



Definition of Strategies in Ecuadorian Hospitals in a Plithogenic Environment

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Abstract. The modeling of a SWOT matrix in a plithogenic environment is an excellent decision support tool that allows selecting alternatives most effectively and optimally. Then, it gives rise to the approach of how to develop an adequate SWOT matrix for hospitals that allows the study and definition of strategies in a plithogenic environment. To solve the problem, the main objective of the research is to develop a SWOT matrix using plithogenic sets. Given the fact that if an adequate strategy that includes uncertainty is implemented, it will be possible to provide an effective tool that optimizes the decision-making process. A theoretical framework of the SWOT matrix will be developed to achieve this objective, and a method for its processing in a neutrosophic environment will be implemented. Afterward, it will be applied to the actual situation of Ecuadorian hospitals and pertinent strategies will be proposed.

Keywords: SWOT, uncertainty, Plithogeny, hospital institutions, strategies.

1. Introduction

Today there is a fiercely competitive environment characterized by low-profit margins, high consumer expectations for quality products and efficient workforce, where organizations are forced to seize any opportunity to optimize and avoid threats in their business processes regardless of their social object [1, 2]. Initially, strategic management had been widely used by companies to face fierce market competition, so it was only associated with obtaining economic benefits since the strategic management process consists of three stages: formulation of the strategy, strategy implementation, and strategy evaluation [3]. Despite this, entities of various types have currently appropriated this tool, such as in the case of hospitals [2, 4-6].

Originally, this analysis was designed to provide a complete study of companies in other types of industries. However, as time has passed, people who saw its benefits are also bringing its use in the healthcare industry [7]. The hospital and healthcare industry is made up of hundreds of licensed operators that offer a range of services that are often lucrative and constitute a representative part of the countries' Gross Domestic Product. Especially in the environment of uncertainty created by the Covid-19 pandemic, where the health system has been collapsed. Therefore, it is necessary to carry out a thorough and detailed analysis to provide the best strategy to follow. Due to the extension of medical services, whether public or private, it is advisable to apply a business management strategy to strengthen its insertion as a service provider [8].

The health services sector has experienced a growing demand, including health tourism as a form of consumption within current trends, which is coupled with the exacerbation of chronic diseases and the aging of the population. There has been an increase in capital inflows in hospitals of various countries such as Brazil, Mexico, Singapore, and Thailand from health tourists. That is, residents of developed countries from the United States and Great Britain for example, have found an economic solution: health tourism in these less developed countries such as those mentioned above. Therefore, it has contributed to the generation of foreign exchange and employment [9].

In Ecuador, hospitals have a similar situation, where it is necessary to achieve the established objectives on a solid basis. Therefore, managers must ensure that they follow due process regarding the establishment or management of the institution. It is essential to work with a detailed SWOT (Strengths, Opportunities, Weaknesses and Threats) analysis [8, 10, 11]. This analysis allows the evaluation of an organization from a neutral perspective

through a detailed discussion of the strengths, weaknesses, opportunities and threats [7]. It could be said that to guarantee that a hospital or health center or another form of business works to the maximum, it is necessary to make certain adjustments endorsed in a tool of this nature [4, 7, 12-14]. It is necessary to clarify that in this research the term SWOT will be chosen to refer to the technique.

Despite the positive in the use of the tool, for the decision-making process regarding the strategy to be taken, the use of multi-criteria methods is preferred for the SWOT processing [1], where the statistic is denoted in its classical and neutrosophic versions. In this way, deficiencies and/or inaccuracies due to the subjective nature of the technique in the measurement and evaluation steps are eliminated [4, 13]. In this particular case, the authors preferred to link Neutrosophy since imprecision is involved throughout the whole process, and it makes the study more natural and allows achieving a greater enrichment in the analysis when formulating strategies [15-18].

It can be said then, that the modeling of a SWOT matrix processed in a neutrosophic environment is convenient since the classical method may be less appropriate. So, it is necessary to have a decision-making support tool that allows the most effective and optimal selection of the steps to be followed by these types of institutions that provide such a broad service to the population [17, 19, 20]. The following problem is formulated: how to develop a SWOT matrix for hospital institutions that allows the study and definition of strategies in a plithogenic environment? For the solution to the problem, the main objective of the research is to develop a SWOT matrix, using plithogenic sets since if an adequate strategy that includes uncertainty is implemented, it will be possible to provide an effective tool that optimizes the process of decision-making. To achieve this objective, the following specific objectives must be executed:

1. Develop a theoretical framework of the SWOT matrix
2. Develop a method for processing by plithogenic assemblies.
3. Apply method to the current situation of health institutions today in Ecuador
4. Propose strategies

From now on, the report of the present investigation is made up of several sections where the used methods are exposed, a case study is carried out, and then the results, discussion, and conclusions of the investigative exercise are exposed.

2. Theoretical framework of SWOT analysis

Over the years, various approaches and criteria on strategic management have been enunciated in management theory. Result of the accumulation of research and studies on the subject, which has contributed to the enrichment and improvement of the theory to become the most used management tool in the world. The use of strategy in management theory appears in the early years of the 60s of the 20th century and emerges as a way for organizations to respond to the challenge imposed by increasing instability, uncertainty and competition on the market which got more and more intense every day [1, 5, 12, 21].

The approach to organizational strategies became widespread globally, both in profit-making and non-profit companies, until it became one of the most universally used management tools [1, 5]. Despite the diversity of research, there is uniformity in the use of the SWOT matrix for strategic analysis regardless of the corporate purpose or type of company, business, institution; due to the impacts that it generates on the strategic management of organizations in general [1, 4, 13, 14, 21-23].

Internal	External	
	Opportunities	Threats
Strengths	Try to make the most of the opportunities. Offensive Strategy Maxi - Maxi	Minimize threats by relying on strengths. Defensive Strategy Maxi -Mini
Weaknesses	Reduce or eliminate weaknesses to take advantage of opportunities. Adaptive Strategy Mini - Maxi	Resist without having to give in so as not to lose positions. Survival Strategy Mini - Mini

Table 1. High impact matrix Source: [24]

The study of strategic planning SWOT is a tool that allows raising a picture of the current situation of a group, company, or organization. In addition, it makes it possible to accurately diagnose the organization and, based on this, allow decisions to be made according to the objectives and policies [12]. That is why it is said to be an advanced strategic planning model that helps companies and organizations identify where they are doing well and where they can improve, both from an internal and external perspective. The strengths and weaknesses are internal to the organization, while the opportunities and threats are of external origin being the strengths and opportunities useful for the strategy of your organization, and the weaknesses and harmful threats. Importantly, this analysis is not a final product: it is the first step to help align the strategy around the areas that have been identified as strengths, weaknesses, opportunities, and threats [1, 4, 8, 13, 14, 23, 25].

On [12], they say that:

- Strengths: Are special capabilities of the group or company to be analyzed, instruments that give it a privileged position in the face of the competition. Capacities and abilities that are possessed, resources that are controlled, activities that are developed positively, among others.
- Opportunities: Factors that are positive, favorable, and exploitable that must be discovered in the environment in which the group or company operates and that allow obtaining competitive advantages.
- Weaknesses: Factors that cause an unfavorable position in the face of the competition, resources that are lacking, skills that are not possessed, activities that do not develop positively, and so on.
- Threats: Situations that come from the environment and that can even threaten the permanence of the organization.

For the classic matrix, the following steps must be performed:

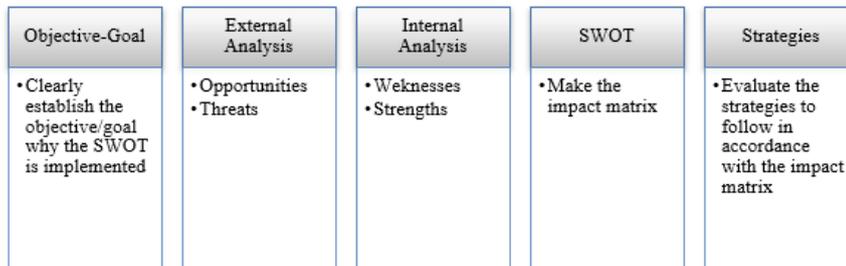


Figure 1. Steps for the elaboration of the SWOT. Source:[7]

Based on the results of the SWOT analysis, the strategic recommendations for the company should be focused on how the institution can [7]: counteract the weaknesses, enhance the strengths, seize opportunities, defend from a threat. At this point, you must also choose one of the normative strategies set out in table 1, which are explained by [26]:

- Defensive strategy is one to be developed to improve weaknesses and that these do not make the threats in the environment even more threatening.
- Reactive strategy will be developed to further reinforce strengths and eliminate threats.
- Adaptive strategy will consist of strengthening weaknesses so that they do not impede taking advantage of opportunities.
- Offensive strategy is the one that will offer the possibilities to take advantage of the opportunities thanks to the fact that the position in the sector is still being strengthened.

3. Methods

The methods used for the development of the research are exposed below:

- Scientific Method: allows getting to know the phenomena that occur in nature and society, by combining comprehensive reflection and direct contact with objective reality.
- Inductive and Deductive Method: with its application, it is possible to know the reality of the problem under investigation, starting from the particular to the general and from the general to the particular of the problem.
- Historical Method: it allows knowing the source and the progress of the problem to compare it with its actuality.
- Descriptive Method: with its application, it is possible to objectively describe the current reality in which the problem develops and thus evidences the aspects of the SWOT.
- Surveys: they are applied to experts who are nothing more than the actors who will intervene in decision-making.

As previously stated for the processing of SWOT, a neutrosophic environment in its plithogenic extension is convenient, since uncertainty is dealt with within the process and decision-making can be more natural. Therefore, for a better understanding, interesting knowledge about mathematical modeling using plithogenic logic is presented below.

Smarandache introduced Neutrosophic sets into the literature because fuzzy intuitionistic sets could only handle incomplete information, but not the indeterminate and inconsistent information, which commonly exists in fuzzy systems. The term neutrosophy means knowledge of neutral thought and this neutrality represents the main distinction between fuzzy logic and fuzzy intuitionist [27]. In neutrosophic sets, the indeterminacy is explicitly quantified through a new parameter I. True membership (t), indeterminate membership (I), and false membership

(F) are independent of each other and the sum between them satisfies the inequalities $0 \leq T + I + F \leq 3$. In fuzzy intuitionistic sets, the uncertainty depends on the degree of membership and the degree of non-membership [28]. In neutrosophic sets, the indeterminacy factor (I) is independent of the true and false values. There are no restrictions between the degree of truth, the degree of indeterminacy, and the degree of falsehood [29, 30].

If U is a universe of discourse, a Neutrosophic Set (CN) is characterized by three membership functions, $uA(x), rA(x), vA(x) : X \rightarrow]0-, 1+[$, which satisfy the condition $0 \leq -\inf uA(x) + \inf rA(x) + \inf vA(x) \leq \sup uA(x) + \sup rA(x) + \sup vA(x) \leq 3 +$ for all $x \in X$. $uA(x), rA(x)$ and $vA(x)$ are the membership functions of the truth, the indeterminacy, and the falsehood of x in A, respectively and their images are standard or non-standard subsets of $]0-, 1+[$. When approaching the perspective of indeterminacy and contradiction, as is the case with Gödel's incompleteness theorem, it states that any proposition in a mathematical axiom system will present a degree of truth (T), falsehood (F), and indeterminacy (I). Neutrosophy, therefore, establishes a unique solution for the existence of paradoxes in philosophy [31].

Plithogeny is the genesis or origin, creation, formation, development, and evolution of new entities from dynamics and mergers of multiple contradictory and/or neutral and/or non-contradictory previous entities. Plithogeny advocates the connections and unification of theories and ideas in varied fields of science. "Knowledge" is taken as "entities", in various fields, such as social sciences, technical sciences, theories of arts and letters, and so on [32].

Plithogeny is the dynamics of various types of opposites, and/or their neutrals, and/or non-opposites and their organic fusion. Plithogeny is a generalization of dialectics (dynamics of a type of opposites: $\langle A \rangle$ and $\langle \text{anti}A \rangle$), neutrosophy (dynamics of a type of opposites and their neutrals: $\langle A \rangle$ and $\langle \text{anti}A \rangle$ and $\langle \text{neut}A \rangle$), since Plithogeny studies the dynamics of many types of opposites and their neutrals and non-opposites ($\langle A \rangle$ and $\langle \text{anti}A \rangle$ and $\langle \text{neut}A \rangle$, $\langle B \rangle$ and $\langle \text{anti}B \rangle$ and $\langle \text{neut}B \rangle$, etc.), and many do not opposites ($\langle C \rangle$, $\langle D \rangle$, etc.) all together. As an application and particular case derived from Plithogeny, the plithogenic set is an extension of the classical set, fuzzy set, fuzzy intuitionist set, and neutrosophic set, and has multiple scientific applications [32].

So, (P, a, V, d, c) is called a plithogenic set

- a) Where "P" is a set, "a" is an attribute (multi-dimensional in general), "V" is the range of values of the attribute, "d" is the degree of membership of the attribute value of each element x to the set P with respect to some given criteria ($x \in P$), and "d" means "d_F" or "d_{IF}" or "d_N", when it is a degree of fuzzy membership, an intuitionistic fuzzy membership, or a degree of neutrosophic membership, respectively, of an element x to the plithogenic set P;
- b) "c" means "c_F" or "c_{IF}" or "c_N", when it is a fuzzy attribute value contradiction degree function, intuitionistic fuzzy attribute value contradiction degree function, or neutrosophic attribute value contradiction degree function, respectively.

Functions $d(\cdot, \cdot)$ and $c(\cdot, \cdot)$ are defined according to the applications that experts need to solve.

Then, the following notation is used: $x(d(x, V))$, where $d(x, V) = (d(x, v))$, for all $v \in V, \forall x \in P$.

The attribute value contradiction degree function is calculated between each attribute value with respect to the dominant attribute value (denoted by) in particular, and also for other attribute values. v_D

The attribute value contradiction degree function is calculated between each attribute value with respect to the dominant attribute value (denoted by v_D) in particular, and with respect to other attribute values as well.

The attribute value contradiction degree function c evaluated between the values of two attributes is used in the definition of plithogenic aggregation operators (intersection (AND), union (OR), implication (\implies), equivalence (\iff), inclusion (partial order), and other plithogenic aggregation operators that combine two or more degrees of values of the attribute based on a t-norm and a t-conorm. Most plithogenic aggregation operators are linear combinations of a fuzzy t-norm (indicated by) with a fuzzy t-conorm (indicated by), but nonlinear combinations can also be constructed. \wedge_D and \vee_D [33]. If the t-norm is applied on the value of the dominant attribute denoted by, and the contradiction between and is, then it is applied on the value of the attribute as follows:

$$1 - c(v_D, v_2) \cdot t_{\text{norm}}(v_D, v_2) + c(v_D, v_2) \cdot t_{\text{conorm}}(v_D, v_2) \tag{1}$$

Or, using symbols:

$$[1 - c(v_D, v_2)] \cdot (v_D \wedge_F v_2) + c(v_D, v_2) \cdot (v_D \vee_F v_2) \tag{2}$$

Similarly, if the t-conorm applies to the value of the dominant attribute denoted by v_D , and the contradiction between v_D and v_2 is $c(v_D, v_2)$, then v_2 applies to the value of the attribute as follows

$$[1 - c(v_D, v_2)] \cdot t_{\text{conorm}}(v_D, v_2) + c(v_D, v_2) \cdot t_{\text{norm}}(v_D, v_2) \tag{3}$$

Or, using symbols:

$$[1 - c(v_D, v_2)] \cdot (v_D \vee_F v_2) + c(v_D, v_2) \cdot (v_D \wedge_F v_2) \tag{4}$$

The plithogenic neutrosophic intersection is defined as:

$$(a_1, a_2, a_3) \wedge_P (b_1, b_2, b_3) = \left(a_1 \wedge_F b_1, \frac{1}{2} [(a_2 \wedge_F b_2) + (a_2 \vee_F b_2)], a_3 \vee_F b_3 \right) \tag{5}$$

The plithogenic neutrosophic junction is defined as:

$$(a_1, a_2, a_3) \vee_P (b_1, b_2, b_3) = \left(a_1 \vee_F b_1, \frac{1}{2} [(a_2 \wedge_F b_2) + (a_2 \vee_F b_2)], a_3 \wedge_F b_3 \right) \tag{6}$$

In other words, with respect to what applies to membership, the opposite applies to non-membership, while in indeterminacy what applies is the average among them. Plithogenic neutrosophic inclusion is defined as follows:

Since the degrees of contradiction are:

$$c(a_1, a_2) = c(a_2, a_3) = c(b_1, b_2) = c(b_2, b_3) = 0.5,$$

We apply, $a_2 \geq [1 - c(a_1, a_2)]b_2$ o $a_2 \geq (1 - 0.5)b_2$ o $a_2 \geq 0.5b_2$, while $c(a_1, a_3) = c(b_1, b_3) = 1$

So, having the opposite being true for $a_1 \leq b_1$ if and only if $a_3 \geq b_3$, therefore $(a_1, a_2, a_3) \leq_P (b_1, b_2, b_3)$ if and only if $a_1 \leq b_1, a_2 \geq 0.5b_2, y a_3 \geq b_3$. Next, an algorithm for the resolution of this research is presented where Plithogeny will be merged with the algorithm of neutrosophy. From this moment on, expressions 2 to 8 must be applied to execute the operations of the classical algorithm with plithogenic numbers. For the elaboration of a single decision matrix, the median of the plithogenic numbers is calculated for each combination, for all specialists. The median is calculated using the following formula:

$$\text{median}_{i=1}^m \{PN_i\} = (\text{median}_{i=1}^m \{T(PN_i)\}, \text{median}_{i=1}^m \{I(PN_i)\}, \text{median}_{i=1}^m \{F(PN_i)\}) \tag{7}$$

Where PN_i , are plithogenic numbers, $T(PN_i)$ are their true components, $I(PN_i)$ are their indeterminate components and $F(PN_i)$ are their false components. In other words, Equation 8 means that the median of a set of plithogenic numbers is defined as the plithogenic number of the medians of its components.

Therefore, the procedure designed based on the plithogenic sets will be explained below:

Objective/Goal: Determine the business strategies to follow in hospital institutions in Ecuador

1. Determine the characteristics of the organization in its external and internal environments through surveys and brainstorming.
2. Make the SWOT matrix
3. Process the matrix in a plithogenic environment:

Weight the criteria using the following linguistic terms shown in Table 2, since it is more suitable to evaluate a numerical scale since human beings identify better with natural language than with numerical scales:

Linguistic Expression	Phytogenic number (T, I, F)
Very poor (VP)	(0.10, 0.75, 0.85)
Poor (P)	(0.25, 0.60, 0.80)
Moderately poor (MP)	(0.40, 0.70, 0.50)
Medium (M)	(0.50, 0.40, 0.60)
Fairly good (FG)	(0.65, 0.30, 0.45)
Good (G)	(0.80, 0.10, 0.30)
Very good (VG)	(0.95, 0.05, 0.05)

Process the weights for each quadrant using equation 7.

4. Prepare a high impact matrix using the union between plithogenic sets using equation 6.
5. Determine strategies to follow

4 Results

The results of the application of the designed procedure are shown below.

INTERNAL FACTORS	EXTERNAL FACTORS
WEAKNESSES	THREATS
Lack of motivation in doctors due to salary issues and work schedules	Great amount of competitors offering low price services which makes the general prices to go lower
Resource gap for the medical activity	Sanitary emergency due to Covid-19
Contracted market's segment	The competence offers free treatments
It requires a lot of cash to be able to acquire the best medical equipments and also to hire some of the best consultants of the industry	Constant update of the technology and the medical equipment which optimizes services but increases costs
	Cultural rooting of the population in the indigenous treatments
STRENGTHS	OPPORTUNITIES
Technical and administrative processes to reach the organization's goals	Increase of the migration to Ecuador of people with low incomes
Qualified health professionals team	Need for client service due to Covid-19 crisis
Several payment options	Existence of alternative medications that minimize costs
Properly equipped health center	Increase of health tourism at international level
Wide network of institutions with diversity and quality of services	Government focused in mitigating the sanitary crisis

Figure 2. Steps 1 and 2 of the procedure.

For the processing of the matrix in a plithogenic environment, the groups among themselves will be chosen as attributes, to achieve the high impact matrix, that is, they will face each other according to what is stated in table 1. Therefore, for the plithogenic analysis of the multi-attribute of dimension 4 and cardinality (4x5x5x5) 500, which is established in pairs. This is given because experts agree that the greatest degree of influence lies in the internal component. Therefore, the degrees of contradiction between the pairs are the following:

- $c_D(S1, S2) = c_D(S1, S3) = c_D(S1, S4) = c_D(S1, S5) = 0.2$
- $c_D(W1, W2) = c_D(W1, W3) = c_D(W1, W4) = 0.25$
- $c_D(T2, T1) = c_D(T2, T3) = c_D(T2, T4) = c_D(T2, T5) = 0.2$
- $c_D(O2, O1) = c_D(O2, O3) = c_D(O2, O4) = c_D(O2, O5) = 0.2$

The dominant values are F1, D1, A2, and O2.

The evaluation of the pairs by the experts was as follows:

<i>W</i>	<i>Medium</i>	<i>T</i>	<i>Medium</i>	<i>S</i>	<i>Medium</i>	<i>O</i>	<i>Medium</i>
<i>W1</i>	[0.45,0.55,0.55]	<i>T1</i>	[0.5,0.4,0.6]	<i>S1</i>	[0.899,0.075,0.135]	<i>O1</i>	[0.63,0.1,0.47]
<i>W2</i>	[0.575,0.35,0.525]	<i>T2</i>	[0.65,0.25,0.45]	<i>S2</i>	[0.698,0.25,0.402]	<i>O2</i>	[0.848,0.175,0.186]
<i>W3</i>	[0.525,0.35,0.55]	<i>T3</i>	[0.65,0.3,0.45]	<i>S3</i>	[0.749,0.2,0.351]	<i>O3</i>	[0.599,0.35,0.501]
<i>W4</i>	[0.525,0.5,0.475]	<i>T4</i>	[0.725,0.225,0.325]	<i>S4</i>	[0.749,0.2,0.351]	<i>O4</i>	[0.5,0.4,0.6]
<i>WM</i>	[0.525,0.425,0.5375]	<i>T5</i>	[0.725,0.225,0.325]	<i>S5</i>	[0.432,0.25,0.668]	<i>O5</i>	[0.698,0.25,0.402]
		<i>TM</i>	[0.575,0.25,0.45]	<i>FM</i>	[0.749,0.2,0.351]	<i>OM</i>	[0.63,0.25,0.47]

Plithogenic neutrosophic union between attributes according to equation 6 is defined as for the creation of the impact matrix:

	Opportunities	Threats
Strengths	[0.47187,0.25,0.16497]	[0.430675,0.25,0.15795]
Weaknesses	[0.33075,0.390625,0.252625]	[0.301875,0.390625,0.241875]

Figure 2. High impact matrix.

As can be seen, experts agree that the current situation of hospitals in Ecuador needs to improve their competitive strategy, so it is recommended to choose:

Defensive strategy: invest in new production facilities for current services to deal with the technological obsolescence of the process.

Reactive strategy to reaffirm strengths and mitigate threats, seeking care and personalized attention to achieve a high level of satisfaction and thus achieve their loyalty.

Adaptive strategy so that weaknesses do not prevent taking advantage of opportunities by opting for an increase in out-of-hospital services to achieve greater commercial attractiveness.

Offensive strategy to take advantage of opportunities due to the lack of an advantageous position in the sector through a strong campaign to promote one of the products and services in certain distribution channels to improve

market share and web presence within tourism of health. Tasks that will require follow-up are proposed below:

<i>Main area</i>	<i>Indicators or criteria by area</i>
<i>Market share</i>	Strategic positioning vision Market development Partnership development Product development
<i>Price Competitiveness</i>	Cost review Pricing strategies Sales cost
<i>Financial position</i>	Operational structure and functionality Financial structure review Financial and accounting management Review of Financial Statements Company valuation
<i>Product quality</i>	Product development Improvement of benefits Compliance with specificities
<i>Customer loyalty</i>	Customer orientation Loyalty strategies

Table 4. Follow-up actions for the offensive strategy

It is also recommended to keep in mind the following principles for the implementation of the strategies:

- Efficiency: the relationship between those produced and the resources consumed or used. In this sense, there would be economic profitability, sales/labor cost, sales profitability.
- Effectiveness: degree or level of objectives achieved. It would be used to assess market share, sales growth, meet shareholders' expectations.
- Fairness: impartiality or equality with which the activities of the company are carried out concerning the environment. In this case, there would be the dividends of the shareholders, price/quality ratio of the products to the various clients, taxes paid, employment.
- Responsibility: degree of importance that a company attaches to meet demands. For example, average delivery time, number of complaints and claims handled, ability to react under pressure.

Conclusions

SWOT is a simple tool to handle; however, its processing may lead to errors in the classical environment. For this reason, the neutrosophic environment in its plithogenic extension is very convenient. The latter allows working with uncertainty at all times and therefore obtaining more realistic conclusions. The identification of the threats and opportunities in the environment, and the weaknesses and strengths are essential for the creation of variants of strategies. In this context, the situation can be defined qualitatively and quantitatively, which makes it possible to determine the reality of the analyzed system and, therefore, gives the possibility of building and developing a competitive advantage. During the research development, the proposed objective was achieved by designing a procedure to determine the business strategies to be followed in hospitals in Ecuador, which consists of 5 steps. First, modifying the algorithm enunciated by other authors, including Plithogeny in the determination of the high impact matrix. With the application of the model, strategies based on the real situation were established, which denotes the tool's usefulness.

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