Risk Analysis in Renewable Energy: Assessment of the Vulnerability of the Environment and Community.

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Abstract:

As a result of recent accidents, society is becoming more conscious and concerned about the risk that the environment and communities are under to. A proposal of assessment of the vulnerability of the environment and community is presented here under a holistic perspective using Fuzzy Logic as formal tool. An internal factor of the risk of a system under a given threat is assessed.
Risk is considered as the union between the *threat* and the *vulnerability of the environment and community*. This approach shows that the reduction in either or both of them makes a reduction in the risk content as well.
The main purpose of this proposal is not to obtain a single value as output; in fact the result is a map which can contribute to the different areas of the community in decision making.

Key Words: *risk, threat, vulnerability, soft and hard systems, holistic approach*

1. Introduction

Massive concentration of population around strategic areas and the increasing number and magnitude of "accidents" with catastrophic consequences produced by nature or due to human activities demonstrate nowadays the high degree of vulnerability of the environment and the communities. Society is becoming more and more aware of its fragilities and is demanding more safety for the inhabitants.

It is well known that the use of renewable energy sources is meant to provide a benefit to society in terms of health and quality of life [1]. So, location, construction, operation, maintenance and recycling of these facilities should not represent an extra risk either to the inhabitants who will take advantage of them or to the environment.

Based on this, it can be said that ***given a certain renewable energy facility which may represent a threat to the community or the environment, it is postulated here that the higher their degree of vulnerability is, the higher the risk they are under to.***

Risk is considered as the union between the *threat* the facility represents and the *vulnerability* of the environment and community. This approach shows that the reduction in either or both makes a reduction in the risk content as well.

From this perspective, risk is conceived as the union of two elements: ***threat*** and the ***vulnerability of the environment and community.***

In this paper the assessment of the vulnerability of the environment and community is proposed when the *threat*, the virtual "accident", is caused by a renewable energy facility of large magnitude.

The idea of risk is universal and at the same time various interpretations are actually used. In order to conceptually situate the proposal, definitions of the principal terms are presented and then the relationships among them are introduced.

A *Threat* is an event which can produce damage, the possibility that an unwanted incident occurs and the environment or community exposed to it would be damaged. In the other hand, *risk* is related with the likelihood of the damage itself, [2]. As an example the deficient state of a dam is a *threat* to the environment and the inhabitants downstream. There can be harm or loss of lives and property. Risk is the result of the threat **and** the fact that the environment and people not only exist but are vulnerable in a given degree.

The ***vulnerability of the environment and community*** is related to the characteristics that enable to anticipate, to survive, to resist and to recover from the impact of a not desired event.
Thus the threat and the vulnerability of the environment and community are components of risk that results from the convolution (concomitance and mutual conditioning) of both.

The assessment of the vulnerability of the environment and community presents complex problems. To start with, it has to do with a ***multidisciplinary*** task. Each area has its own interests, conceptions, incumbencies, criteria and methodologies of work. At the same time and within a given discipline the relevant information is diverse in precision, source, etc. Its nature varies from the social to the technical. When that happens, it is usual to turn to experts' opinions, which base their judgments on objective information, along with their experience and professional capability.

The influence of the human factor is another important and difficult aspect to evaluate. Human behaviour does not have established frameworks neither follows foreseeable laws. Human beings can commit omissions and errors, either for cost-reducing issues, or lack of training, experience, labor pressures or another one. People, besides, integrate the net of relations on which the functioning and control of systems depend. The latter can fail for deficient communications, bad delimitation of responsibilities, etc.

This last aspect even turn the problems to a higher complexity because to improve the human conducts, the process to follow is slow, not uniform and has to do very much with cultural issues (idiosyncrasy).

When risk is assessed, in general engineers concentrate on the analysis, evaluation and control of what we have defined as *threat* more than on the relative aspects to the consequences on the environment or community. However, from the point of view of the service that engineering renders the society we consider that their relative aspects should also be evaluated in a rational manner.

Based on the previous considerations, for the assessment of the vulnerability of the community and environment, it is necessary a rigorous tool and methodologies capable in a consistent and coherent way to mix information of different type and at the same time allow controlling the subjectivity it is worked up with.

We propose in this paper a hierarchical like tree arrangement based on a systemic and holistic approach where the formal tool is the Fuzzy Logic, first introduced by Zadeh [3].

2. Holistic perspective Hard and Soft Systems

The problem to be addressed has the complexity as the principal characteristic. Two relevant aspects of the problem can be highlighted:

1. Many components and different in nature: very precise information together with vague, imprecise and incomplete data

2. Many disciplines, each with their own interests, methodologies, conceptions, strategies, etc

In order to address the first, a classification of variables in *soft* and *hard* is proposed

A *hard* system is the traditional physical-technical system that does not involve people and which is fundamentally based on the application of hard engineering science. It is commonly said to be 'objective' (materials performance, geometry, natural phenomena, etc) A *soft* system involves people and is fundamentally concerned with organizational, social and political systems and is commonly said to be 'subjective'. Examples of these are poor skilled personnel, deficient communications, external political or financial pressures, not well defined responsibilities, among others. Although the first ones are embedded in the latter, the ways in which we understand and hence treat hard and soft systems should be quite separate

All hard systems have a function in a determined process. However this function is accomplished by people from its conception to its use. Decision making is also in people's hands.

We can say then, that the hard systems are themselves immersed in the soft systems. For the purpose of this paper the main characteristics of hard and soft systems are extracted from [4] in Table 1.

TABLE 1 Hard and Soft Systems

Soft System	Hard System
2. Has a purpose which is a function that derives from the soft system in which it is embedded	Has a set of purposes which derive from the needs and consequent intentions of players in a process
3. Dependable measurements are central	Dependable measures are difficult
4. Has relationships which can be modeled in formal language	Has relationships which can normally only be expressed in natural language or statistic
5. Has models which are deterministic or stochastic	Needs systems thinking models
6. Is usually associated with physical sciences	Is usually associated with social sciences, management and marketing
7. Is clear and reasonably predictable	Can be vague and difficult to predict, needs grounded judgments
8. Has measurable data	Has little measure data

In order to address the second aspect of complexity pointed out, a *holistic approach* is proposed. It is a framework of thought which permits to capture complexity. The idea has origin in biology and now is widely used to indicate an idea of the whole. Frequently, however, the depth of its meaning and usefulness is not appreciated. The concept of a holon is fundamental to systems theory [5]. We define a holon as a process which is both a whole and a part [4].

3. Risk -Threat -Vulnerability

The concept of risk is always associated with the future, with *possibilities*, with events that have not yet happened. Risk is a natural consequence of uncertainty and it is inherent to all the human activities.

The concept of risk adopted in this paper takes as a starting point the definition given by ICOLD (International Committee of Large Dams), in its Bulletin 130 [6], where the process of *Risk Assessment*, comprises two parts:

***Risk Analysis**:*
The risk analysis process, involves the scientific characterization of what is known and what is uncertain about the present and future performance of the dam system under examination. It is to structured process aimed at estimating both the probability of failure of the dam or dam components and the extent of the consequences of failure. The outputs of the risk analysis effort plow to theoretical construct of the state of knowledge about the performance of the dam under the full range of physical conditions and applied loads that plow anticipated over its design life. In this regard, the estimate you of risk is not to physical property of the dam rather it is to mathematical representation of the state of knowledge of the dam and the confidence in its future performance.

***Risk Evaluation**:*
Risk evaluation is the process of examining and judging the significance of risk.

Also according to ICOLD [6]:

Risk assessment is the essential anticipatory element that underpins the safety management process. The result of risk analysis is to transparent mathematical construct of the uncertainty in the future performance of to dam, the most common form of this statement of uncertainty been in terms of probability. In risk assessment the results of the risk analysis and risk evaluation processes plow integrated and recommendations plow made concerning the need to shorten risk.

Even though these definitions were formulated for large dams, we took the essence and extend the concepts to renewable energy facilities of great magnitude.

Then we can say that two factors influence the *risk assessment:* the possibility of the occurrence of an unwanted event, the ***threat***, a*nd* the characteristics and proneness to be affected of the exposed **c*ommunity and environment***. It is usual to associate the risk only to the threat. However when the context is analyzed, it is clear that due to its characteristics, the risk may be different although the threat is the same. For example if a community is not adequately prepared to face an emergency from the social, cost-reducing, structural or cultural point of view it is more vulnerable in front of a threat than another that in fact does. In the first case the consequences of the occurrence of an unwanted event will be severer and recuperation will be slower and more difficult. ***That is, the more vulnerable the community and environment are, the higher the level risk in spite of the fact that the threat could not have been modified***.

Taking into account what has been said, the analysis of risk implies the study and determination of the threat **(T)** and the Vulnerability of the Community and Environment **(VEC)** in an integrated form. Risk **(R)** results from the convolution of both.

Figure 1, shows a hierarchical structure which represents the process of *risk assessment* presented in this paper.

Fig. 1. Risk Assessment

T like **VEC** values depend on factors of different nature, hard and soft. Their characteristics, joint action and mutual conditioning will determine the status attained for each one and, **R** can be obtained from both.

In the determination of the *threat* **T**, hard factors are evaluated by means of procedures and models of high precisions. Physical-mathematical tools allow calculating the probability of failure, the reliability or the safety. These techniques are based on mathematical algorithms that mainly come from probabilistic approaches which try to model failure scenarios from the perspective of their likelihood of occurrence (event and fault trees, Reliability Theory [7], etc).

At the same time, the international experience together with available statistical information [4], [8], [9] indicates that the structural faults, have principally taken place due to human errors. In this sense it can be said that when we refer to the functioning of the devices, in general there is adequate technology and knowledge. However they are not always used in an adequate way. The use or operation of the devices is accomplished and controlled by people that in turn belong to organizations which depend on them.

Although it is wide recognized the influence of human factor, it is not taken into account in the algorithms of calculation. Sometimes it is incorporated by force in statistical approaches, in spite of its not random nature [7]. The adoption of quality control strategies is a way through which it is intended to control the human factor. Sometimes they are used in order to validate algorithms of calculation.

A hierarchical structure for the analysis of **T** is presented in Figure 2, which allows incorporating the human (soft) factor **SF** together with the traditional technical (hard) systems **HS** . A wider scope to the analysis is presented by this. Soft factors **SF** on which **T** depend could be: *Expertise, Training, Operation and Integration of Areas.*

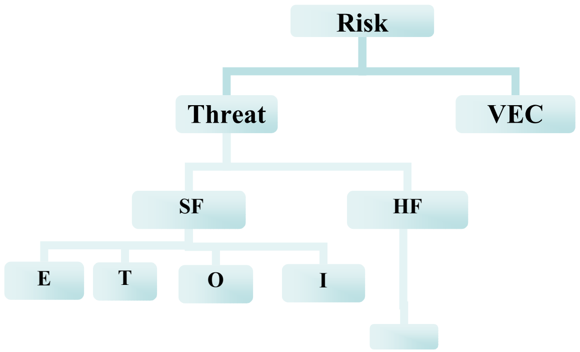

Fig. 2. Hierarchical Tree

Vulnerability of the environment and community, the main subject of this paper is presented in the following paragraphs.

4. Environment and Community Vulnerability

A. Characteristics

Vulnerability is a characteristic of a human group or material system, from the point of view of its capability of ***anticipating, surviving, resisting and recovering*** from the impact of a not desired event. It is an internal factor of risk related not only with the ***exposition of the material context*** or the physical susceptibility of the exposed elements to be affected, but also with the ***social fragilities*** and the lack of ***resilience*** of the system. The latter is associated with the capabilities of answer and recuperation.

Vulnerability can also be defined as the ***degree of efficiency*** of a given social group or environment which represents their organization suitability in front of changes in the natural or man-made environment which incorporates risk. Vulnerability can be conceived as a set of factors in interaction which result in various degrees of incapacity to answer and to adapt to change in front of a threat. It increases with it and is a factor on which the potential intensity of the damage depends on.

The principal components of the social behavior in relation to the vulnerability in front of a threat can be summed up as follows [10]:

Economic: it is the aspect most noticed in the analysis of risks and the one that is often considered as basic component of vulnerability (possibly for the available evidence). Essentially it shows the direct relationship between low levels of income and high intensity of the impact caused by an accident.
In this field there exist statistical data that evidence this relationship. Even considering that richer countries or social groups always have more to lose, it seems that they can also defend themselves better against the possibility of that loss.

Social cohesion is another factor that composes the vulnerability in such a manner that the societies that possess a complex net of organizations can absorb the consequences of a disaster more easily and reacts more quickly than the ones that do not. Social cohesion can manifest itself formally, through official organizations or the public administration sectors specialized in the theme, or through spontaneous groups that for a number of reasons engage themselves in these issues.

Juridical and political frames, in a different way but intimately related with the previous aspect, is also of great importance. They comprise the existence of legal regulations to mitigate the effects of risk and their adjusting to the reality they intend to order, the respect to environmental restraints that incorporate regulations of potential dangerous activities capable to generate risky processes and all over, the possibility to give a politic frame or the adoption of adequate measures and policies on the territory and the environment.

Technical plans of defense can also be considered as factors of vulnerability. Above all because they cannot exist, but in the event that they do, they can be adequate or not to the defensive feature that is attributed to them, including an unfortunate design that converts them in cause or disaster amplifier.

Cultural and educational factors include the type of information that is given to the population on the events pointed out above, that includes the generation of situations of false safety. They comprise, for example, the elaboration of attitudes in a given population using messages through the media or through the educational processes presenting numerous issues aside from very specific problems: isolation, illiteracy and others.

The importance of this last aspect is by such degree that possibly would be convenient to add the media vulnerability to the different facets of the global vulnerability sketched. It would consist basically in the fact that a catastrophe can be maximized, minimized or can even be ignored according to the treatment that the media makes about it. This treatment mainly depends on political or cost-reducing interests which generate, sometimes, informative slants not always involuntary. True catastrophes or certain human vulnerable groups may remain occult if the information that is given about them does not exist or is incorrect.

B. Practical Application of the Analysis of the VEC

The assessment of the vulnerability of the environment and community can contribute the decision making process in order to prevent the potential damage in front of failure scenarios. In cases where the failure is produced, it may also be useful to implement activities in order to contribute mitigation and/or recuperation. This information can be useful in *different aspects* to the *several actors* of society:

1) *Population in general:*

- To make them aware of their strengths and deficiencies
- .To demand information, infrastructure, training, etc., on the basis of the above
- To organize tasks in front of a possible damage

2) *Juridical and Political Organizations:*

- To organize plans of defense
- To speed up the functioning of the social nets in case of emergency
- To improve resource assignations to fragile areas
- To improve control and coordination of the functioning of the several actors
- To improve the monitoring the state of every area
- To encourage the design and update of standards which guarantee an acceptable degree of vulnerability

3) *Technical Professions:*

- To help to know the environment and community in which the renewable energy facility is immersed at the designing, construction and maintenance stages
- To control the fulfillment of the standards referred to the safety of the surroundings to the facility site
- To demand to the authorities the fulfillment of the safety standards in each area
- To support and guarantee the good exercise of the profession in the region
- To include information and complete traditional risk analyses.
- To contribute to a better understanding to support their decisions
- To determine *acceptable risk values*

Perhaps the worst problem that affects the assessment of vulnerability is the amplitude of the concept and the variety of disciplines, that turns it into a task of high complexity. Besides, given the different nature of the factors that intervene and the dependence of the human factor, the task should be accomplished by experts' consensus in the different disciplines. Parallel to this, the population should also take part in active way, through consultations of opinion.

Given the characteristics of the problem, the proposal for the assessment of **VEC** is presented in the following paragraphs.

5 Proposal

A. Principal Characteristics

The proposal presented in this paper has the following main characteristics:

1) It is based on the concept of *risk* **R,** which takes into account the ***Threat*** **T** and the ***Vulnerability of the Environment and Community*** **VEC**.
2) The analysis is made through a ***hierarchy like tree arrangement*** with different levels of definition (Fig. 3).
3) ***All the available information*** (numeric and linguistic values) is included and integrated
4) To determine **T** and **VCE** values, all variables are divided in human (soft) factor *SF,* and hard factors. *HF.*
5) Inherent ***subjectivity*** of linguistic values ***is controlled*** using a unique procedure which qualifies and integrates them.
6) Different experts take part giving subjective values based on evidence like indexes, polls, historical data, etc.
7) The procedure presented results in an integral map that shows the whole and details of the different components. It points out ***where and how to work*** and the level of each component in the whole process; identifying the order of actions.

B Description of the Methodology

The process of evaluation of **VEC** is made by an interdisciplinary group of experts, gathered to such aim, coordinated by a professional of engineering. In all this process it is important to delimit functions and responsibilities. The actors and their activities are:

Experts: they have proven experience and knowledge in their own discipline. It is also convenient that they have some degree of representation in the community as the values they give or determine must be significant for it.
The tasks they do are:

1. To participate in the design, fit and definition of the general hierarchical tree (Risk).
2. To design the hierarchical tree to evaluate VECi referred to his speciality (variables, hierarchical location, interactions and influences).
3. To collect and classify evidence which justify the value they give
4. To value using labels given by the coordinator, the state of the variables and their associated uncertainty.
5. To design actions to follow according to the value the variables get in order to control them.
6. To calibrate the algorithms together with the coordinator

Coordinator: engineering professional who knows well the whole problem: .the facility under study and its surroundings
Tasks:

1. To present the initial hierarchical scheme in order to define together with the experts the threats to analyze

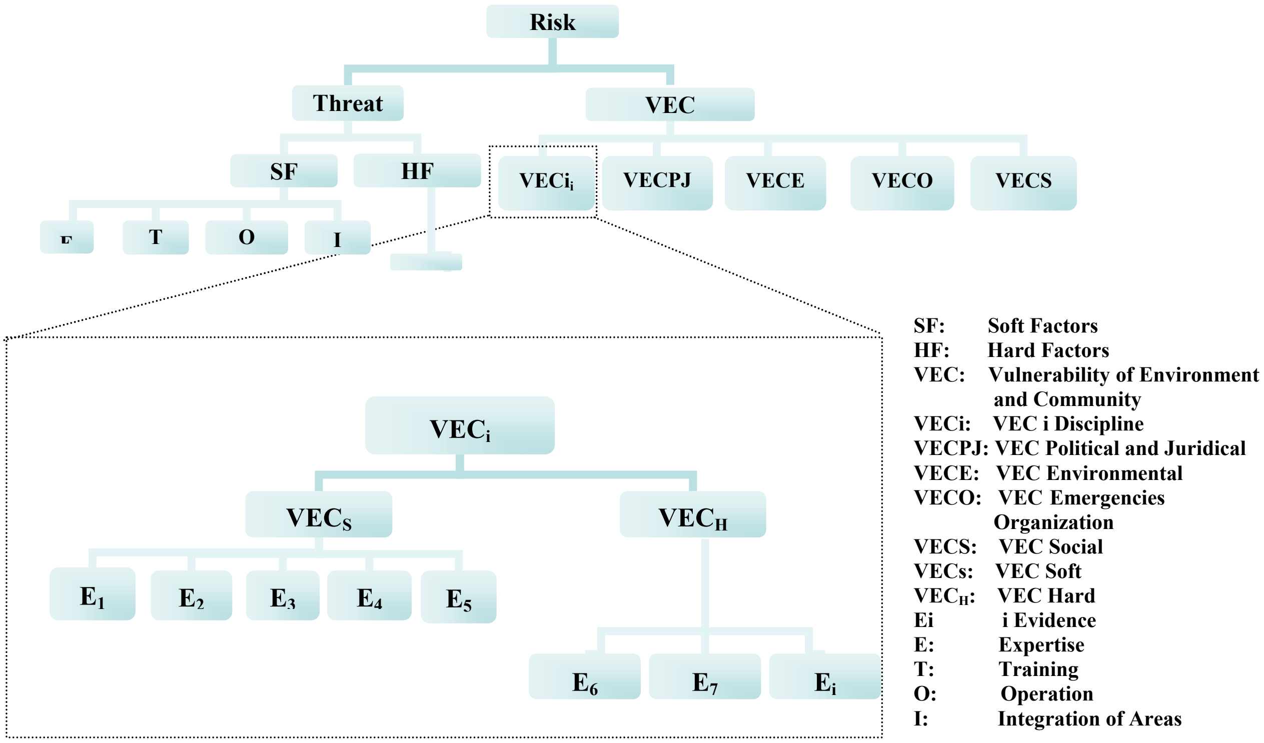

Fig. 3. General Hierarchical Tree – Holistic Approach

2. To coordinate the design, fit and definition of the general hierarchical tree (Risk)
3. To advise the experts about the procedure.
4. To provide catalogues and labels (from his interaction and communication with the experts the uniformity of the process will arise).
5. To interpret the values of **VEC**, obtained by each expert using the programmed algorithm.
6. To analyze with each expert these values. To fit and calibrate the procedure.

Previously to the evaluation of **VEC,** suitable and sufficient information must be gathered on the following aspects:

1) Characteristics of the facility: infrastructure and the plan of construction and assembly.
2) Scope and characteristics of the zone of influence of the work.
3) Identification of the failure scenarios **(T)**
4) Assessment of the characteristics of each possible disaster in the environment and community.
5) Assessment of the expected damage in communications, transport, electricity, potable water provision, telephony, etc.
6) Evaluation of the existing sanitary capacity in the zone.
7) Evaluation of the capacity of evacuation necessary to people, based on the expected damage

With the available information the process of **VEC** evaluation starts (individually and within the interdisciplinary groups). It is designed in three stages:

I. Hierarchical tree Design: multi and interdisciplinary definition of the hierarchical tree based on the fact that for different threats, the behaviour of the context will be different. Each expert must know what is ***being evaluated***; ***the methodology*** and ***the main objective***: risk evaluation. For this purpose a tentative hierarchical tree is presented to each one, (Fig. 3). It will be discussed, in order to modify, to complete and to fit from the agreed opinion of the group. The hierarchical tree allows each expert conceiving the whole and each part in its relative position to the whole. The available information, its sources and the possibility of obtaining new data is socialized

II. VEC_i Evaluation: each expert evaluates the vulnerability (social, economic, environmental, etc.) from their own point of view, following a unique procedure, that is to say; each expert gives the value of **VEC**i of his area of expertise. This stage is personal and the expert has to inform the hierarchical tree he used and the available evidence on which he based his judgement to come to the value. This action will show the logic followed to obtain the qualification. A catalogue with the meaning of each qualification with labels to be used (such as: low, medium, etc.) will be provided to each expert. The uncertainty associated to the assigned values will also be given using the catalogue.

III. Environment and Community Vulnerability Qualification: The different values of **VEC**i by means of a fuzzy algorithm (1) are aggregated, previously determined by consensus like **I**, to obtain the value of the vulnerability of the environment or community.

C. Description of the Hierarchical Tree

The proposal of evaluation of VEC is structured through a hierarchical tree with different levels of definitions. At lower levels the variables have more precise values and smaller conceptual content. Soft variables are taken apart from hard ones and the work is made in two different areas: Soft (S) and Hard (H).

As an example of evaluation, **VEC** in the hierarchical tree of Figure 3, different disciplines are considered, each one with different nature and sources of evidence

- ***Environmental (*VECE)** (environmental studies taking into account unwanted events)
- ***Social (*VECS*)*** (statistical, social cohesion indexes, etc.)
- ***Political and Juridical* (VECPJ)** (degree of development and operation of the political and governmental structure of the area)
- ***Emergencies Organization Surveying* (VECO)** (training, organisations, emergency plans, firemen, non governmental organizations, police, hospitals, rescue teams and assistance)
- ***Economic* (VECEc)** (statistical on the development and economic potential of the zone).

Each area works in the same way, as Figure 3 shows, detaching its $\mathbf{VEC}_i$ using a new hierarchical tree which is a whole in itself and a part as well. ***The holistic perspective defines within each part, an analogous structure to the whole.***

D. Variables Qualification – Calculus Algorithm

Each expert, asked to describe the vulnerability of the environment and community from his discipline, will use a ***unique procedure*** that can be summarized in the following way:

In the proposed hierarchical structure, (Fig. 3), **VEC**i (a type of vulnerability) variable is defined at a level of definition *n*. $\mathbf{VEC}_S$, $\mathbf{VEC}_H$, variables, the vulnerabilities corresponding to the soft and hard factors respectively; belong to the next lower level.
The latter depends on **E**i (available evidence), located in lower levels according to the precision of their information.
The value of $\mathbf{VEC}_i$ variable can be obtained using a fuzzy algorithm (1) that considers the $\mathbf{E}_i$ evidences.

In the most general case, the variables will be *interactive*, that is to say, their values will be determined by the dependencies, the network of relations and the state of the other variables. .In these cases where the whole is not a sum of parts in the traditional meaning of the word, as it was said, a systemic analysis is an appropriate approach to use

The network of relations is integrated by the *interactions* $\mathbf{E}_i\mathbf{E}_j$ that represent connections between variables of same level and the *influences* $\mathbf{E}_i\mathbf{VECi}_S$, which represent relations between variables of different levels.

Along with the $\mathbf{VEC}_i$ given value, the expert of discipline *i* is asked to specify the evidences $\mathbf{E}_i$ or arguments in which he bases the value given to it to check the value with a programmed algorithm

Symbolically:

Algorithm [$\mathbf{E}_1$; $\mathbf{E}_2$ . . $\mathbf{E}_N$; $\mathbf{E}_i\mathbf{E}_J$; $\mathbf{E}_i\mathbf{VECi}_S$] $\rightarrow$[$\mathbf{VECi}_S$] **Value**

The values of the variables, interactions and influences can be represented using triangular fuzzy numbers (TFN) [11], no matter their origin is: deterministic, random or fuzzy. .The expert only works with the labels while the coordinator is the one who transforms the labels into TFN.

The process of giving value to interactions and influences can be controlled as far as its coherence making a correction that allows to a priori detecting missing or wrong influences evaluated by the experts. Theory of the Forgotten Effects is used for it [12].

Once established the network of relations and starting off from $\mathbf{E}_i$ values, $\mathbf{VEC}_{iS}$ will be obtained using a weighed average fuzzy algorithm (1) [11]. It is assumed in this algorithm, that each $\mathbf{E}_i$ variable is condition necessary but no sufficient to determine the value of the $\mathbf{VEC}_{iS}$.

$$\mathbf{VEC} = \frac{\sum_{i=1}^{N} \mathbf{E}_i \cdot a_{ij}}{\sum_{i=1}^{N} a_{ij}} \qquad (1)$$

The values of the weighing coefficients $\mathbf{a}_{ij}$ are the influences.

The calculation algorithm is already programmed and it is not necessary to know fuzzy logic to use it as experts work with labels.

Once defined the hierarchical tree, the calculation process (made by the coordinator) begins in the lowest level, where the program is loaded.

It is useful to calibrate partial or totally the hierarchical tree, in order to detect or verify situations that can not fit to the reality. This operation can be made taking characteristic limit values or to establish edges to the problem which are of general acceptance. These would be initial hypotheses with which the hierarchical tree was set.

A "level at level" control can be also established in order to solve or diminish partial non coincidences results with the reality. This is therefore, each level represents a state of definition of the problem and the expert has a general and initial appreciation (a priori) of it.

The obtained value of $\mathbf{VECi_S}$ by means of the proposed methodology is valid for the time *t* for which it was made as a "picture" of the process. The states of definition of the problem can vary with time, with evolutions that not necessarily are linear or totally predictable; so these values must be taken just as instantaneous.

An analogous methodology to that presented for $\mathbf{VECi_S}$ allows finding the state of $\mathbf{VECi_H}$. According to the characteristics of this variable, the available evidence has higher precision. That is the reason why in general they are located in lower levels in the hierarchical tree as Figure 3 shows.

In order to interpret the outputs, TFN, can be associated to qualifications using the same labels.

6. Conclusions

- A structured procedure for the ***evaluation of the vulnerability of the environment and community*** is presented using all available information, generally of different types and precisions.

- All along the evaluation process not only the ***magnitude*** of the chosen qualifications for the different variables are included, but the ***uncertainty*** associated with them.

- This proposal includes and integrates the ***human factor*** together with hard variables; the former generally excluded from traditional approaches.

- The obtained level of **VEC** represents the degree of been ***susceptible to damage*** in front of a threat. Different community actors and organizations can use this information in order to improve overall safety.

- The process map offers useful information to guide the ***decision making process*** and risk control.

- The procedure proposed in this paper can be used to define in a multidisciplinary way the ***acceptable vulnerability*** for a given threat. These values can become a valuable reference to new projects.

- **VEC** value can be used ***to complete*** the traditional acceptable risk determination.

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