

Operational Risk of Insecurity using Control Self Risk Assessment and Linear Programming

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Abstract

This research work focused on the risks we are faced with on our day to day activities, either directly or indirectly, which can gradually accumulates and results to communal crisis, religious crisis, socio-economic agitations and tribal crises. Nasarawa Eggon Local Government Area of Nasarawa State was used as case study and a well structure close-ended questionnaire was used for data collection as it relates to Controlled Self Risk Assessment (CSRA) and linear programming technique was used to analyze. The results proved that many of this processes were neglected in these communities, making them to be prone to incessant communal crisis. The study recommend that Government should strongly, as a matter of urgency address the unemployment rate, distribution of political position, schools, primary health care and equip security personnel with the modern technology facilities, which happen to record the highest risk level.

Keywords: Risk, Security, Linear programming, Nasarawa Eggon and CSRA

1.0 Introduction

Insecurity has overwhelmed our homes, communities, local Government, states and up to the national level, through so many means of which some are known to us while some are not, these insecurities occur sometimes as a result of our carelessness, lack of discipline, refusal to accept

and enforce the lay down laws that govern the people and poor knowledge concerning security. Jennifer *et al* (2007), describe the causes of insecurity to includes politics and elections, that is, the shift to democratic governance, the rise of armed groups, oil, ethnicity and religion, and poverty which are the major issues that represent dividing lines in communities that have led to heightened tensions between and within groups. But to say that groups or individuals are fighting over any single issue is too simple-minded. At the heart of many of these conflicts is access to resources and control over the distribution of benefits. This struggle for resources has led to a broad sense of opportunism, and the pursuit of self-help strategies across the country. Also according to Olabanji *et al* (2004) reveals that, an increase over time, which constitutes serious threat to lives and properties, hinders business activities and discourages local and foreign investors, all which stifles and retards Nigerian's socio-economic development. This rising wave of insecurity has not abated but has assumed a dangerous position which is threatening the corporate existence of the country as one geographical entity. In light of the aforementioned works, we found it necessary as residents of these areas to embark on this study as a prompt response to security challenges that have befallen our land in recent times. Jacob *et al* (2012) referred in fairness, that insecurity is not a problem that is unique to Nigeria but rather it has geographical spread across the globe. In addition, the United States, United Kingdom and many countries of the world faced similar challenges of insecurity within their borders on a daily basis. But the difference between these nations and Nigeria according to Adejumo (2011) is how they manage and responds to these threats. Unfortunately, the speed with which evil is growing in Nigeria and the merciless ways that lives of innocent ones are being wasted are worrisome. People are burdened on a daily basis with psychological and emotional trauma resulting from gory sights of lifeless and mutilated bodies of loved family member on daily basis.

Previous studies such as Adeleke (2013) viewed insecurity as a hydra headed monster which security agents in Nigeria appear incapable of handling and said also that the power shift from the northern hegemony to a minority geo-political zone of South-south is currently on top in the list of issues that are instigating groups and individuals against the interests of the state. Other causes of insecurity challenges include intra/inter-party rancor; porous boundaries; unemployment, jobs racketeering and illiteracy. In view of these situations of insecurity in Nigeria, this study intended to use a risk management technique and mathematical model approach to come up with the possible means that can minimize some of these risks.

1.1 Control Self Risk Assessment (CSRA)

This is one of the tools that was developed by Gulf (1987) to evaluate control processes of the operational of staff, to pick out risk areas in a process, which is mostly used in our financial industries. CSRA is a process whereby risk inherent business unit's activities and associated controls are identified, subject to corrective action plan, appropriately documented and reported. A comprehensive Control Self Risk Assessment covers controls over the effectiveness of its process to ensure compliance with the applicable laws and regulations. It can be applied as a tool in homes, communities, societies, and local government with special interest in Nasarawa Eggon local government area of Nasarawa State.

2.0 Literature Review

Eme *et al* (2011) study the Challenges of Insecurity in Nigeria in a thematic exposition, in their research they examine the concept of insecurity and its various manifestations using vital examples. It goes further to establish the need to check the rising threats to lives and property across Nigeria and the poor living conditions of many Nigerians. The work identifies the implications and challenges insecurity possess for the polity and concludes by positing that

Nigeria's democracy is endangered as political intolerance, and economic frustration gather momentum in the form of assassinations, intimidations, threats and hostage across Nigeria. Jide *et al* (2012), examines that the Boko Haram's campaign targets security formations and churches in several parts of the North. Also, they have also turned their attacks on institutions like, the media and universities etc. From being an obscure movement confined to north-eastern Nigeria, the Boko Haram has emerged as the most palpable threat to the polity's continued peace and development. Not only do the persistent attacks of the sect create widespread insecurity and fear, the prevalent dread of the militant sect has stifled normal processes of trade and investments as well as the performance of routine security functions. and concludes by positing that for the terror to be won, the citizenry must see it as their fight and not just as an individual. Christina *et al* (2010) Study the overall rise in numbers of security incidents and the shifting of insecurity has been much discussed in the humanitarian literature. According to them 2006 report Providing Aid in Insecure Environments concluded that, 'the level of risk in highly insecure environments has been effectively transferred from UN agencies and international organizations to international NGOs, and from international NGOs to their national staff and local partners. Their report provides additional evidence by looking at patterns of security events from 1996 to 2010 that affected different types of humanitarian workers, categorized by origin, provider organization, and gender.

3.0 Model formulation

Suppose Nasarawa Eggon Local Government has seen the need to improve the security of lives and properties, however the number of process that will be used to pick out these risk will be, Satisfactory (L), Needing improvement and (M), and Unsatisfactory (H). Let $L_{t_1}, L_{t_2}, \dots, L_{t_k}$, be the number of Risk rated Satisfactory, $M_{t_1}, M_{t_2}, \dots, M_{t_k}$, be the number of Risk Needing

Improvement, and $H_{t1}, H_{t2}, \dots, H_{tk}$ be the number of Unsatisfactory Risk, in each community in Nasarawa Eggon Local Government. Suppose that (I) is the number of Inherent (I) Risk in the process tool and (R) is the number of Residual (R) Risks in the process tool in the community. Let d_1, d_2, \dots, d_k , be the number of community whom will benefit from the Control Self Risk - Assessment (CRSA) tool testing in the Local Government. The objective is to know the present value of Risk in each community in line with Korve et al. (1996).

Process CRSA	Number Risk	Rate of Risk
Satisfactory Risk	$L_{t1}, L_{t2}, \dots, L_{tk}$	L
Needing Improvement	$M_{t1}, M_{t2}, \dots, M_{tk}$	M
Unsatisfactory Risk	$H_{t1}, H_{t2}, \dots, H_{tk}$	H
Inherent Risk	$I_{t1}, I_{t2}, \dots, I_{tk}$	I
Residual Risk	$R_{t1}, R_{t2}, \dots, R_{tk}$	R
Community	d_1, d_2, \dots, d_k	D

Let X_1, X_2, \dots, X_k the number of communities to be examined in the Nasarawa Eggon Local Government respectively, suppose that the government policy decision is specific to the minimum Risk they are to manage or bear, then the objective will check then the minimum value in each community and then compare it with the government minimum value. The linear programming problem is formulated in line with as

Minimize

$$\sum_{j=0}^k d_i X_j$$

Subject

to:

$$\sum_{j=i}^k H_{tj} X_j \geq h$$

$$\sum_{j=i}^k M_{tj} X_j \geq m$$

$$\sum_{j=i}^k L_{tj} X_j \geq l$$

$$\sum_{j=i}^k I_{tj} X_j \geq i$$

$$\sum_{j=i}^k R_{tj} X_j \geq r$$

For $j = 1, 2, 3, \dots, k$

$0 \leq X_i \leq 1$ for all $h, m, l, I, r \geq 0$

Where H_{tj} , M_{tj} , L_{tj} , I_{tj} , R_{tj} , are the number of satisfactory process, needing improvement process, Inherent Risk, Residual Risk, and h, m, l, I, r is the number of Satisfactory process, Needing Improvement process, Inherent Risk, Residual Risk in the communities.

3.1 Linear programming

According to Business Dictionary, Linear programming is a mathematical techniques used in computer modeling to find the best possible solution in allocating limited resources (energy, machines, materials, money, personnel, space, time, etc) to achieve maximum profit or minimum cost. However, it is applicable where only all relationships are linear and can accommodate only a limited class of cost functions. For problem involving more complex functions, another technique called 'mixed integer modelling, is employed. Developed by the Russian Economist

Leonid Kantorovich (1912-1986) and the U.S Economist C. Koopmans (1910-1986), on the basis of the work of the Russian Mathematician Andrew Nikolaevich Kolmogorov (1903-1987). According to the Wolframathworld, Linear programming, is also known as linear optimization, is the problem of maximizing or minimizing a linear function over a convex polyhedron specified by linear and non-negativity constraints. Simplistically, linear programming is an optimization of an outcome based on some set of constraints using a linear mathematical model. Linear programming is introduced in mathematics as linear programming, which find a vector \mathbf{x} which minimizes a quantity $c\mathbf{x}$ subject to the constraints $m\mathbf{x} > \mathbf{b}$ and $x_i \geq 0$ for $\mathbf{X} = (x_1, \dots, x_n)$.

Linear programming falls within convex optimization theory and is also considered to be an important part of operational research. Linear programming is extensively used in business and economics, but may also be used to address some certain engineering problems.

Linear programming can be solved using the simplex method (Wood and Dantzig 1949,) which runs along polytope ridges of the visualization solid to find the best answer, Khachian (1979) found a polynomial time algorithm. A much more polynomial time algorithm was found by Karmarkar (1984). This method goes through the middle of the solid (making it a so called interior point method), and then transfer warps. Arguably interior points method was known as early as (1960) in the form of the barrier functions methods, but the media hype accompanying Karmarkar's announcement led to this method receiving a great deal of attention.

The origin of minimization problem is stated formally in a result of the von Neumann Duality principles, after the American mathematician John von Neumann (1903 - 1957).

$$\begin{aligned} W &= c_1x_1 + c_2x_2 + \dots + c_nx_n \\ \text{Subject to} \\ a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n &\geq b_1 \\ a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n &\geq b_2 \end{aligned}$$

$$\begin{matrix} \cdot \\ \cdot \\ \cdot \\ a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mn}x_n \geq b_m \end{matrix}$$

Where $x_i \geq 0$ and $b_i \geq 0$ to solve this problem we solve the following steps:

1. Form the augment matrix for the given system of the inequalities and add a bottom row consisting of the coefficients of the objective functions

$$\left| \begin{array}{cccc} a_{11} & a_{12} & \dots & a_{1n} : b_1 \\ a_{21} & a_{22} & \dots & a_{2n} : b_2 \\ \cdot & & & \\ \cdot & & & \\ a_{m1} & a_{m2} & \dots & a_{mn} : b_m \\ \dots & \dots & \dots & \dots \\ c_1 & c_2 & \dots & c_n : 0 \end{array} \right|$$

2. Form the transpose of the matrix.

$$\left| \begin{array}{cccc} a_{11} & a_{12} & \dots & a_{1n} : c_1 \\ a_{21} & a_{22} & \dots & a_{2n} : c_2 \\ \cdot & & & \\ \cdot & & & \\ \cdot & & & \\ a_{m1} & a_{m2} & \dots & a_{mn} : m_m \\ \dots & \dots & \dots & \dots \\ b_1 & b_2 & \dots & b_n : 0 \end{array} \right|$$

3. Form the Dual maximization problem corresponding to the transposed matrix.

That is, find the maximum of the objective function given by

$$z = b_1y_1 + b_2y_2 + \dots + b_my_m$$

Subject to the constraints

$$a_{11}y_1 + a_{12}y_2 + \dots + a_{m1}y_m \leq c_1$$

$$a_{12}y_1 + a_{22}y_2 + \dots + a_{m2}y_m \leq c_2$$

$$\begin{array}{c}
 \cdot \\
 \cdot \\
 \cdot \\
 a_{1n}y_1 + a_{2n}y_2 + \dots + a_{mn}y_m \geq c_n
 \end{array}$$

where $y_1 \geq 0, y_2 \geq 0, \dots$, and $y_m \geq 0$.

- 4 Apply the simplex method to the maximization problem. The maximum value of z will be the minimum value of w . Moreover, the values of x_1, x_2, \dots, x_n and will occur in the bottom row of the final simplex tableau, in the columns corresponding to the slack variables.

4.0 Material and Method

In this aspect of the study, the procedures for building the Control Self Risk Assessment model was discussed. An operational Risk model of insecurity in Nasarawa Eggon Local Government Using Control Self Risk Assessment (CSRA) and simplex method for minimization technique of linear programming case was developed as an extension of Korve et al (1996). The processes indices considered to be asses in the research work are Employment, Education, Laws, Police Station, Schools, Social amenity and infrastructure, Laws reform agencies, Primary health care clinic and Dialogue. A comprehensive Control Self Risk Assessment Process tool was formulated and was used to assess some few communities in the Nasarawa Eggon Local Government, and pick out those possible Risk areas that have trigger out the recent crisis in the local government and some part of the state.

The data was collected as follow: For the inherent Risk, that is, before accessing a particular index, from the outlook, structural appearance or hearing, one can record it to be either satisfactory, needing improvement or unsatisfactory, depending on how you see the appearance, thereafter, then you go in to access by asking question regarding the index, checking on the

facility, equipment and interviewing the personnel working there to see whether the risk is also satisfactory, needing improvement or unsatisfactory. Thereafter you sum up the number of satisfactory, needing improvement and unsatisfactory risk before which is known as Inherent risk and also sum up the satisfactory, needing improvement and unsatisfactory risk after which is also known as Residual risks to form the matrices (details are presented in the appendix).

Table 1: Risk Assessment Form

S/No	Process	Inherent Risks			Residual Risk		
		High (H)	Medium (M)	Low (L)	High (H)	Medium (M)	Low (L)
1	Employment						
2	Education						
3	Political position						
4	Social Amenities and infrastructure						
5	Police Station						
6	Law						
7	Dialogue						
8	Law reform agency						
9	Primary Health care						
10	Schools						

Control self-Risk Assessment (CSRA)	Risk before assessing the community (Inherent) X_1	Risk after assessing the community (Residual) X_2
Number of high Risk (Unsatisfactory Risk)		
Number of medium (Needing improvement)		

Number of low Risk (which is satisfactory)		

An operational Risk model of insecurity in Nasarawa Eggon Local Government Using Control Self Risk Assessment (CSRA) and simplex method for minimization technique of linear programming case was developed as an extension of Korve et al (1996).

5.0 Discussion of Results

In the Operational Risk Model, the Control Self Risk Assessment (CSRA) pick out those possible risk areas and formed a parameter in a form of a matrix, then the simplex method of linear programming technique was used to get the present minimum risk values in each community as recorded in the table 2 below and figure 1 below. in the case of Angbashuru Odne which recorded the highest risk value from the analysis correlate with the information recorded during accessing the community, the community was known to experienced consists violence and attack for quite a long period of time till the time of this research work alongside Mada station and others community with high level of tension that violence can escalate at any time. As earlier stated that this work became a necessity to check the risk level in this community through the indices mentioned above which actually shown that so many of these indices which is meant to keep and sustain rules and regulation among the people, were seriously neglected as they gradually wear out. This research work agreed with Jennifer *et al* (2007) whose stated in their work the major causes of insecurity that led to high tensioned in communities today are the rise of armed groups, ethnicity, religion, and poverty which can be liken to say, that the indices that should prevent this from existing or happening in our communities today were over looked and are out of hand, which we can vividly see this from the result of this work. In fact, we can

boldly say that those rules and regulation they are merely songs in our mouth today but they are no longer in practice in our communities.

Table 2: The result value analysis of risk recorded during the research is as follow.

S/No	Names of some community in Nasarawa Eggon L.G.A	Risk Recorded by Control Self Risk Assessment
1	Kuba Hamlet	200
2	Nasarawa Eggon	533.3
3	Wulko	93.3
4	Alhamis Ezzen	400
5	Kagbu Wane	100
6	Mada Station	625
7	Lizy Keffi	450
8	Lambaga	225
9	Angbashuru Oddne	1500

Source: Control Self Risk Assessment and Simplex Method technique

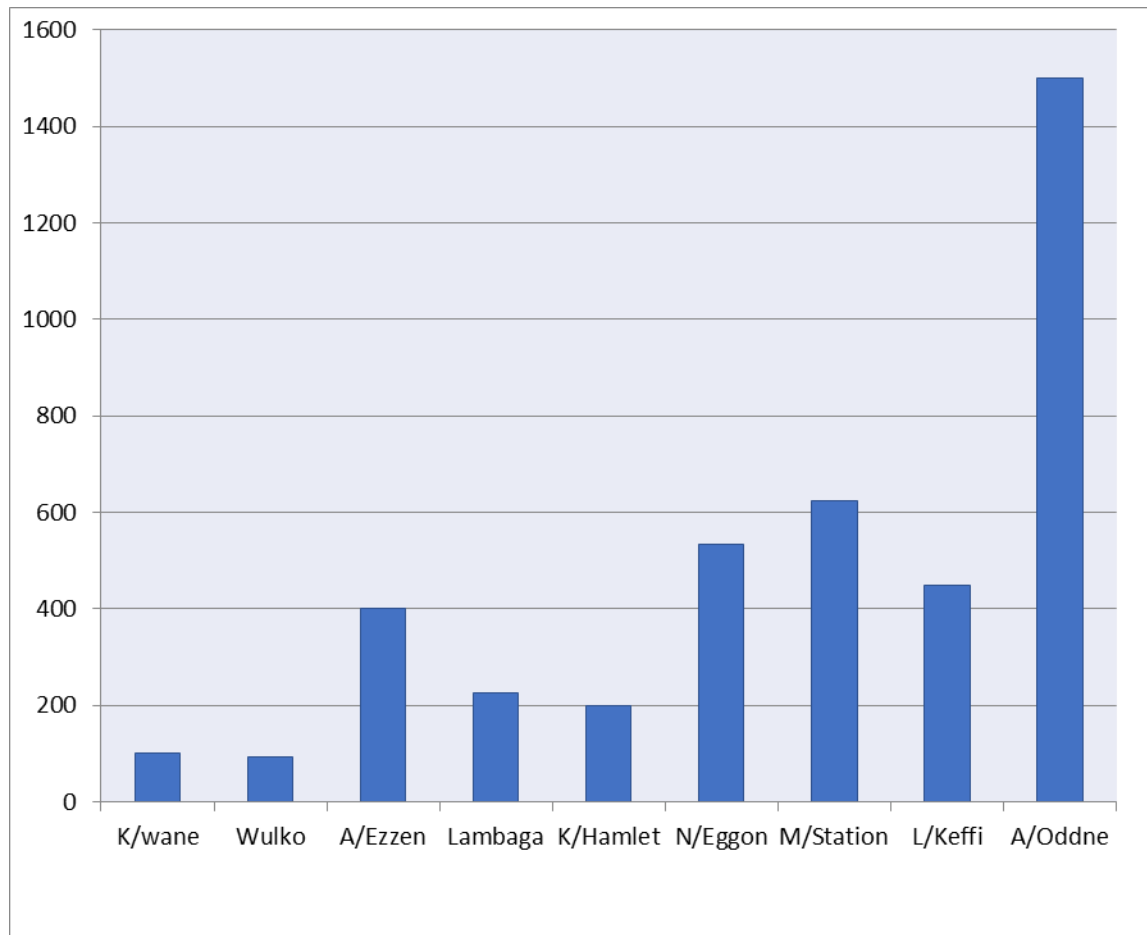


Fig 1: The Graphical Representation of the Risk value

6.0 Conclusion and Recommendations

This model was able to pick out those possible risk areas that causes the inter-tribal crisis, ethno-religious crisis, socio-economic agitations, ethnic militias, boundary disputes, cultism and criminality also as a result hindering economic activities, tourism, and good democratic political system in some communities in the local government ranging from unemployment, Poor Educational system, Social amenity and Infrastructure, Lack of Police Station and scarcity of security personnel, Lack and Poor Primary Health Care Clinic, etc. The Model should be used as the name implies from one of it tools which is control self-risk assessment (CSRA) to assess

each community to know the insecurity level, so that the policies maker, such as Government, Non-Governmental Organization etc should give attention to those communities that have more of security challenges in time of distribution of resources and allocation of budgetary.

In line with the results, The government should strongly address the unemployment, distribution of Political position, schools and primary health care issues which was noticed during the research work to have the highest risk record that contribute to insecurity in most of the communities. The Government, Non-Governmental organization (NGO) and other Civil Society Groups should consider using this models which is easier and less cause for the Operation. Also Government should focus, trace the possible risk areas and resources should be directed to places with high risk of insecurity.

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APPENDIX

**NASARAWA EGGON LOCAL GOVERNMENT AREA PROCESS FOR CONTROL SELF RISK
ASSESSMENT (CRSA)**

PROCESS	SUB PROCESS	RISK DISCRIPTION	INHERENT RISK H/M/L	CONTROL DISCRIPTION	TEST STEPS	RESIDUA RISK H/M/L
Employment	Seventy five (75%) percent's of people living here have to be employed	Unemployment usually result to some form of crime rate and violent agitator, it's breed discount against the state and any incident may trigger violent demonstration and social unrest which may result in loss of life and property also as a result of unemployment social security is jeopardize. It also instigate electoral violence and become automatic threat to social, economic and political security.		Proper supervision and adequate resources should be invented to support employment base across the Area, and there should be increase allocation of national budget for employment promotion activities. Government should increase effort to facilitate greater access of operators in the formal sector to the means of production through land and improve management technology.	Verity that out of hundred percent (100%) of people in each community how many are workers.	
Education	There should be primary and secondary schools in every community in the Area. We should have literate people	If people are not educated it will serve as a barrier to social development work with individual and groups in the community. It will cause inability and incapacity of individual		Adequate and conscious effort should be made to ensure improvement in the education and training provided to young people with a greater focus on vocational skills and	Verify if the communities have primary and secondary schools	

	in each community.	and group of all ages due to their exposure. Their action will not improve their quality of life; central to this is their inability to participate in democratic process.		training. People should be trained to acquire transferrable high skills highly meeting the current economic trend.		
Primary Health care clinic	Each community should be provided with a well equip clinic	The absent of health care or inadequate facility of health in a community will give access to different kind of disease like the polio, disability, Hepatitis B.A and C, meningococcal disease, invasive pneumococcal infection, which may lead to death and also challenges in time of birth delivery that also result to loss of life and will make people not to have interest to any democratic process due to negligence of the authority.		A well equip structure should be put in place. Professional and expert should be employ to manage it, also immunization should be introduce against feature disability	Verify, if the communities have a well primary health care clinic	
political position	Each community have to be consider in time of political sharing	Unequal or inappropriate distribution of political position may instigate dispute, grudge in the heart of individual which can also result to community crisis		Proper distribution of political position should be done with a highly consideration of the majority, minority, tribally and religiously.	Verify, Has there be properly distribution of political position	

Social amenity and infrastructure	There should be infrastructure to communities	Absent of infrastructure deny community of public benefit, private sector from inventing, as a result of poor road network, rather they are expose to disease such as cholera, typhoid, riches, stomach pains as a result of dirty water.		There should be road, water supply and electricity to allow stable economic activities	It should be verify whether the communities have access to road, pipe water, and electricity	
Dialogue	A justified dialogue on issue that seem to be complicat-ed	This involve disrespect and an attitude not ready to listen to one talk, also not ready to address diversity and division among tribes and religious		There should be dialogue among the community on dispute issues through their chief head	It should be verify that did they enter dialogue in times of dispute.	
Law	There should be law guiding communit-ies.	Ineffectiveness of law give rise to sexual abuse, drug abuse especially marijuana, stealing, killing, fighting and so many form of criminal act that result in insecurity of life and properties		There should be law that conveys social changes and shapes various form of life style.	Find out that the communities have law guiding them.	

Law reform agencies	Communities should regulate law guiding them	Failure in reforming the law will result to inadequate application of the existent law in time run as changes will be taking place in the communities as a result it may fail in imposing a appropriate punishment to some offences which can cause conflict among the individual, groups, tribes, and religious.		Communities should have their law reform agencies with the responsibility of monitoring the operation of the law and proposing and reforming of the law as changes occurs in the communities.	The communities should be verify to know if they have law reform agencies.	
Police station	There should be a police station in each community	The absent of police station will result to break down of rules, less privilege will be deny their right, and dehumanize people.		Police station should be site in each community to avert the breakdown of rules and regulation, to protect and defend the less privilege there right.	It should be verified that each community have a police station	
Schools	Each community should have Nursery, Primary and Secondary schools	Lack of schools in a community or society will give ways for illiteracy, restricting people from social life and adopting the primitive and cultural way norms that hinders civilization as a result will under develop the community, society and environment and at times may result to violence due to miss understanding that can easily occur in there mist		Each community should be provided with nursery, primary and secondary schools to eliminate illiteracy from the communities	It should be verify that each community have nursery, primary, secondary schools and a well equip, quality and quite a number of staff.	s

S/No	Process	Inherent Risk			Residual Risk		
		High (H)	Medium (M)	Low (L)	High (H)	Medium (M)	Low (L)
1	Employment						
2	Education						
3	Political position						
4	Social Amenities and infrastructure						
5	Police Station						
6	Law						
7	Dialogue						
8	Law reform agency						
9	Primary Health care						
10	Schools						

Control self Risk Assessment (CSRA)	Risk before assessing the community (Inherent) X_1	Risk after assessing the community (Residual) X_2
Number of high Risk (Unsatisfactory Risk)		
Number of medium (Needing improvement)		
Number of low Risk (which is satisfactory)		

This is the analysis of one the community

The test for **KUBA HAMLET** community

Control self Risk Assessment (CSRA)	Risk before assessing the community (Inherent) X_1	Risk after assessing the community (Residual) X_2
Number of high Risk (Unsatisfactory Risk)	5	4
Number of medium (Needing improvement)	2	4

Number of low Risk (which is satisfactory)	3	2
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Number of satisfactory Risk after assessing is 2

Number of needing improvement Risk after assessing is 4

Number of unsatisfactory Risk after assessing is 4

Hence to calculate the value of risk present in this community I use the simplex method of Linear Programming.

Let x_1 and x_2 represent the number of inherent risk and residual risk given by;

Min: $4x_1 + 4x_2$ Objective function

Subject to the constraints

To get the solution variables, we take the percentage value of each process.

$$5/4 \times 100 = 125$$

$$2/4 \times 100 = 50$$

$$3/2 \times 100 = 150$$

To proceed, let x_1 and x_2 represent the number of inherent risk and residual risk given by;

Min : $4x_1 + 4x_2$

Objective

$$5x_1 + 4x_2 \geq 125$$

$$2x_1 + 4x_2 \geq 50$$

$$3x_1 + 2x_2 \geq 150$$

Where $x_1 \geq 0$ and $x_2 \geq 0$

Solution

We augment the matrix corresponding to the minimization problem above

$$\left| \begin{array}{ccc|c} 5 & 4 & : & 125 \\ 2 & 4 & : & 50 \\ 3 & 2 & : & 150 \\ \dots & \dots & & \dots \\ 4 & 4 & : & 0 \end{array} \right|$$

Next, we form the **transpose** of this matrix by interchanging its rows and columns.

$$\begin{array}{ccc|c} 5 & 2 & 3 & : & 4 \\ 4 & 4 & 2 & : & 4 \\ \dots & \dots & \dots & & \dots \\ 125 & 50 & 150 & : & 0 \end{array}$$

thus our dual maximization problem will be

$$\text{Max : } 125x_1 + 50x_2 + 150x_3$$

Dual objective function

$$5x_1 + 2x_2 + 3x_3 \leq 4$$

$$4x_1 + 4x_2 + 2x_3 \leq 4$$

Where $x_1 \geq 0$, $x_2 \geq 0$, and $x_3 \geq 0$.

Solution

Multiply the dual objective function by -1

$$\text{Max : } -125x_1 - 50x_2 - 150x_3$$

$$5x_1 + 2x_2 + 3x_3 \leq 4$$

$$4x_1 + 2x_2 + 2x_3 \leq 4$$

Bas. variable	x_1	x_2	x_3	s_1	s_2	b
s_1	5	2	3	1	0	4
s_2	4	2	2	0	1	4

Departing S_3 - 125 -50 -150 0 0 0

↑

New Row 1

$$OR_1/3 = 5/3 \quad 2/3 \quad 3/3 \quad 1/3 \quad 0/3 \quad 4/3$$

$$NR_1 = 5/3 \quad 2/3 \quad 1 \quad 1/3 \quad 0 \quad 4/3$$

$$NR_2 = OR_2 - 2NR_1$$

$$4 \quad 4 \quad 2 \quad 0 \quad 1 \quad 4$$

-

$$NR_2 = \begin{array}{cccccc} & 10/3 & 4/3 & 2 & 2/3 & 0 & 8/3 \\ \hline & 2/3 & 8/3 & 0 & -2/3 & 1 & 4/3 \end{array}$$

$$NR_3 = OR_3 - (-150)NR_1$$

$$- \begin{array}{cccccc} -125 & -50 & -150 & 0 & 0 & 0 \\ -250 & -100 & -150 & -75 & 0 & -200 \\ \hline 125 & 50 & 0 & 75 & 0 & 200 \end{array}$$

Basic variable	x_1	x_2	x_3	s_1	s_2	b
x_3	$5/3$	$2/3$	$1/3$	$1/3$	0	$4/3$
s_2	$2/3$	$8/3$	0	$-2/3$	1	$4/3$
s_3	125	50	0	50	0	200
				↑ x_1	↑ x_2	

Interpretation

From this final tableau, we see the present value of Risk in this community from Row s_3 to be 200.

To verify our minimization objective function of Inherent and Residual Risk

$$\text{Min} : 4x_1 + 4x_2$$

Substitute the value of s_1 and s_1 from the final tableau

$$\text{Min : } 4x_1 + 4x_2$$

$$4(50) + 4(0)$$

$$200 + 0$$

$$200$$