA> ideas (not just <antiA> as Hegel argued) - as a state of equilibrium.

- <noA> = what is not <A>,
- <antiA> = the opposite of <A>
- <neutA> = what is not <A> or <antiA>

In their classical form <A>, <neutA>, <antiA> are disjointly in pairs. As in several cases the boundaries between concepts are vague to imprecise, it is possible that <A>, <neutA>, <antiA> (and <nonA> of course) have common parts two in two as well. This theory has formed the basis for the neutrosophic logic [2], the neutrosóficos sets [5], the neutrosophic probability, and the neutrosophic statistic and multiple practical applications [6].

1.1.1. Antecedents of the neutrosophic logic

The development of the neutrosophic logic was motivated by the need of a conceptual frame able to handle the imprecision of the current language, with

which the phenomena of the cotidianidad are described, in order to be able to interpret the linguistic terms to be able to express them in mathematical terms capturing all the uncertainties associated with reasoning and human thinking.

The human being is usually handled with vague concepts, which can not be represented with traditional mathematics, so he tries to incorporate methods so that these "vague" concepts can be used as mathematical functions. The neutrosophic logic is a mathematical formalism that pretends to emulate the ability that the people have to make correct decisions from vague or imprecise data and that are expressed linguistically [7, 8, 9]. When natural language is normally used to impart knowledge or information, there is a use of imprecision and vagueness, which is widely accepted among human beings.

When a person in his everyday life expresses phrases like "Juan is tall" or "Maria is young" he is making use of that imprecision, and in that affirmation the very particular concept of what that person considers to be high and which is young. If we ask each person for a value to quantify the high linguistic category, he or she will most likely deliver a range of values and not a single value [10]. Vagueness appears when human language is used, whether professional or not, to describe the observation or measurement of the result of an experiment as a piece of information. It is especially true when working

with expert opinions that are translated into verbal expressions that, subsequently, have to be treated as modalities of a variable (linguistic variables), so the basic underlying problems are the existence of concepts without definition [11].

In neutrosophic logic, it starts from the fact that concepts such as high, low, noisy, sweet, expensive, bitter, cheap, thin, etc. they are perceived differently by each person. The **High, Medium** and **Low** sets are called neutrosóficos sets. A neutrosófico set is a set with indeterminate limits or "not very well" defined [12]. Therefore, the neutrosophic logic allows to treat this type of information when providing mathematical tools to approximate the reasoning of these statements when the available information is uncertain, incomplete, imprecise or vague because the classic logic or bivalved is too restrictive: an affirmation can not be neither true nor false [11].

The neutrosophic logic, can also be understood as a mathematical tool whose broad applicability is based on the conception of sets with no exact borders [13, 14] that is used in the presence of imperfect information [15], which deals with the problems related to imprecision, uncertainty and approximate reasoning and it is a framework that tolerates imprecision and partial truth under a non-statistical approach [16, 17] and that can be

constructed based on expert knowledge. It allows to deal with information that is not exact or with a high degree of imprecision unlike conventional logic which works with accurate information. Due to the limited capacity for expression of classical logic is that the main problem to deal with this type of information arises.

1.1.2. The diffuse and neutrosophic sets as a tool to represent human knowledge. Differences

The neutrosóficos sets have that name from the diffuse sets of the theory of Lofti A. Zadeh [1]. Fuzzy sets were born with that name in 1965, based on the article by the professor of Electronic Engineering at the University of California at Berkeley, and founder of the theory, Lofti A. Zadeh [1], who constituted a amazing tool to represent human knowledge. However, soon, limitations were seen in some decision-making problems and from these limitations emerged the generalizations of fuzzy sets [18]. These were created to mathematically represent uncertainty and vagueness, under a non-statistical approach, and provide formalized tools to address the intrinsic imprecision that many environmental problems present [17].

Zadeh's idea is to make the range of membership values of an element to a set vary in the interval [0,1] instead of being limited to one of the values of

the pair [19] (or what is the same thing False true). The statement is supported according to the following authors:

- "It is the one that handles uncertainty by degrees of certainty (values between zero and one) to answer a logical question." [20].
- "It is one that allows to deal with inaccurate information, such as average height, low temperature or a lot of force, in terms of neutrosophic sets. It should be emphasized that the term neutrosófico, fuzzy, imprecise or vague is not the logic itself, but the object being studied "[21].

Different uses of the neutrosophic logic are:

- In complex processes, if there is no simple solution model or a precise mathematical model, that is, where it is very difficult or impossible to create a model.
- In non-linear processes, also when it is necessary to introduce the experience of an "expert" operator based on imprecise concepts obtained from his experience, that is, to handle experience based on imprecise or ambiguous concepts.
- In systems controlled by human experts, with complex and continuous inputs and outputs, which use human observations as inputs or as basic rules.
- When certain parts of the system to be controlled are unknown and can not be measured reliably (with possible errors).

- When the adjustment of one variable may produce the mismatch of others.

In general, when they want to represent and operate with concepts that have imprecision or uncertainty (as in vague or ambiguous databases), that is, real-world objects that do not have defined membership criteria. It is not advisable to use it when a mathematical model already solves the problem efficiently.

On the other hand, the neutrosophic logic that comes etymologically from "neutrosophy", and means knowledge of neutral thought, is used to represent the neutral / indeterminate / unknown part (in addition to the "truth" / "belonging" and "falsehood"). of "non-belonging" that appear in the fuzzy / whole logic) and is what distinguishes the diffuse logic. The neutrosophic logic is a generalization of Zadeh's fuzzy logic, and especially Atanassov's intuitive fuzzy logic, and other logics.

The neutrosóficos sets generalize the diffuse set (especially the diffuse and intuitionist set), the paraconsistent set, the intuitive set, etc. The neutrosophic logic [6] is a logic in which each proposition is T% true, I% indeterminate, and F% false; **-0 <= inf T + inf I + inf F <= sup T + sup I + sup F <= 3+**; T, I, F are not necessary intervals, but any set (discrete,

continuous, open or closed or semi-open / semi-closed intervals, intersections or junctions of the previous sets, etc.).

The Indetermination, in the neutrosophic logic can be divided in more subcomponents to better capture the vague information with which one works, for example, it is possible to obtain more precise answers to the Systems of Questions and Answers initiated by Zadeh [22]. However, in the logic of four values of Belnap [23], the indetermination is divided into Uncertainty (U) and Contradiction (C), which are interrelated.

With respect to the intuitionist diffuse logic and its difference with the neutrosophic logic, it is to emphasize that in the neutrosophic logic there are no restrictions in T, I, F, whereas, in the diffuse logic, the sum of components (or its superior limits)) = 1; and in the neutrosophic logic it is possible to characterize the incomplete information (sum <1), paraconsistent information (sum> 1). According to the characterization made between the fuzzy logic and the neutrosophic logic, in the next section the theory of the neutrosophic logic is defined to be able to apply it to the accounting sciences and to the taxation.

1.2. Theory of neutrosophic logic

Let Ube a universe of speech, and Ma set included in U. An element $x$of $U$is written with respect to the set M as x (T, I, F) and belongs to M in the

following way: it is t% true in the set, i% indeterminate (unknown) in the set, and f false%, where t varies in T, i varies in I and f varies in F. Statically T, I, F are subsets, but dynamically T, I, F are functions / operators that depend on many known or unknown parameters. The neutrosóficos sets generalize the diffuse set (especially the diffuse and intuitionist set), the set for consistent, the intuitive set, etc.

When considering the interval of non-standard units] -0,1+ [, with left and right edges vague, imprecise; where T, I, F are the standard or non-standard subsets of] -0,1+ [; and according to the neutrosophic logic [6] where each proposition is T% true, I% indeterminate, and F% false; then we have that -0 <= inf T + inf I + inf F <= sup T + sup I + sup F <= 3+, so T, I, F, are not necessary intervals, but constitute any set (discrete, continuous, open or closed or semi-open / semi-closed intervals, intersections or junctions of the previous sets, etc.).

1.3. Operations on neutrosóficos sets

Let X be the universe of discourse and let A and B be two fuzzy subsets with membership functions, uA (x) y, uB (x), respectively. The following operations can be defined:

- Union: $\mu_{\cup}(x) = \max(\mu(x), \mu(x))$
- Intersection: $\mu_{\cap}(x)(x) = \min(\mu(x), \mu(x)) \min(\mu(x), \mu(x))$

- Complement: μ (x) = (1 - μ (x))

These ways of defining the intersection and the union constitute a generalization of the classical sets, although these are not the only generalizations. There is a wide class of functions for intersection and union, respectively. Since intersection and union are not unique operations, contrary to classical sets, different functions may be appropriate to represent these operations in different contexts.

The concept of neutrosophic numbers constitutes a useful tool in the applications of neutrosóficos sets and neutrosophic logic. Special cases of neutrosóficos numbers include the real numbers and the intervals of real numbers. Among the neutrosophic numbers widely used in certain applications we have the triangular, the trapezoidal and the Gaussian.

1.4. Definition of linguistic terms

Linguistic terms can formulate vague descriptions in natural language to precise mathematical terms [24] and are a way of compressing information called granulation [25, 26, 27], which contributes to characterize phenomena that are ill-defined or complex to define [28-29]. Zadeh in [28] states that a linguistic variable is a "variable whose values are not numbers but words or sentences in a natural or artificial language". They are a medium that translates

concepts or linguistic descriptions into numerical descriptions, that is, it relates symbolic processes to numerical processes [11]. Formally a linguistic term is defined according to [30, 18, 28-29] and is given by <N, U, T (N), G, M> where:

- N; is the name of the linguistic variable and U underlying domain, which is not more than the universe of discourse.
- T (N) is the set of finite terms of words or linguistic labels (a collection of linguistic values) that N. can take.
- G is a grammar to generate labels or terms in T (N).
- M is a semantic rule that associates each element of T (N) with a diffuse set in U among all possible ones, that is, M is associated with each linguistic value X and its meaning M (X), where M (X) denotes a fuzzy subset of U.

The main objective with the use of linguistic terms (words or phrases) instead of numbers, is that linguistic characterizations are, in general, less specific than numerical ones, but much closer to the way in which human beings express and use your knowledge.

Another important concept is that of linguistic label, because linguistic terms are defined as fuzzy sets that represent the possible values of a

linguistic variable [26, 31, 32]. They can be represented in many different ways, among which we can highlight: real numbers, intervals, diffuse triangular or trapezoidal numbers [16, 28,33,39, 34, 35], so the membership function must be obtained from the expert in that domain of knowledge, hence using the linguistic variables can be implemented the systems of neutrosophic inference. For each neutrosophic set there are dissimilar membership functions, as well as for each of its elements because the linguistic variables are formed by linguistic labels and these are susceptible to being represented in different ways by functions of neutrosophic belongings.

1.5. Neutrophilic modeling

The neutrosophic modeling is the application of the neutrosophic logic and the theory of neutrosóficos sets to model phenomena through neutrosóficos rules. For example, in processes of control and decision making, it is feasible to apply neutrosophic systems. A neutrosófico system consists of four phases:

1. Neutrosification
2. Bases of neutrosophic rules
3. Inference
4. Deneutrosification

Neutrosification is the first phase where a function is established from X to all neutrosóficos sets in X. In other words, to a real number $x \in X$ is assigned a degree of belonging to a neutrosófico set A. Then there are the neutrosóficos rules which is a collection of rules that describes the relationship between the actions and the states of the system. The rules are expressed in the form; if (A1) and / or (A2) ... (An) then (Cn) where (An) and (Cn) are the actions and states of the system respectively for $n \in N$.

As for the inference, which is a deduction rule to determine a neutrosophic output based on an arbitrary set in X, and, finally, the deneutrosification, operator that transforms fuzzy sets to real numbers. There are several methods of deneutrosification being one of the most used center of gravity.

1.6. The business environment and the treatment of information

The business environment is characterized by the development of information and knowledge management. To take advantage of these opportunities and minimize the threats of the same, it must be understood that the main value of organizations is in their intellectual capital and their management based on knowledge and not only on tangible assets, hence the competitive advantage of companies in The XXI century lies in the level of

preparation of human resources which must be measured to establish the real value of the economic entity. For this reason, employees of organizations must be subjected to constant learning processes, through teaching and / or training models, in order to create a sense of belonging to minimize risks, increase productivity and reduce associated costs to operation and production.

The intangible is an element that increases the degree of uncertainty and generates challenges in the application of measurement models, its measurement is difficult, because this scenario constitutes the fundamental basis on which the neutrosophic logic becomes the fundamental tool for who wish to have the value closest to reality.

The neutrosophic logic is a useful tool in the study of the social reality, and in contexts permanently impregnated of inaccuracies like almost everything in the human sciences, for that reason, the application of the neutrosophic logic, in diverse fields has spread of fast form , becoming a useful and easy to understand tool in decision-making for senior management, in contracting, and permanence of the most relevant capital within all companies; understanding the skills, knowledge and work experiences that their workers have as an essential key to optimize work, through mutual collaboration among them or the application of training to strengthen work performance, which affects decision

making to propose changes in the way of production and interpersonal relationships in order to improve the work environment.

1.7. Applications of neutrosophy in accounting sciences

The neutrosophic logic becomes a fundamental, adaptable and versatile mechanism against the decision-making process, so that it allows to deal with all the events generated by different variables within an internal or external context of an organization; This is how the world of possibilities diminishes to obtain as a result an accurate decision. The success of the organizations lies in the management carried out, by senior managers and executives, in the development of various activities and strategies to achieve the objectives set by partners, shareholders and investors, so the decisions taken to reach them are fundamental thereof.

Within the applications that require the use of the neutrosophic logic are the processes of planning, those that require of appropriate tools and of pertinent information, so that the taken decisions are guessed right for the growth and competitiveness of the companies. During economic history, the classical methods of measurement have been the basis for decision making, which apply purely quantitative and linear mathematics, leaving aside the human subjectivity that affects the measurement of different economic events, so

that they must take into account quantitative and qualitative criteria; being the latter those that give way to the revolution in the methods of measurement and valuation for the taking of administrative, economic, financial decisions and other areas that intervene in the growth of the economic entities.

Based on the aforementioned, use is made of the properties of neutrosophic logic, in order to adapt the traditional measurement systems to the needs arising from the evolution itself, without ignoring the previously used methods. That is why the neutrosophic logic complements the different measurement techniques and instruments and becomes key for making organizational decisions, involving managers, experts, databases and expectations of improvement, in order to implement the appropriate model for an organization specifically; that is to say, a specific and personalized model for those who wish to apply it, independently of the proposed scenario and the degree of chaos that contain the conditions of action.

Another application of the one of the Neutrosophy in the accounting sciences is it in the managements, because the investors, take as reference of departure on the current state of an organization the diverse financial indicators applied to the same one; from this, every time that financial and administrative indicators are evaluated, it becomes an inherent reality to

guarantee the competitive functioning of an organization, it is necessary the participation of qualified and specialized personnel in the functions carried out within the companies; for this reason, it is necessary to have an ideal profile in order to make a comparison with the characteristics and qualities of the candidate.

On the other hand, there is the selection of human resources, an element of a company that is within the accounting area and that requires the application of the neutrosophic logic, since it is an activity that seeks to efficiently and effectively reduce the weaknesses in the selection of personnel to achieve compliance with the objectives set by the senior management. The application of the neutrosophic logic is more versatile, in those companies that want to reach their objectives, adjusted to a process of planning of activities, which facilitate the taking of decisions in the framework of a suitable performance. The aforementioned leads companies to have a competitive position by having intellectual capital, more apt in the performance of the activities to be carried out in the reference position. Because of this, a level of confidence is established that contributes to the valuation that is considered within the field of uncertainty, assigning values in the interval [0,1] of the qualities,

characteristics or attributes that aspirants have vacancy according to the profile of the job to which they aspire.

On the other hand, it is within the accounting the evaluation of the business perception in the companies, for which the neutrosophic logic is required, because the functionality of its system depends on the levels of efficiency and autonomy of its employees, for which the neutrosophic logic becomes the chord tool to evaluate all the aspects of the organization in order to obtain the point of equilibrium that will allow him to fulfill his objectives. When considering aspects such as efficiency and autonomy that are of incidence within an organization, they can not be left adrift, because when they reach the extremes of these, the management loses control over the management carried out and the consequences are negative for what is expected by the partners or shareholders.

The importance of intangible resources, as capital within an organization, becomes vital as the environment evolves, which causes an increase in the degree of demand for companies in order to remain active and competitive within the market, which It has generated restructuring in the way organizations acquire value quickly and constantly. Every economic entity for its creation and maintenance needs tangible financial resources, with which it opens

the door to participate in the free market game, over the years it has been shown that these resources need others to maintain themselves and be profitable, fulfilling the established objectives.

According to the above, the companies are not only worth the investments made and the economic part that constitutes them, but it is the intellectual capital that contributes to the increase of its value, that is, to the extent that the companies grow and consolidate, there is a need for an adequate assessment of the skills developed by employees to solve problems, because when working efficiently and efficiently, productivity and profitability is greater. On the other hand, it must be taken into account that globalization generates changes in the business world, one of which is the investment alternatives, which are exposed to vulnerabilities due to the different financial risk factors that affect the economy; The probability of obtaining an accurate result is conditioned to the economic, social and environmental resources of those who interact in this process.

In this sense, the neutrosóficos financial models applied to the financial planning and the administration of investment portfolios, are promising for their utility to establish ranges of uncertainty, as well as risk - return intervals that allow to reasonably link the financial optimization with the formation of

expectations. The use of neutrosophic logic in economics and finance is based on 6 fundamental reasons:

- Numerical reason, in this reason there are measurement errors. The correction of errors can be critical in some areas, but in inexact sciences such as economics, finance and business management requires approximations.
- Probabilistic reason, statistical theory is frequentist, and does not address the change and future structural dependence of the variables that affect the economy and business. Fuzzy logic avoids the loss of information that occurs with the use of statistical methods that perform numerical manipulation, since they work with averages, hiding extreme values.
- Theoretical reason, economic and financial models are approximate representations of reality, unlike the models used in physics or mechanics.
- Informational reason, the probabilistic objects of the prevailing economic and financial models do not incorporate qualitative information of great value. The neutrosophic logic allows to leave the preconceived notion with respect to the way how the data must

behave, allowing to understand that the economic and financial decisions are not affected by the difference between the current value of the variable that is observed and some theoretical normative value of balance.

The neutrosophic logic allows us to overcome the simplistic Aristotelian approach to the notion of equilibrium (whether or not in equilibrium), to conceive it as a paradox that presents degrees of belonging to the corners of absolute equilibrium and imbalance, the ideal extremes that are not always reached. This allows us to understand that economic and financial reality runs between these two opposites most of the time.

- Behavioral reason, human beings have limited rationality and are prone to error, which separates the predictions of the "exact" and "general equilibrium" models from the observations of the facts. On a daily basis, the economic and financial data show the behavior patterns of the agents, which synthesize the degree of blurring and asymmetry of the neuronal impulses of human agents.
- Cognitive reason, human beings are naturally gifted to manage imprecision and non-frequentist uncertainty, but they are perceptible and valuable through sensations.

1.8. Neutrosophy and its use in accounting

The accounting system handles data that are not always accurate and precise, sometimes subjected to the subjectivity of the measurement system itself or the accounting model. Faced with the application of probability and theoretical statistics, neutrosophic logic is presented as a better possibility to model in an environment of uncertainty and subjectivity.

In the accounting field, the causes and advantages that have led to the use of neutrosophic logic are frequently presented. The use of traditional mathematics in Economics has not been entirely effective in its results, due to the imprecise nature of the economic concepts studied or measured. This has led to seemingly accurate assessments of uncertain data, so that the results can be classified as artificial or inaccurate.

One example is the valuation and quantification of the variable Gross Domestic Product (GDP), which can sometimes be imprecise because the concept of **value of money** is indeterminate, depending on infinity of variables such as inflation, types of taxes, the interest rate or foreign and domestic policy. Another inaccurate concept that raises many economic discussions is the **number of unemployed in a country**, among other measurement difficulties, because there are part-time workers who would like to work full time. These

employees can not be considered either as employees or as full-time unemployed.

Based on the aforementioned, it is accepted that the economy is imprecise for several reasons:

- Measure; the data handled in economics are often very large and difficult to measure. For example, the number of inhabitants of a country is imprecise, because the measure is inaccurate. Although there are population censuses, they are not constantly updated, there are births and deaths that cause the inaccuracy of the number of inhabitants of a country, so the data is never totally accurate.
- Time; Economies are dynamic systems and therefore change rapidly. Therefore, it may be useless to try to give a value to a variable at a moment in time, since it will be modified with the course of it. In these situations, making a neutrophysical assessment that roughly reflects the range of values could be more interesting.
- Space; it also contributes to generating imprecision in the economic variables. Thus, when talking about the price of normal gasoline, this is not real, since it is different according to the physical location of the gas station and therefore inaccurate.

- The environment; it is a fundamental factor in the different valuations that a variable can take at a given moment. In this way, the dominant position of a company in a particular market depends not only on sales, but also on competitors, who are part of the market and belong to the same environment as the company.

The type of uncertainty caused by time and space is an important problem in any analysis, although it can be solved by applying probabilistic theory. The problem arises with the ambiguity generated by the measurement and the environment, distortions not contemplated in the probabilistic theory and that have to find a solution in other techniques.

The impression generated by the measurement or assessment in most cases depends on the environment. For example, a company will sell the same product at different prices depending on the market where the sale is intended. The entity will supply the product at higher prices if it is in a monopolistic regime, having no competition, while sales should be made at lower prices in an environment of perfect competition and is saturated. To overcome these problems and limitations, a new technique emerges that may be useful in economics, called neutrosophic logic, since it overcomes the limitations of the

probabilistic theory, allowing the treatment of the uncertainty caused by the environment where the company operates.

At the same time, it offers a series of instruments that allow both the transmission of information and the meaning that the individual analyst wants to express with it.

1.8.1. Uncertainty and accounting

In accordance with the aforementioned sections, it should be noted that in the scope of Accounting, there are numerous problems that are ambiguous and imprecise, such as:

- The adjustment of the financial statements to the real financial situation of the company.
- Investigate the meaning of deviations in a weak internal control system.
- Increase the size of the sample if the materiality is weak in the internal control.
- Location of indirect costs using appropriate bases.
- Consider several products as one when your sales levels are small. Ambiguity is captured by imprecise terms such as adjustment, weak, materiality, adequate or small.

- Terms that undoubtedly can not pick up the diversity of contents and nuances that the Accounting offers.

The imprecision and uncertainty must be taken into account when designing accounting systems for several reasons:

a) Ambiguity represents greater inaccuracy in decision making, and what is more important, can affect the choice finally made. The assimilation of the exclusionary dichotomy, whether or not it is, to classify the accounting concepts is unrealistic and unjustifiable, leading to unacceptable conclusions.

b) Another reason is based on the functional advantages of imprecision in a complex business environment. The decision maker needs a flexible framework that allows initially adapt, and remain stable later, in the face of unforeseen changes in the environment.

c) The need for high levels of precision justifies the study of uncertainty and subjectivity, since they can lead to accounting models that lose some of their relevance in the real world, mainly by ignoring variables in which their valuation is imprecise as the estimation of indirect costs mentioned above, or because their incorporation would increase the complexity of the model.

Accurate measurements, which are difficult to obtain, make it difficult to use accounting models. Such requirements may limit the applicability in the real world, such as the cost-benefit in the evaluation of accounting systems, research models of the deviations in the cost or the transfer of prices. Accurate valuations can lead to the concern of potential users, this is induced by the ability of the decision maker to obtain, necessarily, precise measures to give feasible solutions. On the other hand, the study of uncertainty is important because the use of fixed levels of accuracy is unreal, and what is more important, can lead to doubts about the effectiveness of total aggregates.

On the other hand, the imprecision in the accounting decisions allows to improve the prediction and the descriptive power of the same ones. In decision models that introduce ambiguity in real-world situations, they are effective in making decisions under uncertainty, reasons that lead to the need to incorporate the daily accounting work. They are composed of techniques and procedures that introduce subjectivity and uncertainty, using techniques such as neutrosophic logic, widely handled in the field of engineering, whose effectiveness is demonstrated in the treatment of uncertainty and ambiguity.

The subjectivity in the calculation of costs, when it is indicated that the calculation of the cost of the product will attend to the recommendation of the

costs of each one of the products, individually, leads to the need for numerous subjective opinions and locations. These requirements involve the use of techniques that allow the treatment of subjectivity implicit in any opinion of experts.

1.8.2. Probability or possibility in accounting

Faced with the above-mentioned scenario, where uncertainty and subjectivity play a fundamental role when designing efficient accounting models, specialists must have mathematical tools that allow modeling and treating these variables, in order to obtain flexible formulations that allow the of decisions and whose validity remains before unforeseen changes in the environment of the company. Traditionally, probabilistic theory has been used as a mathematical instrument for the treatment of uncertainty.

If the definition of probability of an event is considered as the quotient between the amount that an individual is willing to bet, with respect to the occurrence of said event, and the prize that can be obtained if it is finally verified, it can be deduced that, in the economic, the decision-maker will not really express their knowledge for fear of obtaining losses, therefore, their decisions will be limited by their aversion to risk. On the other hand, probability forces us to assign precise numbers to each event, when in reality, as estimates,

they would be better described by imprecise and therefore approximate assertions.

Another problem that may arise in the probability of occurrence of an event, is that it is calculated a priori depending on circumstances and conditions in force at the time of its acquisition, which in no case allows to ensure that they will remain in the future, given an environment as changing as the current one, which would lead to decisions that in the future would not have an effect or even be harmful, since the probability has changed due to alterations in the conditions that determine it.

Faced with these drawbacks, the introduction of the neutrosophic logic and the concept of possibility allows to better adjust to natural reasoning in situations of uncertainty that the concept of probability, because it contains very rigid rules to address all aspects of uncertainty.
The neutrosophic logical utilization facilitates the representation of common knowledge in a special mathematical language (that of the theory of neutrosóficos subsets and the distributions of possibility to them associated) and, through a logical calculation that makes the operative notion of truth more flexible, as a singular predicate, it allows to make approximate inferences from patterns of reasoning that reproduce, acceptably, the usual methods of

reasoning that are, mainly, qualitative linguistic type and not necessarily quantitative. To be reduced with the possibility of reinterpretation of the final results obtained through formulas is one of the usual aids that present us the current mathematical techniques and that are mixed with Artificial Intelligence.

Through the use of classical logic, it is possible to make reasonings that have very precise formulations. However, with the neutrosophic logic the precise reasoning is only a limit case of the approximate knowledge. Hence, the classical assumption can now be reversed: vagueness is no longer the limit of precision, but on the contrary, it is the limit of precision. Actually, the neutrosophic logic represents an extension of classical logic systems. Saying otherwise, classical logic can be considered to be a particular case of neutrosophic logic.

From the above statements it is clear that a whole new world of enormous possibilities for analysis and treatment is opening up, in areas such as Accounting, where they had been restricted with traditional logic. For all these reasons, the neutrosophic logic is revealed as a basic instrument when it comes to modeling accounting systems by allowing, on the one hand, to collect the uncertainty generated by the company's environment, and on the other hand, to

deal with the subjectivity implied by any opinion of the company. experts The advantages of the use of the neutrosophic logic is that through it it is possible to solve problems that are currently presented in Accounting such as the location of costs, quantification of materiality, preparation of capital budgets, among others. Cost locations are often inaccurate. While labor and direct material have a high degree of precision, other costs have a lower degree. Among the latter are the indirect costs.

In recent times, the relative importance of indirect costs has increased, which is why models have been developed to more accurately approximate the location of such costs, as is the case with ABC. These methods allow to locate some of these costs, but they can not be generalized to all.

Decisions concerning the products require this information, such as the sale price of the product and decisions to increase or decrease production. Many companies operate in highly competitive environments. The sale of its products is conditioned to numerous factors. One of these, which is with a level under control, are the sale prices and their changes.

One of the data for the determination of the sale price is the determination of the cost of the product. This refers to decisions about the location of the cost to the product that can have a significant impact on sales.

However, the best prediction about this kind of impact, at best, is very imprecise.

The decision making suggests the use of the neutrosophic logic in two levels, with the objective of maximizing the total profitability reached by the company in all its products. The first stage is the location of costs, and the second, the estimation of the impact of the changes produced in the sales prices of the units sold.

On the other hand, the opinions to be issued on materiality are evident in many areas of Accounting and Auditing. In the context of the Audit materiality is determining the areas to be treated by the auditor, the time and cost to the client. As well as the financial and legal responsibility of the auditing firm will be the result of the auditor's materiality decisions.

Materiality judgments are made during the Audit planning process, determining the complexity of the tests and procedures. Materiality in the planning process will influence the extent and depth of the testing system, the work to be done by the auditing team and the time to devote. Materiality levels will determine the type of opinion taken by the auditor, which may significantly affect the future of the company.

The ambiguities associated with materiality decisions in Audit result from the nature of the situational factors that are presented in each audit, as well as from the scale used by the auditor in the determination of materiality. Situational factors will affect the materiality decision, some importantly. The auditor should attribute different scales of importance according to the situational characteristics, the influence of these factors and their effect on the decision.

The neutrosophic logic facilitates the design of models capable of incorporating the vagueness and ambiguity associated with the decision-making process on materiality, further refining the results obtained. The use of this technique as a reasoning process used in materiality models would incorporate the ambiguity associated with the decision processes on materiality.

The possibility of this logic to incorporate the variation of degrees of importance would allow the adoption of different scales between the auditors. The flexibility of the neutrosophic logic can also be important in the assignment of situational-related variations, rarely collected in traditional decision models. Additionally, this technique contributes to the auditors to define factors and situations in terms of natural language.

In another sense, another possibility of using neutrosophic logic in Accounting is presented when analyzing the capital budgeting process, where the main problem lies in the uncertainty and ambiguity that surrounds the expected results. The case of investments in new technologies, this problem is increased by the difficulty in estimating the impact of unexpected changes.

It should also be borne in mind that the factors that generate the problem are not only economic and technological, the temporary aspect also plays an important role in the budgets, since, although the payments are generally controlled to a large extent by management, charges are the opposite, being subject to the evolution of the environment. If collections are not made in the initial periods of the project and extend over number periods, the problem of ambiguity and uncertainty could be serious.

The neutrosophic logic facilitates the modeling of uncertainty and ambiguity in such a way that it is shown as a flexible and effective method compared to traditional methods, based on the estimation and the probabilities associated with them, which are generally not known exactly. If the neutrosophic logic is carefully considered as a method of measuring decisions at the time of investing, these would be more in keeping with the needs to be met.

To measure the degree of competitiveness of organizations, as an activity within the accounting sciences, according to the performance of the productive processes, strategies, competences, tasks, the organizational climate, the level of customer satisfaction, financial results, suppliers , supported by the financial and accounting balances, which allows to analyze the factors of this measurement, it is advisable to use the neutrosophic logic, to appropriately deal with the level of uncertainty, according to the financial perspectives of the client, internal procedures and learning and increase.

1.9. Neutrosophic logic to assess the level of management in a company

The evaluation of the level of management in a company is a complex task and full of subjectivities; However, with the use of neutrosophic logic, the situation becomes less complex, since the neutrosophic logic, it is possible to analyze the information more accurate way for decision-making. The indicators associated with employee performance or customer satisfaction belong to the group of indicators whose subjective component is high.

At present the analysis of the information derived from the financial statements, is complex due to the amount of qualitative information they PROVEN, so incorporate neutrosophic logic to complement and get results more in line with reality, keeping organizations in competitiveness so that the

interaction between the financial, the clients, the employees and the decisions taken are directed towards the reach of the proposed strategic objectives.

According to the financial system for the development of a country's economy, if it is stable and solvent, it contributes to economic and financial stability; additionally, it is the channel through which the collection, allocation of financial resources and the mobilization of these are made, which allows the consumption, production and distribution of goods and services; at the same time that it offers money, it presents the motivation to create the demand on it by means of a transactional motive.

On the other hand, it has application in financial institutions and in particular, at the time of granting credit. In financial institutions the level of risk increases due to this activity, in order to reduce this situation, it is necessary to evaluate not only the quantitative aspects, but also the strengthening of qualitative ones; because, generally, financial institutions are based on the opinion and criteria of the experts involved therein, being the logical neutrosophic appropriate measurement tool to measure these criteria.

The neutrosophic logic, makes possible to include in the majority of financial models the uncertainty of way different from which it does at the moment the theory of probabilities. The advantage of the neutrosophic logic is

that it allows to define and include in the analysis, concepts or variables, even when they are not formulated in an accurate way. The neutrosophic logic works with rules of inference, which are obtained from the experiences of the experts or from historical series that are specific to each system.

Conclusions

In the present chapter, the neutrosophic logic in the accounting has been based, a characterization was made on the antecedents of the neutrosophic logic. A comparison between fuzzy and neutrosophic sets was made as a tool to represent human knowledge.

The fundamental aspects of the theory of the neutrosophic logic were shaped in order to apply it to the accounting sciences, describing the theory of the neutrosophic logic, the operations on neutrosóficos sets, the definition of linguistic terms, the neutrosophic modeling, the business environment and the treatment of information. The applications of neutrophysics in the accounting sciences are detailed, as well as their use in accounting and in the treatment of uncertainty. Elements of probability or possibility in accounting were addressed and the neutrosophic logic is specified to evaluate the level of management in a company.

CHAPTER 2. THE NEUTROSOPHIC LOGIC APPLIED TO TAXATION

2. Introduction

The tax policy in the last decades has been a permanently addressed issue, an aspect in which it is not deepened enough and it is immersed in the knowledge of its economic effects. Their interaction with macroeconomic policies, their implications in terms of savings and investment and their repercussions on the distribution of income are issues for which there is still a large margin of uncertainty, a variable that facilitates the use of Neutrosophy to be treated and support decision making.

Economic and social circumstances are changing throughout Latin America, which is the result of the processes of commercial and financial openness at the international level, the abandonment of the State's business role, the increase in the informality of labor markets and the growing concentration of the income registered in the majority of the countries has left a mark in the tax question, although in many cases some characteristics prior to these events still remain.

The palpable tax changes throughout Latin America have been linked to profound structural changes. These changes have not been harmonious and permanent, but, on the contrary, they have been shown to be unbalanced and

continuous, because in all these years an adequate balance has not been achieved in the distribution of the tax burden among the different socioeconomic strata that would allow it to reach a certain degree of social consensus in this regard, just as it has not been possible to establish definitive patterns regarding tax participation in Latin America.

A global vision of the transformations that has taken place throughout the period shows two significant milestones in taxation:

1. Need to substitute resources from taxes applied to foreign trade - process that still continues in response to the deepening of commercial regionalization processes- and that has led to the rapid diffusion and strengthening of the value added tax (VAT).
2. Challenge to obtain greater fiscal resources originated by the new expenditure demands that the process of universalization and maturation of pension benefits entails, which has led to the increase of taxes on the labor factor, as well as to the allocation of resources of general income to supplement these taxes.

Taxes are the benefits that the State receives in money, goods / services, determined by law, based on the economic capacity and contribution of citizens. These taxes are aimed at financing public services and other

purposes of general interest. A review of several systems and the academic literature available, contributes to the assertion that there is some agreement at the time of indicating which types of taxes, although it should be noted that each country has certain particularities. The consensus of the types of tribute rests in:

- Taxes
- The cups
- Special contributions

The three taxes defined above can be of several genres and can be taxed or applied to: spending or consumption; on the income of taxpayers; or by way of a benefit provided by the State.

Taxes are taxes paid by people for the direct provision of a service by the State, such as education, health or social assistance. There are many and diverse rates, from those paid for obtaining a citizenship card or a passport; even municipal taxes like those paid for the removal of badly parked cars.

On the other hand, special contributions refer to the amounts paid by citizens who are benefited by a work or investment of the public sector, such as: paving, works and drinking water systems, sewage works, among others. In other words, as a consequence of the performance of public works, the taxpayer

obtains an increase in the value of his assets and it is on this real or presumptive benefit on which the object of contribution falls.

2.1. The taxes

The taxes correspond to the coercive obligation and without consideration of making a transfer of economic values (generally in money), in favor of the State and of the minor entities subrogated by virtue of a legal provision, the conditions for the provision of services being fixed. an authoritarian (unilateral) way by the active subject of the tax relation [36]. Taxes are distinguished by five essential elements:

1. The active subject, ie the State, which has the fiscal power derived from its sovereignty to demand compliance with tax obligations.
2. The taxpayer, an economic entity (national or foreign, public or private, natural or legal person) with the obligation to contribute according to what the law dictates.
3. The material object of the tax, understood as the means of monetary transmission, that is, money.
4. The cause and purposes of the tax, which generally distinguish two causes: the law, and the need for the State to raise revenue for

the execution of its powers. In the same way, two effects of taxes are identified: the fiscal, that is, collection; and that of ordination, the influence on the individual and collective behaviors necessary to achieve certain basic objectives of the State.

5. The form of transmission of the tax, characterized by the obligation and the absence of consideration.

In general, it should be noted that taxes are the most important taxes in terms of their collection potential and, unlike other types of taxes, they are based on the principle of equity. Taxes, according to their equity, are classified as proportional (flat), progressive or regressive.

A proportional tax is one in which the agents pay the same percentage of the tax base, regardless of their income or wealth. A progressive tax is one in which the tax rate increases together with the taxable base, in such a way that it requires a greater contribution while the level of income or wealth is greater. A regressive tax is one whose rate is fixed or uniform; that is, it does not grow according to the amount of the taxable event, but it is expressed in percentage terms with respect to it. According to the object of application, taxes are classified as:

- Direct
- Indirect

Direct taxes are applied to wealth and income simply because they exist. On the other hand, indirect taxes are levied on the process of their circulation. In other words, direct taxes are those in which the taxpayer receives the tax burden, being impossible to transfer them to a third party.

2.2. Principles of taxation

The challenge of any tax system is mainly the prevention and control of evasion and avoidance of taxes, as well as the sanction to the commission of tax infractions. The tax theory has a set of principles of taxation that should govern tax systems. These principles vary depending on the role assigned to such systems from an ideological point of view, as well as from the perspective of economic policy. Although there is a variety in terms of and as long as the principles of taxation, the contributions of [36], [37], [38] and [39] summarize the considered common principles of taxation.

The first principle is tax sufficiency; this principle refers to the ability of the tax system to raise enough resources to cover public expenditures. A tax policy that complies with this principle must have three additional characteristics:

- Generality of taxes, that is, for all • Fair determination of exemptions; and the breadth of the economic bases and the subjects reached by the taxes.
- Flexibility, which implies the adequacy of the tax structure in relation to the national income variables. One of the main tax requirements to achieve such flexibility is the preference of the progressive tax on income.
- Fiscal equity, in this principle there are two basic types of tax equity:
    - Vertical equity, which means that when two people have different tax capacity, the one with the highest capacity must pay proportionately more taxes.
    - Horizontal equity, where two people of similar tax capacity should be taxed in the same way.

Another principle is simplicity, this principle refers to a functional and efficient technical structure. To achieve this objective, comfort is required, costs are not high and justified, taxpayers' knowledge of tax obligations and simplification of taxation. Both private investment and private savings are stimulated when there is a tax system that allows to know previously and accurately the tax consequences of any act.

Neutrality, is another principle within the taxation, this principle refers to the application of taxes, which should not alter the economic behavior of taxpayers; It is hoped that the provisions relating to production and private consumption will not be disturbed and that the allocation of resources will remain unchanged in the private sector.

The tax policy is guided by the fundamental principles on taxation that have evolved and proven over time, are guidelines for the design of tax systems and the more attached to them, the results of their application are more desirable and favorable, both for the State as for the citizens.

In accordance with the above, it is worth noting that the tax policy as a whole has uncertainty which can be dealt with through the neutrosophic logic, which facilitates the treatment of uncertainty, in a different way in financial models and in all the areas of accounting sciences. The implementation of the neutrosophic logic as aid in the evaluation of economic and financial activities is useful, since with it it is possible the analysis of the characteristics of the users, important aspect to make the decision to grant or deny the credit, in such a way that allows to provide a timely service and lower taxes.

2.3. Neutrosophic logic in taxation

Every country needs economic resources for the sustenance and social, cultural, environmental, educational development and other factors that affect the sustainable growth of the same, doing the collection through taxes established in guidelines and with the support of specific entities that manage and administer so that, in spite of the measures taken by the high officials, there are taxpayers who fail to comply with the obligations and responsibilities that are acquired at the time of commercial transactions, use and enjoyment of movable property, property or service, making it necessary to look for a model of measurement on the monies that are not received.

Although the above is true, there may be many factors in the incidence of non-compliance with this duty and governments seek ways to measure and know the causes of delinquency in the payment of taxes. Talking about several scenarios gives rise to the fact that the level of uncertainty is high and the degree of probabilities increases; within this context, it is possible to use the neutrosophic logic, based on the behavior of the accounting indicators.

The essential characteristic of the neutrosophic logic like measurement support, acts of multidisciplinary way with positive results; in this case the contribution of the neutrosophic logic to the study of these indicators

contributes to precise rules of behavior for the analysis of the delinquency in the payment of taxes by the companies of Latin America and also, identifies the relation of the entities with the economic situation of the same, which is represented through various accounting ratios.

The neutrosophic logic offers a different vision to the granted one by the classic logic, it appears then like one of the tools that allows to obtain numerical values from these qualitative variables in the majority of the financial models.

A system of neutrosófico inference for the treatment of the uncertainty in the taxation, can be defined like a mechanism that models nonlinear functions. It has input linguistic variables that it converts into output variables through the neutrosophic logic and groups of rules.

It is important to note that, in order to build a neutrosophic system, the following aspects must be taken into account:

- Identification of input and output variables.
- Determination of neutrosóficos sets.
- Selection of methods for aggregation and deneutrosification or concretion.

- Creation of the knowledge base through the use of rules of type YES-THEN.
- Design of the inference mechanism.
- Evaluation and use of the system.

The neutrosophic inference is the process of formulation of the route that is made from a given entrance until the exit is generated, for which the neutrosophic logic is used. It is a method that interprets the values in the input vector and is based on a set of rules to assign values to the output vector. This formulation involves the selection of the functions of belonging, the determination of the neutrosóficos logical operators, the design of the neutrosophic s rules, the election of the mechanism of implication and incorporation of the neutrosophic s rules (mechanism of inference) and, finally, the precision of the method of system output.

The Neutrosophic Inference Systems, according to their flexibility, their tolerance to errors in the data and their capacity to operate with non-linear functions, or subject to statistical budgets about the characteristics of the data, is an application complementary to the judgment of the expert and traditional analysis, as in this specific case for the evaluation of corporate tax arrears.

In this sense, a system of neutrosophic inference can be defined as a mechanism that models nonlinear functions. It has input linguistic variables that it converts into output variables by fuzzy logic and rule groups. There are two types of neutrosophic inference systems:

- Typology Mamdani
- Typology Sugeno

The Mamdani typology responds to a kind of inference by which the neutrosóficos sets resulting from the application of each rule are combined through the aggregation operator. The set derived from this process is desneutrosoficado to obtain the output of the system. The Sugeno typology, the effects of the use of the rules are translated into a linear combination of the input variables. The output, therefore, is a weighted linear combination of consequences.

Specifically, the models of the Sugeno style present the input variables - independent, outputs - dependent, linguistic categories, neutrosóficos sets and associated belonging functions, where they interact with the traditional statistics techniques and the financial and accounting indicators, it is evident that this model It provides solutions and reveals the impact caused when making

an entry in relation to tax liability and delinquency. This model can be applied in different areas, especially in financial institutions.

Both models (Mandami and Sugeno) resemble each other in several aspects. The first two parts of the inference system - neutralization of the input and application of the fuzzy operators - are exactly the same, but, in the case of Sugeno, the average of the weights is used as a deneutrosification method for a total of n rules it is calculated through equation 1.

$$\text{Final output} = \frac{\sum_{i=1}^{N} W_i Z_i}{\sum_{i=1}^{N} W_i} \quad (1)$$

Where;

Z_i: Output level of each rule

$_i$: Weighted weight of each rule

In Figure 1 a general mode of representation of a neutrophysical control in a block diagram is shown.

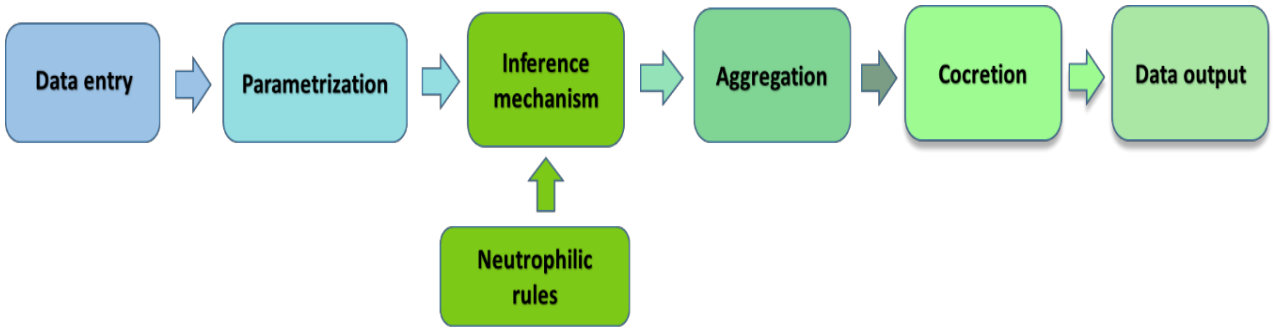

Figure 1. Neutrosophic Inference System.

According to the Fuzzy Inference System represented in Figure 1, the steps for the development of this type of system are presented.

1. Parameterization, also known as neutrosification, consists of taking the inputs and determining the degree to which they belong to each neutrosófico set by belonging functions. The input to the neutering process is always a numerical value of the real world limited to the universe of speech of the input variable. The exit to the process is a degree of belonging in the interval 0 to 1.
   The commonly used membership functions are triangular, trapezoidal, Gaussian, sigmoidal and Bell's generalized. These are chosen in such a way that adequate correspondence is recorded between the entry and exit spaces of a system. They can be seen in Figure 2.

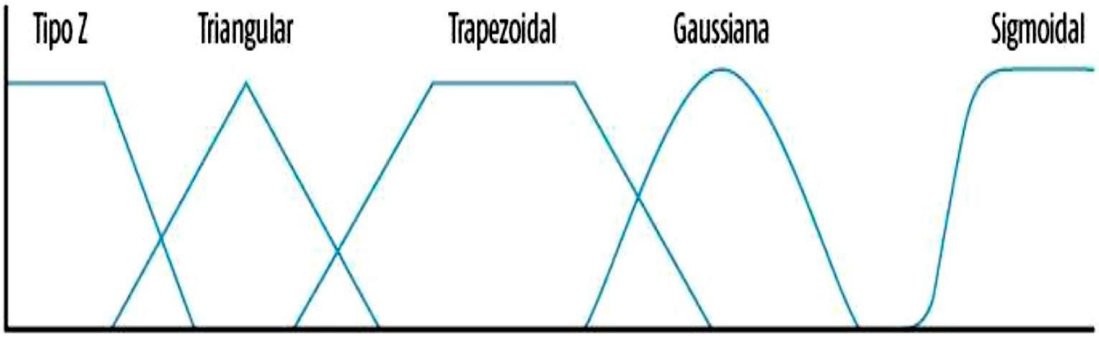

Figure 2. Types of membership functions.

2. Inference mechanism, once the inputs have been parameterized, it is known to what degree each part of the background is satisfied for each rule. If the antecedent of a rule has more than one part, when the neutrosophic operator is applied, a single number is obtained that represents its result. The implication of the antecedents to the consequence is done to modify the output neutrosophic set.
3. Aggregation, in the process of adding the consequences of the rules, the neutrosophic sets that represent the output of each one are combined into a single area or set. The aggregation process then includes a list of truncated neutrosophic sets resulting from the process of implication, from which a neutrosophic set is derived for each output variable.
4. Concretion, also known as neutrosification, constitutes a neutrosophic set (resulting from the aggregation process) whose output is a natural number. The most popular deneutrostation method, for the Mamdani case, is the centroid, which returns to the center of an area under the curve. Meanwhile, for the Sugeno type, it is the average of the weights.

In accordance with the elements described on taxation and the neutrosophic logic, the next section explains the use of neutrophysics for the analysis of corporate tax arrears.

2.4. Analysis of the tax delinquency of companies applying neutrosophic techniques.

The behavior of the accounting indicators of different companies of small and medium size of the socio-productive environment affects the determination of delinquency in the payment of taxes, whether national, provincial or municipal, through the application of neutral logic. The contribution of the neutrosophic logic to the study of accounting indicators is to contribute to the definition of rules of behavior for the analysis of delinquency in the payment of taxes by companies and their relationship with the economic and financial situation of said companies, represented through various accounting ratios. The definition of rules of behavior through linguistic proposals will favor a conceptual understanding of the economic and financial reality of the companies inserted in the decision-making processes.

The form of evaluation of the tax delinquency of the companies is carried out through a set of ratios indicative of the economic and financial task that allows, on the one hand, an analysis of the historical evolution of the organization and on the other, a comparative analysis of the same with respect to other institutions of the sector. The set of ratios with which it operates is usually quite broad, many of which tend to be strongly correlated, which is why, as a

first step, we must operate to carry out the analysis with a group of indicators that present redundant information for the realization of the analytical synthesis and in addition, the numerical extension of them.

The Neutrosophic Inference Systems, given their flexibility, their tolerance to errors in the data and their ability to operate with non-linear functions, or subject to statistical assumptions about the characteristics of the data, are an application complementary to the expert's judgment and to the traditional analyzes, as in this specific case for the evaluation of the tax delinquency of the companies. The methodology of the Neutrophysical Inference System of the Sugeno type, arises from the data provided for the independent and dependent variables, allows through the selection of a set of uncorrelated ratios, to establish its incidence in the determination of the tax delinquency, or tax indebtedness, as it has been called the respective output variable in the analysis.

The models based on the neutrosophic logic allow to obtain a set of rules, that in our case of study they demonstrate the tributary behavior of the signatures established like units of analysis. That is to say, the purpose of the model is twofold, on the one hand, to characterize through the rules the behavior of the units of analysis, and on the other to obtain a predictive value

for tax arrears, allowing human experts to better analyze the decisions of payment of taxes. The selected explanatory variables are translated into a prediction of the values of the dependent variable through a mathematical function and a set of neutrosophic rules, obtaining the minimum variables required to perform the prediction of a new analysis of tax arrears.

The ratios represent a tool for the rational decision making, which consists of the collection of financial data, expressed by means of a coefficient, that allow analyzing the company in its economic and financial aspect, facilitating the posing of diverse problems, without giving the solution precise to them. They allow two types of comparisons: in the same company, they allow analyzing the evolution of the company over time, or with similar ones, or with industry averages, allowing to establish its position. It should be noted that the technique of the ratios to perform the economic-financial analysis of companies is the simplest and most widespread.

According to the steps of the Neutrophysical Inference System, it is necessary to define the input and output variables, their categories or linguistic terms constituting each diffuse set and their membership functions. The following variables constitute the linguistic input variables of the system: Profitability partners, Profitability society, Indebtedness, Operational

Liquidity and Rotation of the asset, which give rise to the values of the output linguistic variable, Tax delinquency.

Figure 3 shows the variables mentioned in the construction of the neutrophic inference model of the Sugeno type.

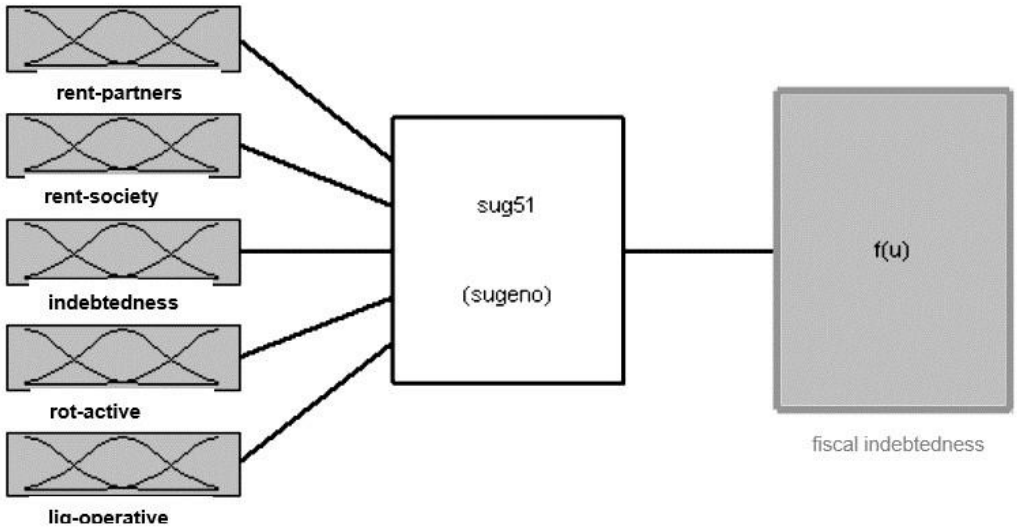

Figure 3. Neutrosophic Inference System for the determination of tax arrears.

The terms or values of the linguistic variables are the values that the variable can take, for example, for the predictive variable Tax arrears, the membership function grants a degree of correspondence (membership) to each value of the linguistic variable, such as if the exit value is 0.12 we are facing some low tax arrears.

The membership functions of the neutrosófico set of the input linguistic variables are Gaussian and for the output variable also corresponds to the

Gaussian type. By observing the result thrown by the Neutrosophic Inference System, it is obtained that if the input value is from 0.09 to 1.699 we have a low Asset Rotation, whereas if the values go from 1.699 to 1.84 we are facing a moderate Rotation of Assets and finally those values of the variable higher than 1.84 would be giving us a high Rotation of Assets.

The same analysis is feasible for all input variables selected to analyze the tax delinquency. The output linguistic variables Tax delinquency with the description of its representative elements in the Neutrosophic Inference System is shown in Table 1.

Table 1. Linguistic variable Tax arrears

Linguistic variable	Language categories	Membership function	Support set
Tax arrears	Low	Gaussiana	[0,02;0.20]
	Moderate	Gaussiana	[0.20;1]
	high	Gaussiana	[1;1,86]

Each indicator is associated with the linguistic categories to the measurement variations that it experiences, these categories can be: mild, moderate, medium, high and superior. Each of these linguistic terms defines a diffuse set in itself that is represented through a membership function μ - numerical value in which the linguistic variable is expressed.

The membership function chosen to represent each linguistic category corresponds to a degree of membership between 0 and 1. The membership function used for the different fuzzy sets of the chosen indicators is Gaussian. For the construction of the model, a neutrosophic clustering is performed in a Sugeno implication. The neutrosophic clustering is based on the identification of cluster centers, according to the density of the points defined as centers and grouping the rest of the data according to their distances to these centers, in a function of minimization. Thus, each cluster defines a neutrosophic set for each variable.

With the model of Neutrosophic Inference that evidences the behavior in the payment of taxes and from the obtaining of neutrosophic s rules of behavior, results are obtained derived from the established neutrosophic s rules that determine the degree of presence or absence of interaction between the elements of 2 or more neutrosóficos sets, referred to the existing association between a linguistic category of a variable with another category of another variable.

As the rules have the form "if - then" composed of antecedent -premises- and consequent -conclusion-. The evaluation of the antecedent allows the interpretation of the rule, meaning the neutralization of the values of the input

variables to linguistic categories with the application of a neutrosophic operator (Cartesian product) and ends when the result of the premise is applied to the conclusion to through a membership function. To evaluate the tax delinquency, the following is established:

- If the final average value of the Neutrosophic Inference System is less than 0.20, it would be possible to consider that we are facing a low tax delinquency.
- If the final average value of the Neutrosophic Inference System was between 0.20 and 1, the tax delinquency was moderate.
- If the final average value of the Neutrosophic Inference System is greater than 1, there is a high tax delinquency.

The provision of neutral rules that show the behavior of tax arrears, provides experts with a decision support tool that achieves objectivity and uniformity in the formulation of criteria for evaluating compliance with tax payments.

The models of Neutrosophic Inference on the tax behavior correspond with the profitability of the partners. Profitability is a measure of the performance of the company in terms of the profits obtained. The same can be related to the total sales of the company - in which case the company is taken

as an entity and the profitability obtained is determined by focusing the interest on the company itself or it can also be related to the net equity, that is, the participation of the company. the partners in the assets of the company in which case the focus of interest is placed on the partners, rather than on society.

On the other hand, it is noteworthy that in neutralizing the values of the ratios to pass them to linguistic variables, the Gaussian membership functions of the different categories to be evaluated are similar, which implies that no sensible differentiation could be made in the values of said variables.

Conclusions

In the chapter, a description of the taxes and the principles of taxation is made. It makes use of the neutrosophic logic for the taxation with the purpose of measuring the incidence of the tax delinquency of the companies. Methods, systems and models useful for this purpose are exposed.

CHAPTER 3. APPLICATIONS OF THE NEUTROSOPHIC LOGIC TO THE ACCOUNTING SCIENCES. USE OF MODELS DEVELOPED TO MEASURE RISKS

3. Introduction

Applying the neutrosophic logic to the financial indicators is a proposal little spread in the accounting field. The use of neutrosophy allows us to observe the results of financial ratios with a broader perspective, showing results that are not totally certain or totally false, since they can take an indeterminate value of truth within a set of values, applying the theory of neutrosophic logic.

When interpreting financial risk indicators with emphasis on the neutrosophic logic, a more flexible environment is obtained in the interpretation of financial information. The decision making environment using the diffuse methodology allows the decision maker to graphically observe the levels of belonging to each of the proposed credit ratings.

3.1. CAMEL model to measure the credit risk of companies

An example of application of the neutrosophic logic is based on the model of financial analysis Capital, Asset, Management, Earning and Liquidity (CAMEL), which translated into Spanish means quality or suitability in Capital, Assets, Management, Utilities and Liquidity; this example has been taken because it is

one of the most widely used methods for measuring international credit risk, [40]. The CAMEL model allows to identify financial difficulties in banks, which stands for Capital (C), asset quality (A), administration (M), profitability (E) and liquidity (L); "Is defined as a uniform system of qualification of financial institutions" [41].

The process of measuring credit risk is done on the basis of models that allow measuring performance through the application of financial ratios. Through CAMEL it is possible to develop financial analysis that is based on the construction of financial ratios, and that originate in the balance sheets that are carried out in financial institutions. Table 2 shows those referential values or levels of belonging that an institution could reach in each indicator; however, applying the financial ratios and the CAMEL model to the consolidated statements, the entity would obtain an institutional financial rating in the Savings and Credit Cooperatives (CAC) of AAA as the highest or EE as low as shown in Table 3.

Table 2. Membership levels

Value	Degree of belonging
	without pertinece
0.1	practically without pertinecia
0.2	almost without pertinece
0.3	very weak pertinecia
0.4	weak pertinecy
0.5	median pertinece
0.6	sensitive relevance
0.7	quite pertinect
0.8	strong pertinacity
0.9	very strong pertinece
1	absolute relevance

Table 3. Types of grades

AAA	Highest or best rating. Known as best investment grade.	Optimum
AA+ AA AA-	Emissions of very high credit quality. The protection factors are very strong. The risk is modest. High credit quality The protection factors against investors are very strong	High
A+ A A-	Emissions with good credit quality. The protection factors are adequate. However, in periods of decline in economic activity the risks are greater and very variable. Conservative risk	Good
BBB+ BBB BBB-	The protection factors are below average, however, they are considered sufficient for prudent research. There is a considerable variability of risk.	Satisfactory
BB+ BB BB-	Emissions below the investment grade. Investors who have these portfolios are aware of the economic conditions, policies and cycles that may affect the ability to pay	Questionable

To observe the results of financial ratios with broad perspectives of analysis, from the results not totally irrefutable or totally non-existent; and when using the theory of neutrosophic logic and comparing it with the traditional analysis to classify the credit categories emitted by international and local organisms, the Database previously created for this analysis is used in order to obtain the financial information corresponding to the study in question.

Through the neutralization, the different relationships between the equity sufficiency indicators and the available funds are determined, which makes it possible to reference the relations of the neutrosophic logic. The graphs resulting from this process will help to measure the credit risk of financial institutions, the detailed process is shown in Figure 4.

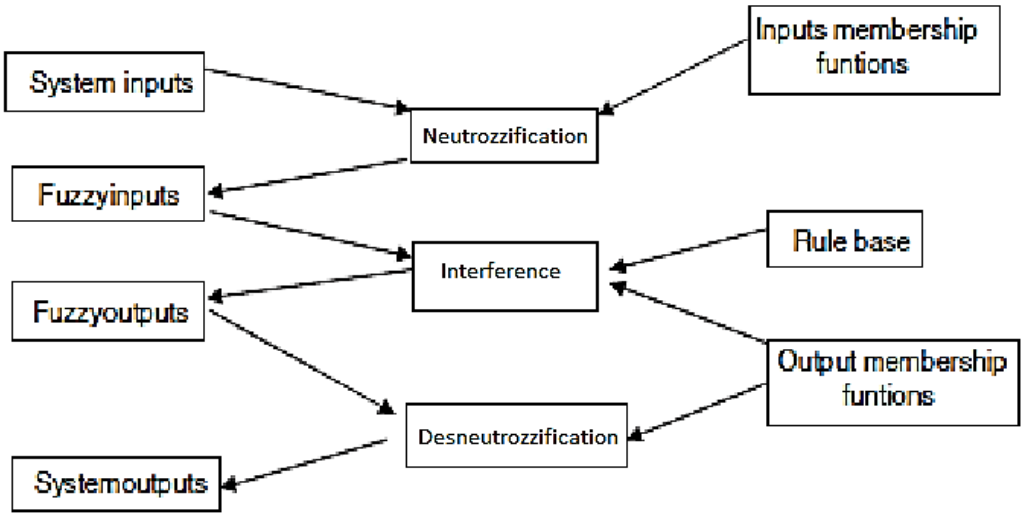

Figure 4. Modeling in a neutrosophic environment.

The pre-established goals of the CAMEL model are our defined reference for comparison with the selected indicators. The maximum and minimum values of each variable are defined with reference to the sample of the population (Segment 1, Cooperative Sector of Latin America); ranges are defined with statistical methods to reference the values previously required (Figure 4).

Each proposed range constitutes a neutrosophic subset that must have its linguistic label, the limit for each subset provides the default system, and can be customized for the neutrosophic logic; Figure 5 and 6.

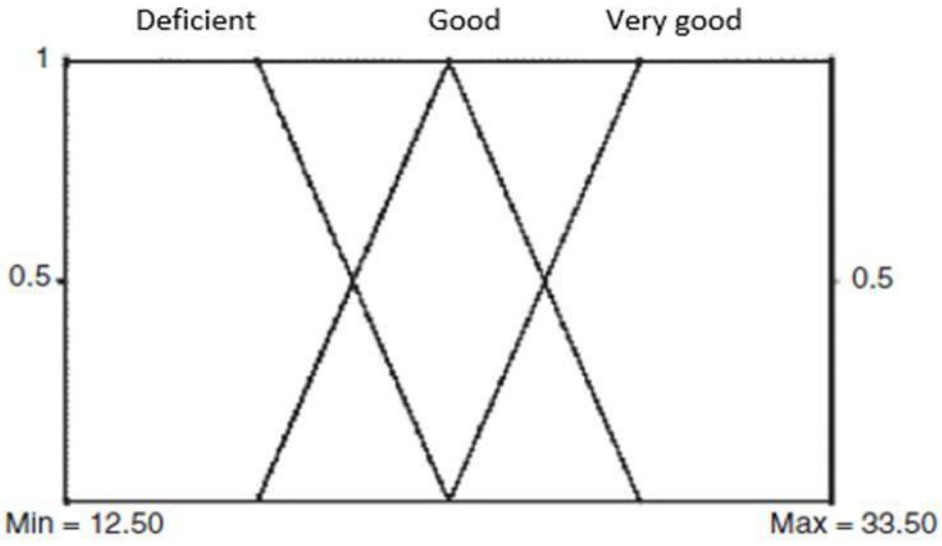

Figure 5. Variable graphic input representation. (Input variable: reference subsets per indicator, output variable: subsets by credit ratings).

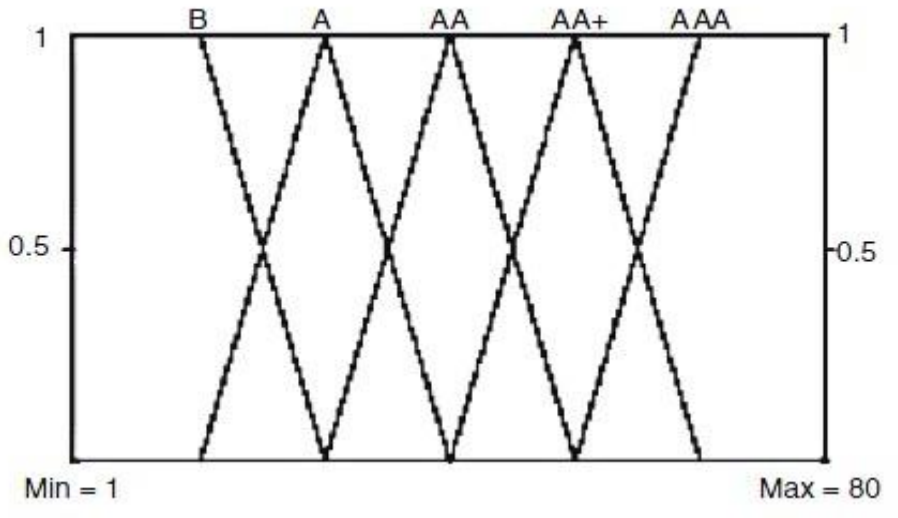

Figure 6. Output variable graphic representation.

The values in Table 4 favor the interpretation of the degrees of belonging of the indicator with respect to the goal established by the model used by CAMEL; by observing the descriptive ranges of the input variables, it can be identified that the neutrosophic logic differs from the traditional logic, because in the neutrosophic logic the frequencies of qualification is not sequential, while the ranges in the traditional logic have a formal sequence and uniform. This is due to the neutrosophic methodology of interpretation of linguistic terms that are used for this study, whose information helps us in the interpretation and reading of the results obtained. However, the neutrosophic method qualifies the categories of entities with ranges that belong to 2 categories at the same time for their qualification. Unlike traditional logic, which contains sequential ranks for categorization in one of the ranges, the

neutrosophic linguistic variables allow the decision maker to more broadly identify which category the indicator belongs to most inclined and which rating category belongs with the least inclination. result.

Table 4. Input variables for the study with the CAMEL model.

Diffuse logic		Traditional logic	
Range description	Range description	Range description	Range description
IF 1112(Funds available)	IF114 (Heritage sufficiency)	IF 1112(Funds available)	IF 114(Heritage sufficiency)
(12.50 to 23.00). Deficient	(84.82 to 671.32). Deficient	(12.50 to 19.50). Deficient	(82.82 to 475.82) Deficient
(17.75 to 28.25). Good	(378.07 to 964.54). Good	(19.50 to 26.50). Good	(475.82 to 866.82) Good
(23.00 to 33.50) Very Good	((671.32 to 1257.82) Very good	(26.50 to 33.50). Very good	(866.82 to 1257.82) Very good

Based on the analysis carried out, it is noteworthy that the traditional financial analysis shows an interpretation and ranges of linear qualification through static categories and goals already established by the control body, whose institutions pursue it to obtain the optimum categories that reflect their level or status in the market. The results of applying fuzzy logic show a break of symmetry with varying scale ranges. Measuring these qualifications with flexible methods allows you to understand business information in a broader context and not only assess the quantity, but the qualities of the different ranges. The cooperative sector is very important in the financial system and the control organisms evaluate their actions through established standardized models. By applying neutrosophic logic it can be verified that the membership

levels for the cooperative segment were rated at good and very good levels. This means that the credit quality is in the upper ranges, and gives strong protection factors and moderate risks; however, during periods of low economic activity you can increase your risk and decrease your rating.

The analysis of the application of the neutrosophic logic in the financial field allows us to determine a risk rating, without omitting the effects of the environment in which this qualification is produced or obtained through the study of CAMEL indicators, applying deneutrosification mathematics.

The application of the neutrosophic logic contributes to identify the level of approximation of tendency of qualification of a company within the different credit categories.

3.2. The Neutrosophy for the countable elements valuation of the undertakings

The search for solutions to problems that start from perceptions turn to alternative models that reflect, in some numerical way, linguistic variables. The neutrosophic logic is presented as a tool to achieve this transformation; its foundations are fuzzy sets according to which the degree of belonging of an element to a set is determined by a belonging function that can take all the real values included in the interval [0, 1]. The neutrosophic logic allows to define

variable degrees of belonging that resemble, in reasoning and patterns, to the human thought, leaving traditional deterministic concepts. At present, any relationship between input variables will be approximated by means of a neutrosophic system constructed in linguistic terms with a high degree of accuracy.

3.2.1. Tool for investment decision making

The value of a company is calculated with criteria that vary among analysts. Three concepts become evident: the price, as a result of the exchange of monetary units; the cost, which are the resources necessary to maintain the company, and the value, which reflects the ability to generate benefits for its shareholders or beneficiaries.

The more complex the good, the more difficult it is to determine its cost, especially when its elaboration is extended over a period of time; this, giving rise to add costs that are not homogeneous. From the microeconomic theory of consumer preference, it is stated that the same good consumed or acquired in two different places or circumstances is equivalent to two different goods, since the buyer can value it differently.

A correct valuation is one that is technically well founded and based on reasonable or correct assumptions, taking into account the subjective

perspective under which the valuation is carried out. The models that influence the perception of the value of the company are supported on triangular sets neutrosophic for the input and output variables, as shown in Figure 7.

Figure 7. Triangular neutrosóficos sets for the input and output variables.

The input variables of the triangular neutroshophic set for the investment of a company corresponds to:

I. Internal competences these competences are directly linked to the management of the company in the market and with customers. The neutrosophic inference system for the analysis of internal competencies is shown in Figure 8.

Figure 8. Structure of the Neutrosophic Inference System to measure internal competences of a company.

The variable internal competences consider two defined neutrosóficos sets:

- High internal competences: Reference to operational and strategic competitiveness.
- Low internal skills: it occurs when the operation of the company is not profitable, the clients are not loyal and there are intermittent periods of work. The input variables for internal competencies are defined as:

    1. Strategic alliances
    2. Time in the market
    3. Loyalty of the clients

In relation to strategic alliances, its importance lies in the fact that there is a high development of communication technologies that support alliances; In addition, they allow entering specific markets more quickly, reduce

financial and political risks, competition, improve access to resources, among others. The neutrosóficos sets that are considered to measure the strategic alliances are:

- High strategic alliances, a type of optimal alliance, with a defined strategy.
- Medium strategic alliances, do not take full advantage of the potential of the alliance.
- Low strategic alliances, whose results are not as expected.

With respect to time in the market, the quotient between the average market time of a company and the average market time in the sector is calculated. The neutrosóficos sets that are considered to measure the time in the market are:

- A lot of time in the market, they make decisions faster.
- Normal time in the market, possibly innovated in the market.
- Little time in the market, they do not achieve positioning in the sector.

Customer loyalty is related to the preference for the products and services of the company, with a recurrence or continuity in the acquisition of

these. The neutrosóficos sets that are considered to measure the loyalty of the clients are:

- High customer loyalty, give stability to the company.
- Half customer loyalty, there is a risk of losing customers.
- Low customer loyalty, customers tend to change providers.

The knowledge base for these cases is constructed through the criterion of experts, with experience in this activity, to analyze the implicit relationships between the input and output variables of the defined system. These relationships are represented in the form of yes-then rules. One of these relationships can be expressed as follows: if customer loyalty is low and associated with low alliances and a short time in the market, internal skills will be low. This means that the company is not taking advantage of its competences or that the management is not taking decisions aimed at creating value.

From the knowledge base for the measurement of internal competences, presents, in Table 5, a part, because all possible combinations should be shown.

Table 5. Knowledge base for the variable internal competences

IF			THEN
Alliances	Lealtad_clientes	Market_time	Internal
Lows	Lows	Little bit	Lows
Lows	Lows	Normal	Lows
Lows	Lows	Much	Lows

II. Monetary competences are the competencies of the company, that is, they can be influenced and established by the decisions of the directives. Impact the future generation of benefits from the operation and strategy. They are typical of cash flow, strategic indicators and the analyst's perception of future opportunities.

To determine the monetary competences, the following neutrosophic inference system is proposed, the same is shown in Figure 9.

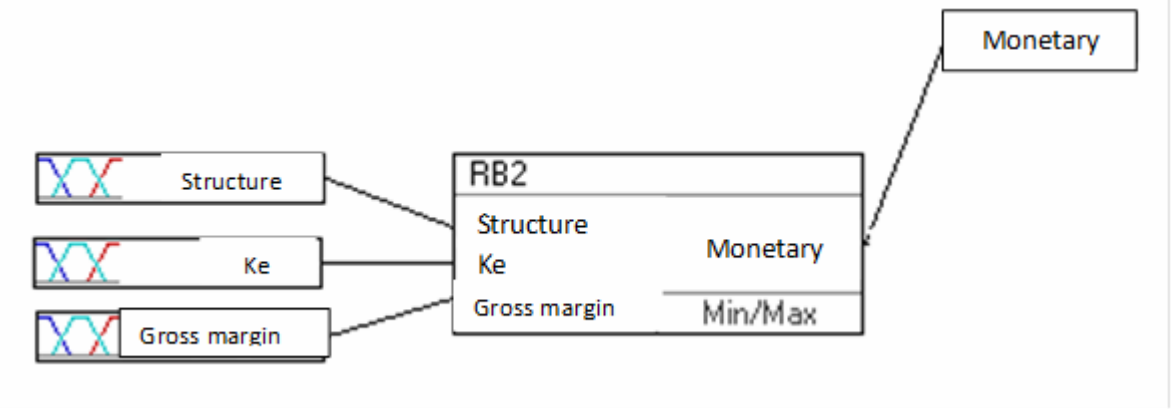

Figure 9. Structure of the inference system for monetary competences.

Two neutrosophic sets are considered defined as follows:

- High monetary competitions, companies that have achieved a balance in their financial structure.
- Low monetary competencies, financial and operational management with considerable shortcomings.

The input variables for monetary competencies are defined as:

1. Gross margin
2. Financial structure
3. Cost of heritage

Gross margin is defined as revenue, less the cost of manufacturing the product. They show comparatively the difference between the gross value of production and the direct cost associated with that activity.

The criterion based on income establishes that the value of an asset is the value present of their expected returns; an asset is expected to provide returns during the period in which it is held; to convert this series of returns into a reliable value, it must be discounted at the discount rate.

The neutrosóficos sets that are considered to measure the gross margin are:

- High gross margin, there is good efficiency in operations and an adequate allocation of prices to products.
- Average gross margin, the company does not use production resources as much as possible.
- Low gross margin, the cost of the merchandise exceeds sales revenue.

The financial structure corresponds to the total of the liabilities divided with the total equity. To finance assets including shareholder capital and debt, in the short and long term. The financing is achieved using the company's own resources or through the debt contracted through a financial system. The objective leverage model (trade off) holds that companies seek optimal leverage, that is, one that minimizes the cost of capital.

The neutrosóficos sets that are considered to measure the financial structure are:

- High financial structure, organizations that use the capital market as their main financing option.
- Average financial structure, short and long-term fund.
- Low financial structure, mix of short-term fund sources and investment.

The cost of equity is the rate of return that the company pays its shareholders for obtaining the capital they provide. The cost of capital of the company is defined as a weighted average of the capital invested from each of the sources of capital at the rate that each one of them is investing in the company; If a company is creating or destroying value, this average is a basic element, along with the return on capital invested (ROI), since whenever the ROI exceeds the cost of capital invested, it creates value.

The fuzzy sets that are considered to measure the cost of capital are:

- High equity cost, shareholder investment exceeds your expectations.
- Cost of average assets, the rate of return is as expected by the investor.

Cost of low equity, the potential of the company is not used correctly. The knowledge base for measuring monetary competencies should be present with all possible combinations; a part is presented in table 6.

Table 6. Knowledge base for the variable monetary competences

IF			THEN
Structure	Ke	Gross margin	Monetary
Low	Low	Low	Low
Low	Low	Medium	High
Low	Low	High	High

III. Macroeconomic aspects of a company are in correspondence with the effect that the economy could have on the performance of the company. These aspects compromise the perception of future flows and limit some of the projections in order to adjust the approaches to reality.

They affect the analyst's perception of the possibility of fulfilling the proposed scenarios and obtain projected returns. The system of neutrosophic inference for the macroeconomic analysis of a company is presented in figure 10.

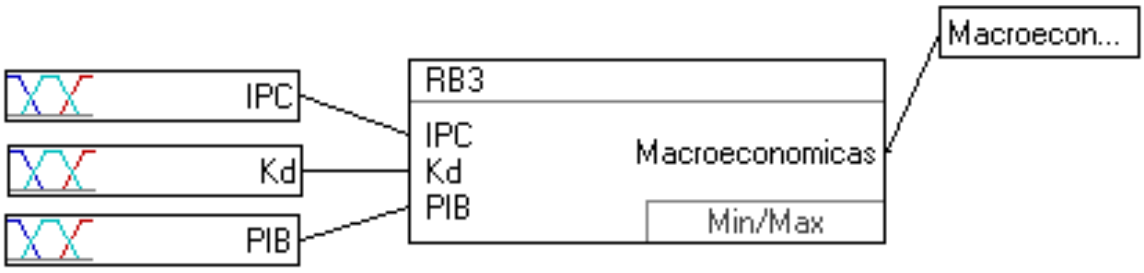

Figure 10. Neutrosophic inference system for the analysis of macroeconomic aspects.

For the variable macroeconomic aspects, two neutrosophic sets defined as follows are considered:

- Favorable macroeconomic aspects, signals are presented that allow us to infer a macroeconomic behavior favorable for the company, in the sector and the country.

- Unfavorable macroeconomic aspects increase the perception of the macroeconomic environment that is counterproductive for the company. The input variables for monetary competencies are defined as:

    1. GDP
    2. IPC
    3. Cost of debt

The GDP, corresponds to the measurement of national accounts, is the information referring to macroeconomic aspects such as: production, consumption, savings, investment, financial transactions and economic relations with abroad. Among economists, the spending approach is the most used.

It is usually called the Keynesian equation and is expressed as: GDP = C + I + G + NX.

The GDP, allows to project the growth of the company with respect to the economic development of the country. This index is made up of all sectors of a country's economy, therefore, it determines the minimum growth that can be demanded from the company.

The fuzzy sets that are considered to measure GDP are:

- High GDP, economies that are characterized by having a better quality of life and fully using the potential and resources.
- Average GDP, people have an average quality of life.
- Low GDP, resources are not efficiently exploited and there is underdevelopment in the economy.

The CPI is related to the variation in prices, which directly affects the income of the company. In valuation models, it is used to project the behavior of assets directly or indirectly related to the operation of the company. The fuzzy sets that are considered to measure the CPI are:

- High CPI represents a pattern marked by the preferences of expensive items, an accelerated market growth given by the dynamics in market prices and reflects the purchasing power of people.
- Average CPI, daily expenses of consumers are adjusted to basic needs, and as these do not change, the variation in prices is not very significant.
- Low CPI, is found in underdeveloped economies, not very dynamic.

The cost of the debt corresponds to obtaining the financial resources that make use of the contributions made by their owners or of contributions

made by third parties, such as suppliers, investors, financial system, etc. The one who invests capital in the company does so hoping that he will rente the investment at a rate that differs for each investor, depending on the perceived risk in the business and the opportunity cost of each one.

The neutrosophic sets that are considered to measure the cost of debt are:

- Cost of high debt, cost above average and reflects a bad financing policy.
- Cost of average debt, adjusted to the value of the sector or similar companies.
- Cost of low debt, the company has a strong negotiation capacity.

The knowledge base for measuring the macroeconomic aspects must present all possible combinations, in table 7 the most significant ones are shown.

Table 7. Knowledge base for the variable monetary competences

IF			THEN
IPC	Kd	PIB	Macroeconomic
Low	Low	Low	Low
Low	Low	Medium	High
Low	Low	High	High

The output variables of the triangular neutroshophic set for the investment of a company correspond to the investment in the company. The valuation of a company, from the analysis of the investment, could be divided into two analyzes, one corresponding with the quantitative aspects and the other with the qualitative aspects. Intertwined allows the investor to make a decision. The evaluation integrates each of the components analyzed:

- Internal competences
- Monetary competences
- Macroeconomic aspects

The neutrosophic inference system for this variable is presented in figure 11.

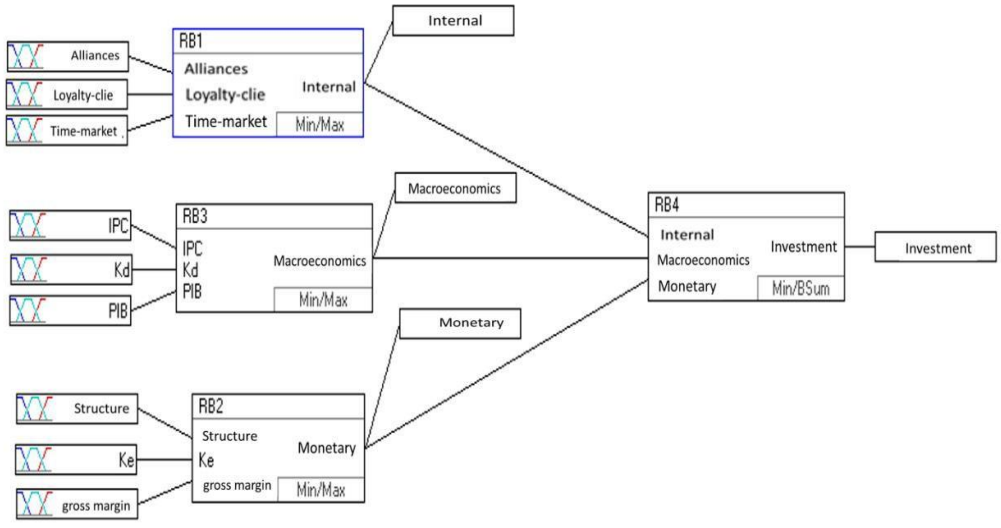

Figure 11. Structure of the neutrosophic inference system for investment in the company.

For the investment variable in the company, two neutrosophic sets defined as:

- Investing, the company has strategic competences that will help it achieve the fulfillment of its future goals, both in the generation of benefits and in organizational growth.
- Do not invest, increase in the analyst the perception of a macroeconomic environment counterproductive for the company.

The complete knowledge base for the measurement of macroeconomic aspects is presented in table 8.

Table 8. Knowledge base for the variable investment in the company

		IF	THEN
Internal	Macroeconomic	Monetary	Investment
Low	Low	Low	No
Low	Low	High	No
Low	High	Low	No
Low	High	High	yes
High	Low	Low	No
High	Low	High	yes
High	High	Low	yes
High	High	High	yes

The Neutrosophic Inference System for the valuation of companies is a support tool in investment decision making, a management monitoring tool that

allows to measure the variations in the value of the company originated by organizational decisions. This tool is flexible and can be adjusted to the characteristics of a country or sector, since it does not have deterministic values that limit its application.

The tool integrates variables that were initially disaggregated and incorporates the analyst's perception, which results in a similar generic valuation even among different analysts.

The fundamental limitation of the System is the number of variables, since the choice of variables must be the result of a thorough analysis that considers the characteristics of the company. However, this tool allows working with more than one variable or data, unlike traditional models that generally focus on the present value of the benefits or the generation of value as the main support for the decision.

Conclusions

The chapter presents two applications with a neutral logic to financial indicators. Proposal little diffused in the accounting field. Specifically, a financial analysis was exemplified through the CAMEL model (Capital, Asset, Management, Earning and Liquidity).

Subsequently, a Neutrosophic Inference System was presented for the valuation of companies, useful for the inclusion of qualitative variables in the analyzes and for the support to the decision making of the investments that are required to be made in a given company. In addition, with these tools it is possible to monitor the management, since it is possible to measure the variations that some organizational decisions generate in the value of the company.

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