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Preparation of Papers for International Journal of Engineering Research and Applications: A new vision of the calculation of risk of disasters, applied to conditions of Nicaragua

Victor Rogelio Tirado Picado, Armando Ugarte Solis
Fundación Planeta Verde Azul, Managua, Nicaragua
Facultad de Arquitectura, Universidad Nacional de Ingeniería, UNI, Managua, Nicaragua
Corresponding Author : Victor Rogelio Tirado Picado

ABSTRACT
The purpose of this work, is to define a relatively new proposal for the calculation of disaster risk based on the real conditions of our country, which houses the subject of risk reduction with a climate change approach, as well as in the incorporation of the planning of the development of each locality.
It is important to note that an analysis is made from a series of bibliographies that help compile and clearly synthesize those vulnerability factors of interest subject to an exhibition, compiling the information to develop evaluation matrices for each element that integrates the risk, developing a case until arriving at the graphs to tabulate in a fast and effective way the magnitude of the risk that the factors may have exposed to a threat and / or multi-threat.
In the development of the new proposal for the calculation of risk, all the threats detected at the national level are examined, playing with them making a combination to generate multi-threat in a triggering way, giving a magnitude with a tabulated level of disaster risk of a studied locality.
Keywords – *Risk, disaster, Amornization, threat, multi-threat*

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I. INTRODUCTION

The countries of the Central American region, is one of the regions most threatened by natural and social phenomena, at the same time is one in which the development models have created more marked social and environmental imbalances in the world, creating conditions of vulnerability that exacerbate the appearance of various disasters.

In Nicaragua, due to its geographical position and its physical, social, economic and environmental, economic and social vulnerabilities, it is one of these countries that presents a high risk, and these have not been handled adequately, continuously generating various disasters, among others. to mention:

The effects of hurricane Mitch in 1998, the earthquake in the area of Masaya - Granada in 2000, the earthquake of April 2014 in Nagarote, the forest fire in the reserve of Indian corn in 2018, and others how structural fires that they have left substantial losses of human and material lives.

These disasters have also generated serious problems that affect production, causing direct and indirect economic losses, greater poverty, unemployment and migrations of families that have to travel to other places looking for how to survive.

Along with the disasters described above, small and medium disasters occur in our municipalities continuously or almost daily, which often do not even appear on the news; examples of them: a family that loses its housing due to a fire, a bus or car that is turned over due to excess speed or for infractions to the traffic law, child malnutrition, domestic violence, fires, etc.

All these events are also disasters, which cause damage to human and material losses and, as you can see, not all of them are caused by natural phenomena.

The subject of disasters has been for a long time and that still prevails can be seen from the following perspective:

A vision, or approach focused on the disaster itself, that is; in the series of physical, economic, social and environmental damages resulting from the occurrence of an event that requires immediate attention and response actions, which allows the emergency situation to be overcome.

A vision of disasters as eminently natural and dangerous phenomena, difficult to prevent and control.

The disasters considered as "external aggressions", product of the "fury of nature" against human beings, which have no other protection mechanism to face or respond to.

Disasters seen as isolated events, detained in time, dimensioned in phases (before, during and after) and, which as irremediable events will happen again. Seen under a product vision.

Over time it has been reflecting and evolving, so that nowadays there are sectors of society that understand that the problem is not the "disasters" in themselves, but are the effect of risk conditions existing in our countries and, of our ability and judgment to act on the factors that determine them, depend on whether they materialize or not in disasters.

Our perception begins to expand and we have a new vision on the problem: our locations as Risk Scenarios built through historical accumulation, in the same scenario of threats and vulnerabilities.

Risk not as a static product, but as the result of a dynamic and continuous process that is configured along with our development processes. Seen under a process approach that can and should become investment policies, plans and projects inserted by Risk Management, seen as a conceptual approach that has arisen from society's need to preserve human wealth (material and non-material). material) before the threats of nature, and those that we ourselves have contributed to create. It can be understood as the effort to renew the individual and social capacity to adapt to the natural and unnatural changes that the planet is experiencing, lost due to the rupture or imbalance created by technology and science, of the relationship between Man / Woman / Nature , to such a degree that we do not feel separated from it.

Finally, under this new vision that points to disaster risk management as a gradual process "although with a certain degree of uncertainty" that defines policies, plans and projects that reflect the concept of disasters as a result of the risk conditions that are present continuously and covering various possible losses that are often difficult to quantify. However, with research and knowledge about natural, socio-natural and anthropic threats, with intervention to reduce vulnerabilities, with knowledge of population patterns and socioeconomic development; You can evaluate and develop maps, disaster risk guides that allow transforming the prevailing conditions of vulnerabilities.

It can be affirmed that, in the 15 years in Nicaragua, Disaster Risk Management (DRM) has evolved, becoming a priority for authorities of all territorial levels and its population, framed in the national development plan with its investments oriented towards a process of sustainable human development.

Under this context, in this work, readers will be able to learn about the Introductory Aspects of Integral Risk Management for Disasters (GIRD), the Conceptual Framework on Disaster Risk Reduction (DRR), the Propositive Aspects related to the Risk Reduction of Disasters. Disasters (DRR) and Climate Change (CC), and instrumental modeling.

II. OBJECTIVES

Review the global approaches and trends of Integrated Disaster Risk Management (GIRD) and Adaptation to Climate Change (ACC) Study the most relevant concepts related to Disaster Risk Reduction (DRR)
Analyze the propositive aspects associated with Disaster Risk Reduction (DRR) and Climate Change (CC)
Model using the instrumental risk scenario with the proposed new methodology.

III. INDENTATIONS AND EQUATIONS

The risk can be represented in a simple way as the relationship between threats and vulnerabilities and in a more complex way incorporating the preparation and capabilities of a territory or people.

One way to express risk quantumly is:

$R = A \times V$; $R = (A \times V) / P$ (1)

Where:
- R: Risk;
- A: Threat;
- V: Vulnerability;
- P: Preparation

3.1. Another vision:

In this section the expression of disaster risk will be defined, in chapter 1 the terms of risk, threat, vulnerability, exposure, and resilience were generally discussed.

[1] Some authors, such as (Maskrey, 1992), establish the following equation for risk assessment:

$Rt = ExRs = Ex (HxV)$ (2)

Where:

Rt = Total, dimensionless risk.
E = Element under risk, dimensionless.
Rs = Specific, dimensionless risk.
H = Threats, dimensionless.
V = Vulnerability, dimensionless.

[2] According to (CIIFEN, 2017), the risk is quantified from the following expression.

R = AxV (3)
V = Ex S / Re (4)

Substituting the expression 3 in the 2, the following equation is obtained, it is clarified that this is a general expression. Later it will be developed for the different identified vulnerabilities.

R = Ax (Ex S / Re) (5)

Where:
R = Total, dimensionless risk
A = Threats, dimensionless
E = Exposure, dimensionless
S = Susceptibility, dimensionless
Re = Resilience, dimensionless

Traditionally the risk in Nicaragua has been determined qualitatively, so that the evaluator develops the instinct or perception assuming probabilities of occurrence of the different factors that affect the environment of a locality, as a whole and concessions with different specialists, consequently There is no methodology to quantify from the qualifications the magnitude of the risk that may yield results depending on the characteristics and conditions of the environment of a local area in Nicaragua.

According to experience and emphasizing the conditions of Nicaragua, and following the different stages for the adaptability and response that exist in the territories of the country prepared by SINAPRED, the following proposal is made to determine the risk:

R = AxVxCo (6)

V = Ex S / (R_e + P) (7)

Where:
R = Total, dimensionless risk
A = Threats, dimensionless
Co = Total cost of reconstruction, c $
V = Vulnerability, dimensionless
E = Exposure, dimensionless
S = Susceptibility, dimensionless
Re = Resilience, dimensionless
P = Preparation, dimensionless

A nomenclature and homologation of the variables will be done to standardize them in the use of the mathematical expression defined in this document, proposing a methodology that helps to quantify the magnitude of the risk.

Neglecting the cost of reconstruction, and doing R = 1, the vulnerability is cleared, we have the inverse, leaving equation (6) in the following way.

$$A = \frac{1}{V} \quad (8)$$

$$\frac{dA}{dV} = \frac{1}{V} \therefore dA = \frac{1}{V}dV \therefore \int dA = \int \frac{1}{V}dV \quad (9)$$

$$A = \ln(V) + C \quad (9)$$

If equation (9) is replaced in (6), neglecting Co, and constant C equals A, we have the following expression

R = (ln (V) + C) * V∴R = (ln (V) + A) * V (10)

This expression is the proposed equation to determine the risk of disaster, and where ln (V) ≥1.

3.2. The risk from tabulations of graphs.

[3] We will consider a value (m), we will call it the base value, from here 20 progressive data are generated to fit them to a cumulative normal probability distribution curve. For the development of this part, pseudo-random numbers will be used, described below:

$$X_i = 13X_{i-1} \quad (11)$$

$$u_i = \frac{x_i}{31} \quad (12)$$

That is, multiply the base value by 13, evaluate module 31, and divide by 31 to get the next pseudorandom number. The result will be repeated only after executing the iteration through the 20 different numbers of zero 1/31 ...... 10/31. In other words, the period of this random number generator is 20. There is nothing that seems random in this sequence of numbers. Once the base is chosen, the sequence is cycled through the 20 possible numbers in a predetermined order, this application will be seen later.

[4] From the Normal equation we have the following:

$$Z = \frac{x - \ddot{X}}{\sigma} \quad (13)$$

Where:

Z = Value to normalize, dimensionless.

X = value generated from pseudorandom, dimensionless number.

$\ddot{X}$ = average of the values generated

σ = deviation of the values generated

In order to be able to give quantitative values to the different variables, it is important to take into account certain classifications and range of values to be worked on, as well as to consider from 0 to 100 in a percentage way, and from 0 to 1 in a probabilistic manner.

The vulnerability is equal to 1 and Ret is cleared from expression 7. For this case we work with Ret = 37, Pt = 33, St = 37 and Et = 42, perform 20 progressive random numbers using mod31 for each of the variables, and developing expression 11 and 12 the following table is obtained. It should be noted that when Ret is removed, negative values can be obtained, so that the expression is entered in absolute value.

$$\boxed{Ret = |(Et * St) - Pt|} \quad (13)$$

IV. FIGURES AND TABLES

Table 1: Summary of data generated from pseudocoding numbers, and with cumulative normal distribution.
Source: self made. (2018).

	Elemento de Riesgo				Si V=1	Ret				Distribución Normal Acumulada
Id	Ret	Pt	St	Et	Ret=|(Et*St)-Pt|	X	$\bar{X}$	σ	Z	
1	9.68	0.84	14.05	21.17	296.6	2.6	197.00	199.87	-0.97	0.17
2	1.84	10.89	27.65	27.17	740.3	6.3	197.00	199.87	-0.95	0.17
3	23.93	17.59	18.45	12.17	206.9	11.1	197.00	199.87	-0.93	0.18
4	1.06	11.63	22.85	3.17	60.7	39.6	197.00	199.87	-0.79	0.22
5	13.82	27.22	18.05	10.17	156.3	59.7	197.00	199.87	-0.69	0.25
6	24.67	12.83	17.65	8.17	131.3	60.7	197.00	199.87	-0.68	0.25
7	10.73	11.85	12.45	13.17	152.1	66.1	197.00	199.87	-0.66	0.26
8	15.50	30.11	6.85	16.17	80.6	80.6	197.00	199.87	-0.58	0.28
9	15.50	19.44	27.05	24.17	634.3	131.3	197.00	199.87	-0.33	0.37
10	15.46	4.76	10.65	4.17	39.6	152.1	197.00	199.87	-0.22	0.41
11	14.98	30.94	14.45	23.16	303.8	156.3	197.00	199.87	-0.20	0.42
12	8.76	30.22	1.87	22.10	11.1	159.8	197.00	199.87	-0.19	0.43
13	20.92	20.88	24.31	8.28	180.5	180.5	197.00	199.87	-0.08	0.47
14	23.98	23.43	6.09	14.69	66.1	206.9	197.00	199.87	0.05	0.52
15	1.77	25.60	17.21	4.96	59.7	266.9	197.00	199.87	0.35	0.64
16	23.00	22.85	6.77	2.45	6.3	296.6	197.00	199.87	0.50	0.69
17	19.99	18.06	25.96	0.80	2.6	303.8	197.00	199.87	0.53	0.70
18	11.81	17.82	27.49	10.36	266.9	384.5	197.00	199.87	0.94	0.83
19	29.56	14.64	16.41	10.63	159.8	634.3	197.00	199.87	2.19	0.99
20	12.33	4.37	27.33	14.23	384.5	740.3	197.00	199.87	2.72	1.00

Table 2: Summary of data generated from pseudocodes, and with cumulative normal distribution

	Elemento de Riesgo				Si V=1	Pt				Distribución Normal Acumulada
Id	Ret	Pt	St	Et	Pt= |(Et*St)-Ret|	X	$\bar{X}$	σ	Z	
1	9.68	0.84	14.05	21.17	287.71	0.70	199.85	199.87	-1.00	0.16
2	1.84	10.89	27.65	27.17	749.32	6.45	199.85	199.87	-0.97	0.17
3	23.93	17.59	18.45	12.17	200.55	28.91	199.85	199.87	-0.86	0.20
4	1.06	11.63	22.85	3.17	71.30	32.57	199.85	199.87	-0.84	0.20
5	13.82	27.22	18.05	10.17	169.69	65.52	199.85	199.87	-0.67	0.25
6	24.67	12.83	17.65	8.17	119.47	71.30	199.85	199.87	-0.64	0.26
7	10.73	11.85	12.45	13.17	153.19	83.56	199.85	199.87	-0.58	0.28
8	15.50	30.11	6.85	16.17	95.24	95.24	199.85	199.87	-0.52	0.30
9	15.50	19.44	27.05	24.17	638.21	119.47	199.85	199.87	-0.40	0.34
10	15.46	4.76	10.65	4.17	28.91	144.92	199.85	199.87	-0.27	0.39
11	14.98	30.94	14.45	23.16	319.74	153.19	199.85	199.87	-0.23	0.41
12	8.76	30.22	1.87	22.10	32.57	169.69	199.85	199.87	-0.15	0.44
13	20.92	20.88	24.31	8.28	180.50	180.50	199.85	199.87	-0.10	0.46
14	23.98	23.43	6.09	14.69	65.52	200.55	199.85	199.87	0.00	0.50
15	1.77	25.60	17.21	4.96	83.56	272.92	199.85	199.87	0.37	0.64
16	23.00	22.85	6.77	2.45	6.45	287.71	199.85	199.87	0.44	0.67
17	19.99	18.06	25.96	0.80	0.70	319.74	199.85	199.87	0.60	0.73
18	11.81	17.82	27.49	10.36	272.92	376.56	199.85	199.87	0.88	0.81
19	29.56	14.64	16.41	10.63	144.92	638.21	199.85	199.87	2.19	0.99
20	12.33	4.37	27.33	14.23	376.56	749.32	199.85	199.87	2.75	1.00

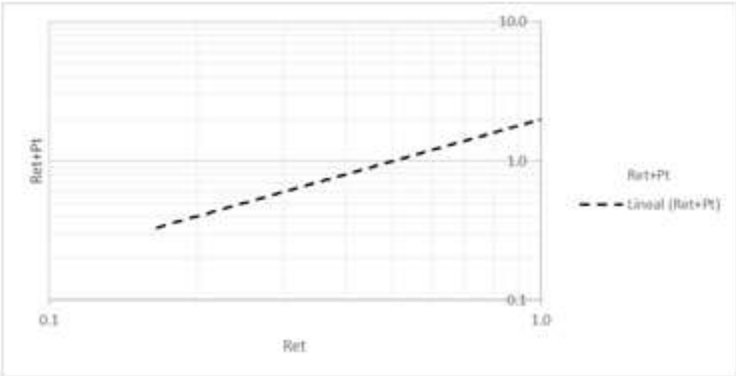
Source: self made. (2018).

	Elemento de Riesgo				Si V=1	Et				Distribución Normal Acumulada
Id	Ret	Pt	St	Et	Et=(Pt+Ret)/St	X	$\bar{X}$	σ	Z	
1	9.68	0.84	14.05	21.17	0.749	0.46	3.39	4.62	-0.634	0.26
2	1.84	10.89	27.65	27.17	0.460	0.56	3.39	4.62	-0.613	0.27
3	23.93	17.59	18.45	12.17	2.250	0.61	3.39	4.62	-0.601	0.27
4	1.06	11.63	22.85	3.17	0.556	0.75	3.39	4.62	-0.571	0.28
5	13.82	27.22	18.05	10.17	2.274	1.08	3.39	4.62	-0.500	0.31
6	24.67	12.83	17.65	8.17	2.125	1.29	3.39	4.62	-0.454	0.32
7	10.73	11.85	12.45	13.17	1.814	1.47	3.39	4.62	-0.416	0.34
8	15.50	30.11	6.85	16.17	6.659	1.59	3.39	4.62	-0.389	0.35
9	15.50	19.44	27.05	24.17	1.292	1.72	3.39	4.62	-0.361	0.36
10	15.46	4.76	10.65	4.17	1.899	1.81	3.39	4.62	-0.341	0.37
11	14.98	30.94	14.45	23.16	3.178	1.90	3.39	4.62	-0.323	0.37
12	8.76	30.22	1.87	22.10	20.843	2.13	3.39	4.62	-0.274	0.39
13	20.92	20.88	24.31	8.28	1.719	2.25	3.39	4.62	-0.247	0.40
14	23.98	23.43	6.09	14.69	7.781	2.27	3.39	4.62	-0.242	0.40
15	1.77	25.60	17.21	4.96	1.590	2.69	3.39	4.62	-0.151	0.44
16	23.00	22.85	6.77	2.45	6.776	3.18	3.39	4.62	-0.046	0.48
17	19.99	18.06	25.96	0.80	1.466	6.66	3.39	4.62	0.707	0.76
18	11.81	17.82	27.49	10.36	1.078	6.78	3.39	4.62	0.732	0.77
19	29.56	14.64	16.41	10.63	2.694	7.78	3.39	4.62	0.950	0.83
20	12.33	4.37	27.33	14.23	0.611	20.84	3.39	4.62	3.774	1.00

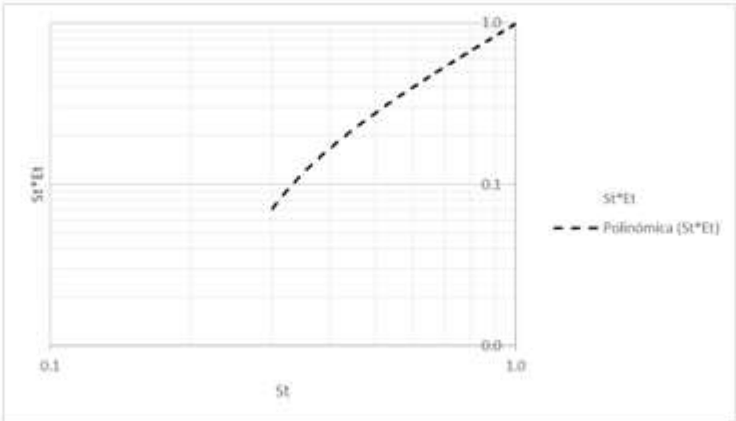
Table 3: Summary of data generated from pseudocodes, and with cumulative normal distribution. Source: self made. (2018).

	Elemento de Riesgo				Si V=1	St				Distribución Normal Acumulada
Id	Ret	Pt	St	Et	St=(Pt+Ret)/Et	X	$\bar{X}$	σ	Z	
1	9.68	0.84	14.06	21.17	0.50	0.47	6.00	10.55	-0.52	0.30
2	1.84	10.89	27.66	27.17	0.47	0.50	6.00	10.55	-0.52	0.30
3	23.93	17.59	18.45	12.17	3.41	1.17	6.00	10.55	-0.46	0.32
4	1.06	11.63	22.85	3.17	4.01	1.45	6.00	10.55	-0.43	0.33
5	13.82	27.22	18.06	10.17	4.04	1.72	6.00	10.55	-0.41	0.34
6	24.67	12.83	17.66	8.17	4.59	1.76	6.00	10.55	-0.40	0.34
7	10.73	11.85	12.45	13.17	1.72	1.98	6.00	10.55	-0.38	0.35
8	15.50	30.11	6.85	16.17	2.82	2.82	6.00	10.55	-0.30	0.38
9	15.50	19.44	27.06	24.17	1.46	2.86	6.00	10.55	-0.30	0.38
10	15.46	4.76	10.66	4.17	4.85	3.23	6.00	10.55	-0.26	0.40
11	14.98	30.94	14.45	23.16	1.98	3.41	6.00	10.55	-0.25	0.40
12	8.76	30.22	1.87	22.10	1.76	4.01	6.00	10.55	-0.19	0.42
13	20.92	20.88	24.31	8.28	5.06	4.04	6.00	10.55	-0.19	0.43
14	23.98	23.43	6.09	14.69	3.23	4.16	6.00	10.55	-0.18	0.43
15	1.77	25.60	17.21	4.96	5.52	4.59	6.00	10.55	-0.13	0.45
16	23.00	22.85	6.77	2.45	18.75	4.85	6.00	10.55	-0.11	0.46
17	19.99	18.06	25.96	0.80	47.76	5.05	6.00	10.55	-0.09	0.46
18	11.81	17.82	27.49	10.36	2.86	5.52	6.00	10.55	-0.05	0.48
19	29.56	14.64	16.41	10.63	4.16	18.75	6.00	10.55	1.21	0.89
20	12.33	4.37	27.33	14.23	1.17	47.76	6.00	10.55	3.96	1.00

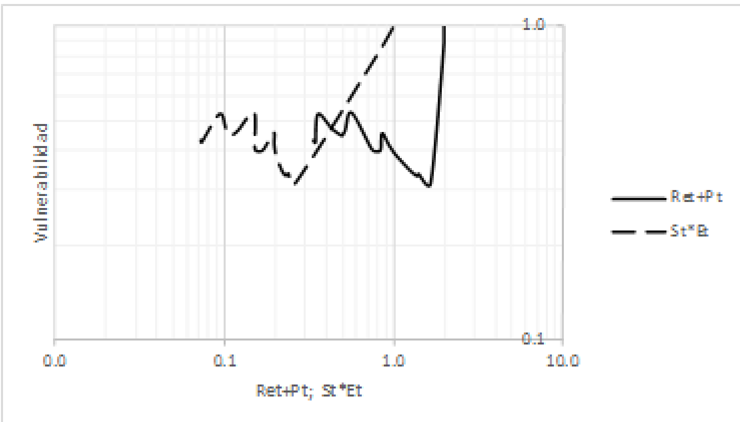
Table 4: Summary of data generated from pseudocodes, and with cumulative normal distribution Source: self made. (2018).



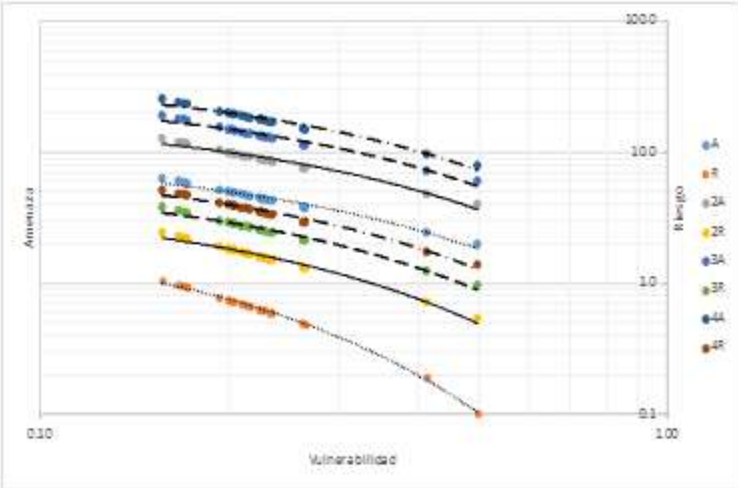
Graph 1: Logarithmic trend graph of Resilience plus preparation, entry data Resilience.
Source: self made. (2018).



Graph 2: Logarithmic plot of tendency of susceptibility by exposure, entry data Susceptibility.
Source: self made. (2018).



Graph 3: Log plot of vulnerability trend, input data Ret + Pt; or St * Et.
Source: self made. (2018).



Graph 4: Logarithmic plot of threat and risk trend, vulnerability entry data.
Source: self made. (2018).

Table 5: Risk level according to the threat scenario.

Amenaza	Riesgo		
	Bajo	Medio	Alto
1	0.10<R≤0.43	0.43<R≤0.90	0.90<R≤1.05
2	0.54<R≤1.19	1.19<R≤2.13	2.13<R≤2.43
3	0.97<R≤1.96	1.96<R≤3.36	3.36<R≤3.81
4	1.40<R≤2.72	2.72<R≤4.59	4.59<R≤5.19

Source: self made. (2018).

V. CONCLUSION

The purpose of this work, is to define a relatively new proposal for the calculation of disaster risk based on the real conditions of our country, which houses the subject of risk reduction with a climate change approach, as well as in the incorporation of the planning of the development of each locality.

The paper insists that the risk of disaster is the product of wrong decisions regarding development, and a threat to the progress that is expected to be achieved in the future, that is why a description of the resilience and mechanism to reduce such risk is made. of disasters.

It is important to note that an analysis is made from a series of bibliographies that help compile and clearly synthesize those vulnerability factors of interest subject to an exhibition, compiling the information to develop evaluation matrices for each element that integrates the risk, developing a case until arriving at the graphs to tabulate in a fast and effective way the magnitude of the risk that the factors may have exposed to a threat and / or multiamenaza.

In the development of the new proposal for the calculation of risk, all the threats detected at the national level are examined, playing with them making a combination to generate multiamenza in a triggering way, giving a magnitude with a tabulated level of disaster risk of a studied locality.

In the example to measure the vulnerability of each factor in the face of a specific or multi-threatening threat, the importance of the development processes that turn these into disaster risks is verified.

By analyzing the socio-economic variables registered at the national level, and the reported effects of disasters, some links can be established between certain conditions and processes of development and disaster risk. Focused on earthquakes, tropical cyclones and floods. In relation to the drought variable, analysis of very low links was presented, because despite the effect of the Nina, in Nicaragua there are areas that do not stop raining or at least medium high rainfalls occur annually.

[5], [6] Earthquake losses occur in characteristic places due to rapid urban growth and high physical exposure, such as Managua, Masaya, León-Nagarote-La Paz Centro. In the case of tropical cyclones, losses occur in areas with a high percentage of arable land, wooded areas and high physical exposure. Some factors of vulnerability associated with floods are: low local population density and high physical exposure.

Rapid urbanization brings with it the risk of disaster due to various factors: cities, population and cultural assets located in unsafe or dangerous areas, social exclusion and poverty, a complex interaction between the various threats, generation of physical vulnerability, spatial transformation of new territories and access to mitigation mechanisms for losses.

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By Victor Tirado Picado

First of all, thanks to God and our Lord Jesus Christ, who have given me the bread of knowledge and value poetry as a literary and integral art of humanity. Thank you.

I express my gratitude to my mother who has been a person who has managed to induce this simple mortal by the luminous path to achieve the goals and goals of my life, who despite his illness has left a trace of the great faith that he has to follow educating me, and who without basilar has given me all the best that a person wants to have, and that is to have the greatest treasure that can exist in the universe, "Knowledge". Thank you Mrs. Beatriz Picado (Mirna).

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My thanks to my sons Dafned Itziar Tirado Flores, Víctor Manuel Tirado Flores, Alexis Fernando Tirado, who are the source of inspiration and serve as an example of overcoming. I wish you all the success in your lives.

To my maternal family, friends and co-workers. Keep harvesting knowledge.

By Armando Ugarte

First of all, thanks to God, who have given me the bread of knowledge and value poetry as a literary and integral art of humanity. Thank you.

I express my gratitude to my mother, my wife (q.e.p.d) and my son Armando Ugarte Nuñez, and my daughter Nancy Ugarte Nuñez ; who are the source of inspiration and serve as an example of overcoming. I wish you all the success in your lives.

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