

Participatory and Inclusive Education in Comprehensive Community Safety: A Study Based on the Assessment of Rural Vulnerability in Ecuador

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Abstract

This paper is part of a study that addresses the strengthening of comprehensive security as an important factor for the sustainable development of the “El Forastero” neighborhood, located in the rural parish of Belisario Quevedo, Ecuador. The community faces a critical level of vulnerability to human-induced and natural risks; in some cases, it has limited access to basic services and economic opportunities, even though its main source of income is agriculture and livestock farming. The research was conducted using a mixed-methods approach, incorporating observation, surveys, and community participation in order to assess the current state of the neighborhood. The survey was conducted on a non-probability sample of 73 residents; among these families, there are 5 who care for people with disabilities, and direct field observation was also carried out. The results show that the main threat to this site is volcanic eruptions (80%), followed by landslides (78%) and floods (65%); likewise, the top priorities are access to drinking water (84%) and sewer systems (76%). This shows that the level of vulnerability to natural hazards and infrastructure limitations is high. Finally, it can be said that strengthening organizational capacity and implementing risk management programs are strategies of the utmost importance for increasing resilience and sustainability.

Keywords: Training, Sustainable Development, Risk Management, Comprehensive Safety.

1. Introduction

Strengthening comprehensive security is considered a key element for sustainable development and social well-being, particularly in rural areas that are vulnerable in social, environmental, and economic terms. Globally, development is based on meeting current needs without compromising the ability of future generations to meet their own needs, taking into account the factors mentioned above (Mensah, 2019). At this point, the United Nations (UN), through the 2030 Agenda and the Sustainable

Development Goals (SDGs), outlines methods and strategies aimed at reducing inequalities, promoting the sustainability of cities and communities, ensuring access to basic services, and fostering community acceptance (United Nations, 2015; Sustainable Development Goals, 2022). Similarly, comprehensive security is understood as a set of guidelines aimed at preventing, mitigating, and responding to natural and human-induced threats that affect their environments and populations (Acecho Seguridad, 2024; Gonzales, 2018).

At the national level, Ecuador faces significant challenges that link risk management to the development of communities, particularly in areas with inadequate infrastructure and limited access to basic services. The Ecuadorian government has implemented risk management and comprehensive safety measures with the aim of strengthening prevention, training, and response to disasters and emergencies (Reinoso Moreno y Fernández Moreno, 2017; Servicio Nacional de Gestión de Riesgos y Emergencias, 2018). According to the National Planning Council of the Republic of Ecuador (2024), it identifies the needs of resilient and sustainable territories through processes that involve communities in the management of their resources and decision-making. These activities are designed to reduce the social and economic conflicts that exist in vulnerable rural areas.

In rural communities, sustainable development requires a balance between economic growth, environmental protection, and social inclusion; furthermore, the specific conditions of each region are taken into account. According to Yunus Khan (2019), the rural sector must strengthen local capacities through educational and administrative measures that lead to continuous improvement in residents' quality of life by integrating systems of investment, participation, and institutional consolidation, thereby facilitating adaptation to the needs of challenging scenarios arising from anthropogenic and natural risks.

Furthermore, risk management is a key tool for minimizing vulnerability and fostering community acceptance. According to the National Risk and Emergency Management Service (2018), risk management involves processes aimed at identifying, assessing, analyzing, and controlling threats that could harm people, infrastructure, and property. According to Villena Falcones (2019), prevention, recovery, and preparedness mechanisms are directly linked to the community in order to facilitate optimal responses to emergency situations. Therefore, scheduled training activities and community-based preventive measures are key strategies for reducing negative impacts and strengthening safer communities.

Comprehensive security is not only based on economic, environmental, and social factors, but it also extends beyond the physical protection of individuals, which has a direct impact on the quality of life of the population. Gonzales (2018), states that comprehensive security involves a link between protection, prevention, and acceptance, taking into account both human-induced risks and natural

hazards. Similarly, Reinoso Moreno and Fernández Moreno (2017), note that in rural settings, safety allows for adaptation to specific conditions such as poor infrastructure, limited access to basic services, and frequent exposure to natural environments. This shows that measures need to be implemented to strengthen local capacities and foster a culture of prevention.

It is important to emphasize community participation, as it is a key pillar in building sustainable and inclusive communities. According to Bin Kashim and Harith Zikri (2024), the involvement of local residents helped to strengthen social integration and improve the effectiveness of initiatives aimed at community development. Similarly, Strathmann, Strathmann (2024), states that public participation in risk management processes enhances the effectiveness of the actions taken, leading to outcomes that benefit the community. In conclusion, neighborhood governance and the collaborative effort between institutions and residents establish specific measures to comprehensively address social and economic issues. The neighborhood of "El Forastero," located in the rural parish of Belisario Quevedo in the city of Latacunga, faces challenges related to security and sustainable development. The community is currently facing obstacles to accessing basic services, administrative difficulties, and vulnerability to natural hazards, all of which are affecting the quality of life of its residents. On the other hand, the economy depends primarily on livestock farming and agriculture, which exacerbates the lack of community-based prevention and management systems. Therefore, the study presented in this document aims to analyze the social and economic needs of the "El Forastero" neighborhood, identify risk factors, and suggest training strategies geared toward the development of risk management, neighborhood governance, and sustainable development, which will lead to improved living conditions and greater acceptance among the population.

2. Methodology

This research study employs a mixed-methods approach, combining quantitative and qualitative methods, and focuses on the analysis of "Strengthening Comprehensive Security for the Sustainable Development of Social and Economic Needs in the El Forastero Neighborhood.". Además, se aplicaron técnicas participativas que den lugar a la identificación de los problemas, recolección de datos y evaluación de los resultados.

2.1. Population and Sample.

Given that the “El Forastero” neighborhood in the rural parish of Belisario Quevedo, located in the city of Latacunga, has a population of approximately 73 families—among whom there are 5 people with disabilities—these residents are exposed to various natural and human-induced risks, while the local economy is based primarily on livestock farming and agriculture. Therefore, the sample is considered a non-probability sample by design, allowing the number of participants essential to the research to be limited (Otzen y Manterola, 2017).

2.2. Instruments

- **Survey:** conducted among residents of the “El Forastero” neighborhood to gather quantitative data on risk management, safety, and sustainable development. Include sample size, selection criteria.
- **Observation:** Regular visits during which living conditions, housing infrastructure, and social dynamics were observed.
- **Community involvement:** We participate in community activities to better understand the needs and perspectives of residents.

2.3. Data Collection Procedure

- **Preliminary Assessment:** Literature Review and Site Inspection of the Study Area Data.
- **Implementation of mechanisms:** Survey administered to residents of the “El Forastero” neighborhood. Direct field observation, with methodological adjustments following a pilot phase.
- **Community Verification:** Reporting Results to Neighborhood Leaders and Community Stakeholders.
- **Data Analysis:** The data collected by the survey app was analyzed using descriptive statistics, while the inspections of living conditions, housing

infrastructure, and social dynamics will be documented in reports that provide a detailed

overview of each of these areas.

The following stands out in particular in the data analysis:

- Perception of risks.
- Social and Economic Needs.
- Level of community participation.
- Impact of Interventions.

residents of the “El Forastero” neighborhood is guaranteed, taking into account the following:

- Confidentiality and Anonymity.
- Justice
- Beneficence and non-maleficence
- Informed Consent
- Respect for autonomy
- Ethics Approval
- Feedback to the Community

2.5. Validation of the instrument

The questionnaire underwent a content validation process through review and evaluation by three experts in risk management, research methodology, and community development. The professionals evaluated each component based on criteria of appropriateness, clarity, and relevance. Consequently, a pilot study was conducted with a sample of 15 participants who were similar to the target population. The reliability of the instrument was also assessed using Cronbach’s alpha coefficient, which yielded a value greater than 80%, considered adequate for this study.

2.6. Calculation of the Vulnerability Index

For this section, a vulnerability index was developed based on the frequency and perception of risks and the priority needs identified by the residents. The index incorporates variables related to natural hazards, basic infrastructure, organization, and access to basic services.

Each variable is rated on a scale of 0–1 based on its level of importance; to do this, a weighted sum of the selected indicators was calculated.

The final score allows the vulnerability level to be classified into low, medium, high, and critical categories, ensuring that automated strategies for strengthening the rural community are prioritized. Equation 1: Vulnerability Index

$$IVC = \frac{\sum_{i=1}^n \omega_i X_i}{\sum_{i=1}^n \omega_i} \quad (1)$$

X_i : indicator value

ω_i : assigned weight

n : indicator number

Equation 2: Frequency-Based Weighting

$$\omega_i = \frac{Valor_i}{\sum Valor_i} \quad (2)$$

2.4. Ethical Considerations

The ethical principles that are fundamental to this research have been adhered to. Therefore, the protection of the rights, safety, and well-being of the

3. Results

The survey was administered to a total of 73 people, including 5 people with disabilities who are members of families residing in the “El Forastero” neighborhood of the rural community of Belisario Quevedo. This methodology was employed in this study, providing a representative and detailed overview of the neighborhood’s current situation. Furthermore, the results will be broken down into four key points, resulting in comparative tables that highlight significant responses, which will inform the design of strategies to improve residents’ quality of life.

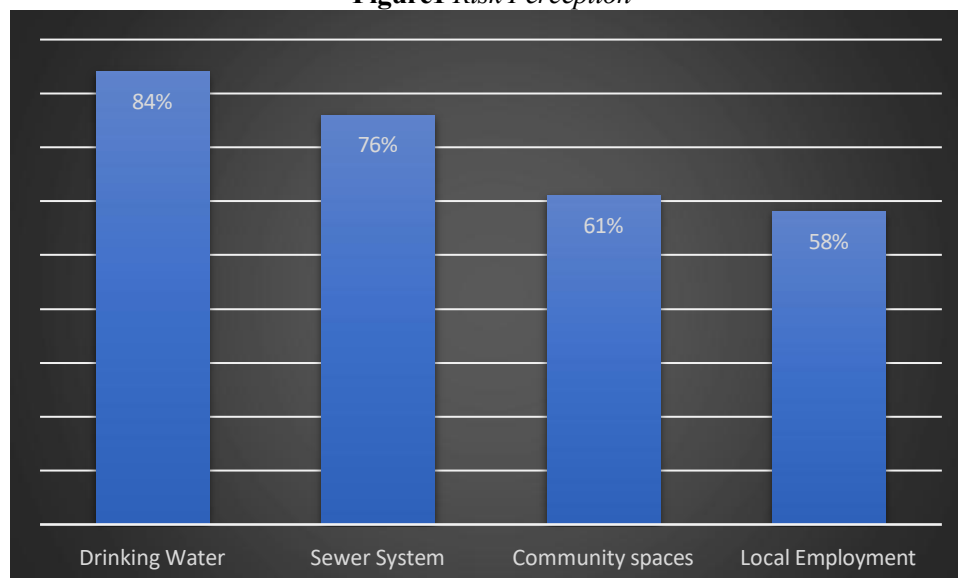
3.1. Risk Perception

Table1 *Risk Perception*

Risk	%	Ranking	Comments
Volcanic Eruptions	80%	1	Proximity to the Cotopaxi Volcano
Landslides	78%	2	There were landslides coming from the hill
Floods	65%	3	Heavy rains are causing rivers and streams to overflow
Neighborhood Insecurity	52%	4	Lack of patrols and streetlights
Electrical hazard	39%	5	Lack of maintenance on electrical connections (old wires)

Note. Table 1 shows the perception of the most significant risks that need to be addressed for future improvements in the neighborhood. Prepared by: The authors.

Figure1 *Risk Perception*



Note. Figure 1 shows the most significant risks that may be present in the “El Forastero” neighborhood. Prepared by: The authors.

The results show that 80% of residents in the “El Forastero” neighborhood identify volcanic eruptions as one of the most significant risks. Although the Secretariat of Risk Management maintains that the sector’s geographic location is classified as a safe zone or high ground in the event of a possible eruption of the Cotopaxi volcano, it should be emphasized that residents’ main concerns regarding this situation are the blocking of roads and bridges, shortages of basic necessities and fuel, lack of communication and power outages, as well as the impacts of ash fall, contamination of drinking water, and the strain of accommodating evacuees. Landslides affect 75% of the community; this indicates the geographical conditions and the presence of unstable terrain in the area. Similarly, flooding is a major risk, at 65%, which reflects residents’ concerns about heavy rains and the lack of a proper sewer system. On the other hand, neighborhood insecurity, at 52%, reflects concern over the lack of community surveillance and governance to address criminal activity. In closing, with a prevalence of 39%, this is directly linked to a lack of maintenance of electrical connections and their deterioration.

Furthermore, these results show that residents identify each of these threats stemming from natural and human-induced risks, highlighting their vulnerability and the need to strengthen risk

management, administration, and prevention systems to improve residents’ quality of life.

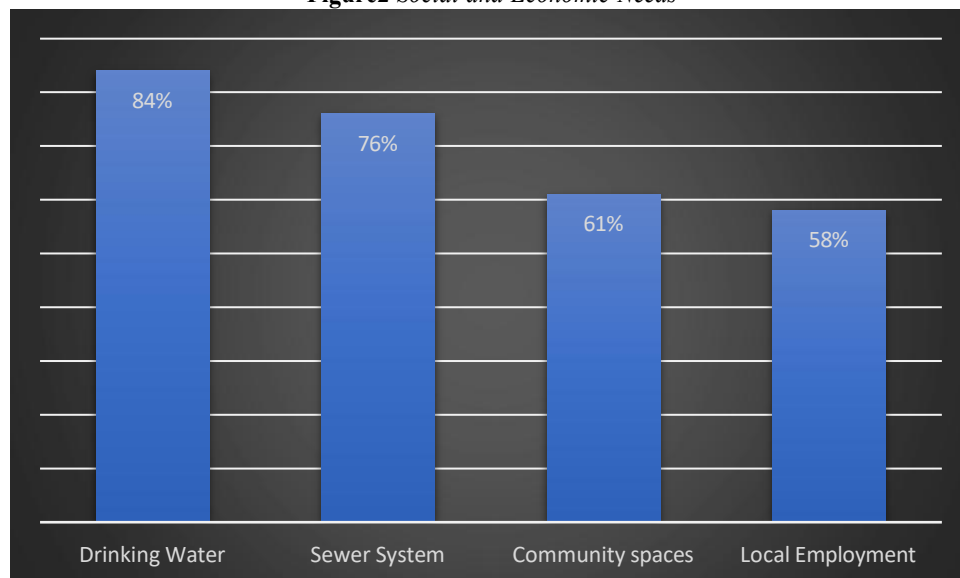
3.2. Priority Needs

Table2 *Social and Economic Needs*

Nonsense	%	Ranking	Impact
Drinking Water	84%	1	It has a direct impact on health and risk management
Sewer System	76%	2	It increases health risks
Community spaces	61%	3	Limit Administration and Training
Local Employment	58%	4	It leads to migration and a loss of roots

Note. Table 2 reflects the priority needs in the social and economic context and allows for a comparison of the neighborhood’s limitations in addressing the situation, based on the participatory assessment. Prepared by: The authors

Figure2 *Social and Economic Needs*



Note. The figure illustrates the social and economic challenges the neighborhood is currently facing. Prepared by: The authors

The findings presented regarding priority needs in the social and economic context confirm that access to safe drinking water is a key need in the “El Forastero” neighborhood, accounting for 84% of the total, due

to its direct impact on health and adequate sanitation systems. Similarly, the sewer system is cited as a major problem by 76% of respondents, reflecting the community’s concern about the rise in health issues and unsanitary conditions caused by the lack of

3.3. Community Participation

sanitation infrastructure. As for community spaces, they account for 61%, revealing a lack of environments that support neighborhood governance, training, and social engagement. Finally, the local employment rate stands at 58%, indicating that limited job opportunities are driving residents to migrate and leading to a loss of community ties. In conclusion, this comparison is linked to the factors that affect limitations in basic services, infrastructure, and economic development, bearing in mind that these factors also influence the community's security and development.

Table3 *Community Involvement in Various Situations*

Participation	Result	Comments
Willingness to collaborate	High	Training and Brigades
Risk Awareness	Medium	They recognize the risks, even though they don't know how to deal with them
Neighborhood Organization	Low	There are no guidelines or meetings

Note: Table 3 shows that residents can participate in various improvement processes despite organizational constraints. Prepared by: The authors
Community participation shows that the results for the “El Forastero” neighborhood are not particularly favorable, even though there is a high level of willingness to collaborate on community improvement—primarily through training sessions and volunteer groups that strengthen knowledge regarding risks. Similarly, awareness of risks was rated as moderate, as it shows that residents recognize the threats originating in the area; however, they currently face limitations in how to respond to

different emergency scenarios. Furthermore, during the analysis of the neighborhood organization, the results were poor because there is no leadership in place to manage the neighborhood and provide the necessary support; this situation hinders coordination and joint decision-making. Finally, these results show that, although the municipality is willing to collaborate and is committed to the effort, it is clearly necessary to strengthen the organization and training processes in order to improve the quality of life for residents and ensure comprehensive safety in the area under study.

3.4. Expected Impact

Table4 *Impact*

Proposal	Result	Impact
Risk Management Training	High	Mínimiza la vulnerabilidad
Infrastructure Improvements	Very high	Prevención de desastres
Organizational Strengthening	Medium	Sostenibilidad del proceso

Note. Table 4 shows the acceptance of systematic strategies that promote comprehensive safety and improve residents' quality of life.

The results show that the proposal leads to prioritizing both physical and pedagogical interventions as precautionary measures in response to the existing environment and threats. The assessment of risk management training programs could minimize the vulnerability in the “El Forastero” neighborhood, with an emphasis on infrastructure improvements, since this component received a very high rating and contributes to natural disaster prevention—which is the impact the residents involved are hoping for. Similarly, organizational strengthening received an average

rating, which indicates the sustainability of the process itself.

While it is true that the survey made it possible to verify and collect essential data on the situation facing the neighborhood, taking residents’ opinions into account, this allowed for specific decisions to be made to improve residents’ quality of life; one such decision is to provide training that addresses the issues mentioned in this study.

3.5. Vulnerability Index

Based on the survey results, a table called the “indicators table” was created, taking into account the natural hazards, basic needs, and infrastructure conditions identified by the participants in this study, as shown in Table 5.

Table5 *Table of Indicators*

Indicator	Value	Weight
Volcanic Eruptions	80	0,21
Landslides	78	0,20
Floods	65	0,17

Drinking Water	84	0,22
Sewer System	76	0,20
Total	383	1

Note. Table 5 shows the most vulnerable areas based on the survey conducted in the community.

Applying equation (1) for the vulnerability index, we obtain the following:

$$IVC = (80 * 0,21) + (78 * 0,20) + (65 * 0,17) + (84 * 0,22) + (76 * 0,20) = 77,13$$

Based on the following table:

Table6 Vulnerability Scale	
IVC	Nivel
0 – 25	Bajo

26 – 50	Medio
51 – 75	Alto
76 – 100	Crítico

Note. Table 6 shows the vulnerability scale ranging from low to critical.

According to the assessment, the community vulnerability index of 77.13 indicates that the community is at a critical level, showing that it is highly exposed to natural hazards—particularly volcanic eruptions, landslides, and floods—and also faces significant limitations in its sewer and drinking water systems.

3.6. Training Plan

Table7 Training Program – Risk Management

Training Program to Strengthen Comprehensive Security in the “El Forastero” Neighborhood				
Objective: To strengthen the “El Forastero” neighborhood’s capabilities in risk management, emergency response, and prevention.				
Target population: Residents of the “El Forastero” neighborhood, community leaders, representatives of the Belisario Quevedo Parish Decentralized Autonomous Government (GAD), etc.				
Module	Topic	Objective	Content	Duration (Hours)
1	Introduction to Comprehensive Risk Management	To train residents of the “El Forastero” neighborhood so they can identify, assess, and prioritize the risks that threaten the community and sustainable development.	Definition of risk, threat, vulnerability, and capacity Types of Risks Stages of Comprehensive Risk Management Ecuador's Legal and Institutional Framework for Risk Management	4H
2	Formation of Community Committees	Establish community committees to improve safety and mitigate risks	Establish the roles and responsibilities of the committee Coordination Among Authorities and Civil Protection	3H
3	Risk Assessment and Analysis	Teach techniques for identifying and assessing risks	Methods for Identifying Threats and Vulnerabilities Publicize existing risk maps Scenario Assessment	4H
4	Response Management and Victim Support	Train residents of the “El Forastero” neighborhood to respond immediately to emergencies and provide assistance to those in need	Emergency Protocols Victim Assistance	

Emer genc	y	Services	4H	Coordination
5	Transportation of People with Disabilities	Train residents on techniques, assistance, mobilization, and the safe	Types of Disabilities and Specific Needs 4h	During an Emergency

		transport of people with disabilities during various emergency scenarios	Principles of Inclusive Care and Appropriate Treatment for People with Disabilities Identifying risks and planning accessible evacuation routes Basic Techniques for Safe Mobilization and Transfer Effective Communication with People with Hearing, Visual, Intellectual, or Psychosocial Disabilities Evacuation Procedures and Community Support in Emergencies
6	Development monitoring of community plan	Develop a participatory and risk management plan with the community and monitor its implementation	Design of action plan, responsible parties, resources Community validation Monitoring Mechanisms

8H

4. Discussion

The study found that the survey had 73 participants, of whom 32% were female, 47% were male, and 1% were non-binary, highlighting a balanced sample.

The results revealed a high perception of vulnerability to natural hazards, particularly volcanic eruptions and landslides, with a key finding being the Community Vulnerability Index (CVI), which had a value of 77.13, placing it at the critical level. These findings are consistent with a study reported by Villena Falcones (2019), who states that rural communities located in areas at risk require permanent preparedness and response systems. Similarly, the limited availability of basic services is consistent with studies on sustainable rural development in Latin America, which highlight the lack of infrastructure, as this increases economic and social vulnerability.

Furthermore, the community under study shows an increase in residents' willingness to participate in the commune's various training and organizational processes, which demonstrates that this factor is conducive to building territorial resilience. The importance of implementing effective risk management—including communication mechanisms that keep the "El Forastero" community informed about potential threats—is emphasized. It is worth noting that this citadel is located near the

Cotopaxi volcano, which threatened to erupt several years ago, suggesting that organization may be one of the key factors in reducing exposure and improving the population's adaptive capacity.

5. Conclusion

Based on the findings, it was determined that the El Forastero neighborhood is significantly vulnerable to various risks and threats, primarily due to the lack of resilient infrastructure, limited information on risk management systems, and a lack of community organization in response to natural disasters. It is crucial to highlight the neighborhood residents' valuable capacity for social cohesion and collaboration, which is essential for the implementation of future activities. Identifying vulnerable areas and capabilities has been a cornerstone for guiding improvement efforts.

An analysis of the neighborhood's needs revealed socioeconomic shortcomings, including reduced access to basic services. As a result, opportunities for economic development and programs that promote community self-sufficiency were identified.

Insecurity and vulnerability combine to create a high level of vulnerability in organizational processes, promoting sustainable development and organizational structure within the context of risk

management, thereby fostering productive and self-management skills.

A training program directly addresses the needs that the neighborhood has faced for a long time; furthermore, this proposal serves as an important and viable tool for improving overall safety and promoting sustainable development.

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8. Author Declaration

8.1. Use of artificial intelligence (AI)

This research utilized ChatGPT and Gemini as supporting tools for organizing and synthesizing bibliographic information; however, these tools had no influence on data collection, analysis, or interpretation. The validity, accuracy, and scientific content of the study were solely the responsibility of the authors.