SCIENTIFIC CULTURE
www.sci-cult.com

SCIENTIFIC CULTURE, Vol. 12, No. 1.1, (2026), pp. 4737-4752
Open Access. Online & Print

DOI: 10.5281/zenodo.121126330

DISASTER RISK POLICY PROGRAM TO IMPROVE PREVENTION COMPETENCIES OF REGIONAL GOVERNMENT SERVERS, PERU 2025

Lisbeth Roxana Becerra Saguma[1]*, Pedro Otoniel Morales Salazar[2], Eduardo Javier Yache Cuenca[3]

[1,2,3] ***Universidad César Vallejo.***

Received: 01/12/2025
Accepted: 02/01/2026

Corresponding author: Lisbeth Roxana Becerra Saguma
(lbecerrasa@ucvvirtual.edu.pe)

ABSTRACT

The objective of the research was to demonstrate to what extent the application of the disaster risk management policy program improves the prevention skills of the servants of a Regional Government of Peru. We worked under a quantitative approach and quasi-experimental design, applied to two groups: an experimental group and a control group, each composed of 90 participants selected by convenience sampling, from a population of 240 workers. The results showed that, before the intervention, the experimental group had a predominance of low levels of preventive competence (73%) and a minimal proportion of high levels (1%). After the implementation of the programme, a substantial change was observed, going to 68% at the high level and reducing the low level to 6%. The findings support the general hypothesis, showing that an intervention structured from the approach of risk management policies significantly improves the prevention competencies of public servants of a regional government, this is proven with the value achieved in the Mann Whitney U test with a p value of 0.000 < 0.05, without this implying affirming absolute or universal effects, but also advances observed in the specific conditions of the study.

KEYWORDS: Prevention skills, Disaster risk, management, Training Program, Public Policies.

1. INTRODUCTION

Research on Disaster Risk Management (DRM) Policy and its improvement in disaster prevention in a regional government of Peru has relevance in the scientific, social and institutional aspects. On a scientific level, it is a relevant study because it contributes to the generation of critical and contextualized knowledge on the way in which public policies for risk reduction provide evidence that can support future interventions and theoretical models in analogous contexts. In relation to society, the research highlights the importance of the search for protection for human life, as well as for livelihoods and sensitive infrastructure, especially in areas where inequality, vulnerability and social exposure predominate, which expose the population to various threats of nature. such as heavy rains, floods, landslides or earthquakes.

On the other hand, with regard to the institutional environment of the entities that work in this environment, this study will contribute to the fortification of planning and coordination processes, in the same way as decision-making, since it allows the identification of structural deficiencies and the promotion of a culture of prevention and resilience.

This research is incorporated into the scope of Sustainable Development Goal 11, which aims to build inclusive, sustainable and resilient cities and communities.

The effectiveness of disaster risk management policies in the face of heavy rainfall is related to the theoretical aspect of integrated risk management that emphasizes rescue management and the efficient elimination of hazards. According to UNDRR (2022), in the international legal provisions of the Sendai Framework, they highlight the importance of government action in a coordinated and planned manner based on confirmed data. Current research has detailed the execution of decisions about dealing with threats. In Spain, research has been carried out on the way in which the public conception of the threat makes it important for preventive strategies to be accepted, proposing strategies that allow greater participation in the preparation of these decisions by the authorities (World Bank, 2022). Thus, research in Chile highlights the differences between regions in terms of disaster prevention competencies to prepare for torrential rainfall, revealing the absence of regulatory knowledge and multi-level organization (Olivares et al., 2023).

Coordinated participation of different levels of government and social actors is a fundamental factor that implies the effectiveness of these policies. In the government's decision to deal with the threat of disasters, different actions are defined in order to increase the coordination of the entities through a series of public agencies in the country, articulated and in a decentralized manner. As in other places, in Peru the relevance of community education on risk management is recognized as elements that complement the effectiveness of these policies. It is essential to understand and be trained for risk if action is to be taken, with special emphasis on the most vulnerable communities and defining homogeneous procedures that are useful to deal with dangerous circumstances; relevant documents will be applied for action to restore damaged communities (Gamo, 2020).

In this way, in Peru a set of agencies have been formed that have the power to adopt decisions related to the management of catastrophic risk and improvement of environmental awareness and education, with the leadership of the President of the Republic. These institutions have the competence to articulate the national and international dimensions, as well as to articulate the sectoral actions committed to the management of catastrophic risk. According to Escuder-Bueno et al. (2023) the hazards in the stages of torrential rainfall are the ones that appear most frequently in Peru. Estimating that the presence of these phenomena has become frequent since 2017.

Similarly, there has been a scarcity of research that addresses community training and education as key elements in risk management, thus highlighting the need to incorporate participatory approaches that integrate cultural beliefs and mitigation strategies that influence risk perception and the design of public policies (Córdova, 2020).

This research aims to answer the following central question: To what extent does the program based on disaster risk policies improve the prevention skills of public servants of a Regional Government of Peru 2025? Within this framework, specific problems have been formulated that allow the phenomenon to be approached from two complementary perspectives: diagnosis and contrast. Regarding the univariate: What is the level of prevention competencies achieved before and after the implementation of the program based on disaster risk policies of a regional government in Peru 2025?

What is the level achieved of the dimensions of prevention competencies before and after the implementation of the disaster risk policy-based program of a regional government of Peru 2025?

On the other hand, in the field of contrast: To what extent does the program based on disaster risk policies improve the normative knowledge of servants of a regional government of Peru 2025?, To

what extent does the program based on disaster risk policies improve the preventive leadership of servants of a regional government of Peru 2025?, To what extent does the disaster risk policy-based program improve the preventive management of servers of a regional government of Peru 2025?, To what extent does the program based on disaster risk policies improve the effective communication of servers of a regional government of Peru 2025?, To what extent does the program based on disaster risk policies improve the continuous monitoring of servers of a regional government of Peru 2025?

Regarding its theoretical foundation, the research contributes to the epistemological development of the field of public management, by analyzing the articulation of preventive policies from a territorial perspective. It also generates new knowledge by proposing a programmatic model that articulates the fundamentals of public governance with current trends in disaster risk management, underscoring the need to consolidate institutional and personnel capacities to strengthen prevention. This research broadens the understanding of the role of the public servant as a key agent in the implementation of preventive policies, promoting an integrated vision where risk management becomes an essential component of planning.

In practical terms, in the applied aspect, it will facilitate the recognition of gaps, critical points and areas for improvement that hinder the efficient execution of risk management policies at the regional level. At the same time, it will offer a program aimed at strengthening the preventive competencies of public servants, providing them with conceptual and operational tools that favor a more efficient, proactive and articulated institutional management with the local and national levels.

Its social value is reflected in the purpose of reducing citizen exposure to disaster situations through a preventive approach, which contributes to reducing vulnerability to natural and man-made disasters. The proposal seeks to promote the commitment of public servants, promoting sustainable actions that protect life, the environment and territorial development. In this way, research transcends the institutional sphere and becomes a tangible contribution to collective well-being and community resilience.

From a legal perspective, it is based on the current national regulatory framework on disaster risk management, in particular Law No. 29664, which gives rise to SINAGERD and its regulations approved by Supreme Decree No. 048-2011-PCM. It is also linked to the National Policy on Disaster Risk Management and to the State's planning instruments, highlighting the regional government's commitment to incorporate risk management into its policies and plans following the principles of prevention, efficiency and sustainability.

It is environmentally relevant research, as it promotes sustainable strategies for adaptation to climate change, and viable, as long as there is access to public information, institutional regulations and key actors in the regional public sector. In short, this work seeks to generate proposals that allow us to achieve safer, more resilient and sustainable cities and communities, in accordance with SDG 11.

As described, the general objective is proposed: To demonstrate to what extent the application of the program based on disaster risk policies improves prevention competencies in a Regional Government of Peru. Regarding the univariate objectives: Determine the level of prevention competencies achieved before and after the implementation of the disaster risk policy-based program of a regional government in Peru 2025, Determine the level achieved of the dimensions of prevention competencies: before and after the implementation of the program based on disaster risk policies of a regional government in Peru 2025.

On the other hand, from a bivariate perspective, it is intended to demonstrate to what extent the program based on disaster risk policies improves the normative knowledge of public servants of a regional government of Peru 2025, to demonstrate to what extent the program based on disaster risk policies improves the risk and vulnerability of public servants of a regional government of Peru 2025, demonstrate to what extent the disaster risk policy-based program improves the preventive management of servers of a regional government of Peru 2025, demonstrate to what extent the program based on disaster risk policies improves the effective communication of servers of a regional government of Peru 2025, it is also sought to demonstrate to what extent the program based on disaster risk policies improves the continuous monitoring of servers of a regional government of Peru 2025.

In order to find antecedents in the national and international contexts for this research, a search was carried out in recognized and academically accepted sources. In addition, literature has been consulted in databases of specialized scientific articles such as Scopus, Web Of Science, SciELO, ensuring the quality, relevance and timeliness of the data analyzed. Likewise, academic theses from recognized universities have been reviewed.

At the international level, Guimarães et al. (2025) present a study that analyzes the effect of community resilience and the different stages of the risk management cycle on post-floods. The research was applied to 66 flood-affected communities in seven countries (Bangladesh, El Salvador, Malawi, Mexico, Nepal, Senegal and Vietnam) and used the FRMC (Flood Resilience Measurement for Communities) instrument. The results show that communities with higher levels of preparedness and social capital reduced the mortality rate by 32% and serious injuries by 28% compared to those without consolidated preventive strategies.

Suárez et al. (2022) carried out a study aimed at measuring and strengthening population resilience to catastrophic risks in the jurisdictions of Jojutla and Yautepec, State of Morelos (Mexico). It made it possible to evaluate the impact of the program through a population resistance scale, Thus, the study demonstrates that experimentally guided preventive training strengthens the adaptive capacity of communities in disaster scenarios.

Dan (2022), based on the study aimed at defining the level of awareness that students have, in relation to the reduction of catastrophic risk, who participated in an educational intervention program in risk management. The pilot program consisted of the application of controlled drills, experiential workshops, and interactive modules on disaster prevention and response, developed over a period of eight weeks. The results showed significant increases of 42% in the level of preventive knowledge and a 35% improvement in risk perception within the experiment group.

Martínez (2021), in his study tries to evaluate the monitoring of hazards and procedures carried out by the population to face the dangers of catastrophes, he proposed to carry out an evaluation regarding the dangers and procedures of the population in the face of disaster situations in two rural populations in Pijijiapan, Chiapas. The research was structured with community intervention, applied to two rural communities, executing an event by areas in which social organizations and all the inhabitants participated. Although they have knowledge about preventive measures, they do not have knowledge about other hydrometeorological phenomena. After the intervention, the results showed an increase in knowledge about phenomena and risk management, as well as an improvement in the identification of community preventive measures.

Carrasco (2024) developed research focused on analyzing how social organizations affect the capacity for resilience and community recovery from a gender perspective. After the implementation of the community strengthening program—which included participatory workshops, simulation exercises, and neighborhood support networks—the level of knowledge increased. Likewise, the perceived social resilience index increased by 45.5%, evidencing a strengthening of social capital and community cohesion. The results indicated that inclusive strategies with a gender perspective promote more equitable and sustained participation in disaster preparedness and recovery processes.

Córdoba (2024), aimed at strengthening preventive awareness and disaster risk management in educational institutions Lima, Peru. The application involved 329 public and private educational institutions. In the diagnostic phase, only 41% of teachers and 36% of students showed adequate mastery of prevention knowledge. Following the implementation of the educational programme, which included drills, teaching materials and interactive training sessions, the group raised its level of knowledge.

2. MATERIALS AND METHODS

The purpose of this research is applied, according to OECD Oslo (2018). Likewise, CONCYTEC (2020) argues that applied research is oriented towards the use of knowledge to improve processes, services, or public policies in real contexts. It seeks to propose a program based on public policies to improve disaster prevention skills in public servants of a regional government in Peru. The research adopts a quantitative approach, since the collection and analysis of numerical information on the level of prevention skills in public servants will be carried out, as well as the implementation of disaster risk management policies. As far as the research design is concerned, it is quasi-experimental, which according to Creswell (2018) this design is appropriate when the researcher cannot control for all the factors in the environment, but wants to evaluate the effect of an intervention on a dependent variable.

The population was made up of 240 servants from the La Libertad region who were working under different contractual modalities during the year 2025.

The inclusion criteria include: regional government workers who perform administrative and field work, public servants who were working under different contractual modalities during the year 2025, public servants whose position, functions or responsibilities are linked to DRM activities, have a minimum seniority in the position of 6 months to ensure sufficient operational knowledge, agree to voluntarily participate in the research. The exclusion criteria include servers with disabilities that do not

allow them to understand or respond correctly (cognitive disability, language barriers without an interpreter) and those who do not have the means to participate in virtual modalities when the collection is through this channel, as well as those servers who did not want to be part of the study that is being carried out during the year 2025.

The sampling was non-probabilistic for convenience, and included a representative number of public servants who perform functions related to risk and disaster prevention. That is why we will work with a sample of 180 servers, divided into an experimental group with 90 servers and a control group made up of 90 servers.

The two groups were evaluated with a pre-test and a post-test at different times.

The diagram is as follows:

Diagrama del diseño cuasiexperimental

Grupos de estudio	Pretest	Estimulo	Postest
G. E.	O_1	X	O_2
G. C.	O_3	_	O_4

Siendo que:

O_1 y O_3: Pre test, grupo experimental – grupo control

O_2 y O_4: Post test, grupo experimental – grupo control

X : Programa de políticas de riesgo de desastres

G. E. : Grupo experimental

G. C. : Grupo control

\- : Ausencia del programa

Figure 1:
Note. In original language (Spanish)

In order to collect the necessary data, the survey technique was used, based on a questionnaire composed of 25 closed questions, organized according to the dimensions that make up the research variable, with a polytomic ordinal measurement scale of the Likert type, elaborated on a five-point scale (1= Never, 2= Almost Never, 3= Sometimes, 4 = Almost Always and 5 = Always). This questionnaire is designed to collect information on the dependent variable, this information was provided by the servers that are part of the sample, with this it is possible to measure the variable under study with its dimensions (Rodríguez, 2020).

The validity of the content of the questionnaire was carried out through the judgment of 6 experts. The evaluation of the construct validity of the items that make up the measurement instruments was carried out with the SPSS software, using the criteria (KMO) and Bartlet's sphericity test. The following was obtained: Regarding the prevention skills of the servers, the Normative Knowledge reached a KMO value of 0.840, higher than the minimum acceptable value of 0.50, accompanied by a Bartlett significance of 0.000, which shows an adequate correlation between the items. Similarly, Risk and vulnerability presented a KMO measure of 0.843 and a statistical significance of 0.000, confirming its structural consistency.

Regarding Preventive Management, a KMO index of 0.762 was obtained, with a significant B. test (0.000), which demonstrates the suitability of the set of items. Likewise, the effective Communication registered a sample adequacy of 0.735 and a significance level of 0.000. Finally, the Continuous Monitoring dimension showed a KMO value of 0.787, accompanied by a statistical significance of 0.000, validating its incorporation into the measurement instrument.

Cronbach's alpha coefficient test was applied to the dependent variable Prevention competencies. The global analysis yielded a value of 0.966, which represents an excellent level of internal consistency in the 25 items that make up the Likert scale, which shows that the items maintain a coherent structure and uniformly measure the constructed analyzed.

Inferential statistics were also used, the same that was carried out in the SPSS v26 statistical program, first the Kolmogorov-Smirnov test was applied to evaluate normality because the sample is greater than 50 data. As the data did not comply with normality, Student's t will not be used for related samples. In the case of this research, the Mann-Whitney U test was applied for independent samples, to test the study hypotheses, since the data did not follow a normal distribution.

3. RESULTS AND DISCUSSION

3.1. Results of the dependent variable prevention competencies of public servants

Table 1: Levels of Server Prevention Competencies Before and After the Disaster Risk Policy Program

	Grupo experimental				Grupo control			
Niveles	**Pre test**		**Post test**		**Pre test**		**Post test**	
	N°	%	N°	%	N°	%	N°	%
Bajo	66	73%	5	6%	80	89%	81	90%
Medio	23	26%	24	27%	9	10%	8	9%
Alto	1	1%	61	68%	1	1%	1	1%
Total	90	100%	90	100%	90	100%	90	100%

Note. Data matrix of the variable server prevention competencies. In original language (Spanish)

Table 1 shows that, in the experimental group, the prevention skills of the employees went from a predominance of low levels in the pre-test (73%) to a high level in the post-test (68%) after the application of the disaster risk management policy program, evidencing a significant improvement. In contrast, the control group maintained predominantly low levels in the pretest (89%) and posttest (90%), due to the absence of intervention.

Understanding Dimension Results

Table 2: Levels of the Normative Knowledge Dimension Before and After the Disaster Risk Policy Program

	Grupo experimental				Grupo control			
Niveles	**Pre test**		**Post test**		**Pre test**		**Post test**	
	N°	%	N°	%	N°	%	N°	%
Bajo	64	71%	5	6%	73	81%	66	73%
Medio	25	28%	34	38%	15	17%	23	26%
Alto	1	1%	51	57%	2	2%	1	1%
Total	**90**	**100%**	**90**	**100%**	**90**	**100%**	**90**	**100%**

Note. Data matrix of the variable server prevention competencies. In original language (Spanish)

Table 2 shows that, in the experimental group, prevention competencies in the normative knowledge dimension went from a predominance of the low level in the pre-test (71%) to a higher concentration in the high level in the post-test (57%) after the application of the disaster risk management policy program, which confirms its positive effect. In contrast, the control group maintained mostly low levels in the pre-test (81%) and post-test (73%), attributable to the absence of intervention.

Table 3: Levels of the risk and vulnerability dimension before and after the Disaster Risk Policy Programme

	Grupo experimental				Grupo control			
Niveles	**Pre test**		**Post test**		**Pre test**		**Post test**	
	N°	%	N°	%	N°	%	N°	%
Bajo	66	67%	4	4%	77	86%	76	84%
Medio	24	27%	27	30%	9	10%	11	12%
Alto	6	7%	59	66%	4	4%	3	3%
Total	**90**	**100%**	**90**	**100%**	**90**	**100%**	**90**	**100%**

Note. Data matrix of the variable server prevention competencies. In original language (Spanish)

Table 3 shows that, in the experimental group, prevention competencies in the risk and vulnerability dimension went from a predominance of the low level in the pre-test (67%) to a greater concentration in the high level in the post-test (66%) after the application of the disaster risk management policy program. evidencing its strengthening effect. In contrast, the control group maintained mostly low levels in both the pretest (86%) and the posttest (84%), due to the absence of intervention.

Table 4: Levels of the preventive management dimension before and after the Disaster Risk Policy Programme

	Grupo experimental				Grupo control			
Niveles	**Pre test**		**Post test**		**Pre test**		**Post test**	
	N°	%	N°	%	N°	%	N°	%
Bajo	55	61%	6	7%	77	86%	75	83%
Medio	32	36%	24	27%	11	12%	14	16%
Alto	3	3%	60	67%	2	2%	1	1%
Total	**90**	**100%**	**90**	**100%**	**90**	**100%**	**90**	**100%**

Note. Data matrix of the variable server prevention competencies. In original language (Spanish)

Table 4 shows that, in the experimental group, prevention competencies in the preventive management dimension went from a predominance of the low level in the pre-test (61%) to a greater concentration in the high level in the post-test (67%) after the application of the disaster risk management policy program, which confirms its strengthening effect. In contrast, the control group maintained mostly low levels in the pre-test (86%) and post-test (83%), due to the absence of intervention.

Table 5: Levels of the Effective Communication Dimension Before and After the Disaster Risk Policy Program

	Grupo experimental				Grupo control			
Niveles	**Pre test**		**Post test**		**Pre test**		**Post test**	
	N°	%	N°	%	N°	%	N°	%
Bajo	74	82%	3	3%	73	81%	75	83%
Medio	15	17%	30	33%	15	17%	13	14%
Alto	1	1%	57	63%	2	2%	2	2%
Total	**90**	**100%**	**90**	**100%**	**90**	**100%**	**90**	**100%**

Note. Data matrix of the variable server prevention competencies. In original language (Spanish)

Table 5 shows that, in the experimental group, prevention competencies in the effective communication dimension went from a predominance of the low level in the pre-test (82%) to a greater concentration in the high level in the post-test (63%) after the application of the disaster risk management policy program, evidencing its positive impact. In contrast, the control group maintained mostly low levels in both the pre-test (81%) and the post-test (83%), due to the absence of intervention.

Table 6: Levels of the Continuous Monitoring Dimension Before and After the Disaster Risk Policy Program

	Grupo experimental				Grupo control			
Niveles	**Pre test**		**Post test**		**Pre test**		**Post test**	
	N°	%	N°	%	N°	%	N°	%
Bajo	66	73%	3	3%	54	60%	75	83%
Medio	21	23%	30	33%	35	39%	13	14%
Alto	3	3%	57	63%	1	1%	2	2%
Total	**90**	**100%**	**90**	**100%**	**90**	**100%**	**90**	**100%**

Note. Data matrix of the variable server prevention competencies. In original language (Spanish)

Table 6 shows that, in the experimental group, prevention competencies in the continuous monitoring dimension went from a predominance of the low level in the pre-test (73%) to a greater concentration in the high level in the post-test (63%) after the application of the disaster risk management policy program, confirming its strengthening effect. In contrast, the control group showed a predominance of low levels in the post-test (83%), attributable to the absence of intervention.

3.2. Hypothesis testing

General hypothesis

(Hi): Disaster Risk Policy-Based Program Significantly Improves Prevention Competencies of a Regional Government of Peru, 2025

(H0): The program based on disaster risk policies does not significantly improve the prevention competencies of a Regional Government of Peru, 2025

Table 7: Hypothesis test of the public policy program on disaster risk in the improvement of the prevention skills of public servants of a regional government in Peru, 2025

Competencias de prevencion	**Grupo**	**Prom**	**Dif**	**U De Mann-Whitney**	**Significania**
Pre-Test	Experimental Control	52.41 50.41	2.27	0.417	P=0.677 >0.05 No Significativo
Competencias de prevencion	**Grupo**	**Prom**	**DIf**	**U De Mann-Whitney**	**Significania**
Pre-Test	Experimental Control	92.23 51.08	43.16	11.136	P = 0.000 >0.05 Significativo

Note. Information obtained from the database. In original language (Spanish)

Output: SPSS Version. 26.0.0.0

The analysis shows that the disaster risk management policy program produced a clear improvement in the regulatory knowledge of regional government officials. The results coincide with what was reported by Dan (2022) who demonstrated that experiential workshops, simulations and practical activities facilitate the understanding of normative and preventive content.

Suárez (2022) found significant improvements in

prevention competencies when training incorporates teaching materials and exercises of direct application. In this way, the study demonstrates that experimentally guided preventive training strengthens the adaptive capacity of communities in disaster scenarios. In the experimental group, the low level decreased from 73% in the pre-test to 6% in the post-test, while the high level increased from 1% to 68%, reflecting a positive effect of the implemented program.

In addition, it is evidenced by the result obtained in the Mann–Whitney U test (U = 11.136) and a level of significance ($p < 0.05$), that after the implementation of the disaster risk management policy program, it improves the prevention competencies of servers.

It is demonstrated with the intervention of the program, in the post-test it is seen that the prevention competencies of public servants in the dimension of normative knowledge are at a high level in 57%, at a medium level in 38%, and at a low level in 6%. (U = 10.439) and ($p < 0.05$) It is inferred that the disaster risk policy program strengthens the prevention competencies of public servants in the normative knowledge dimension. In this way, Córdoba (2024) argues that training interventions that articulate normative explanation with real situations increase knowledge of legal frameworks and institutional procedures. Martínez (2021) states that normative knowledge is strengthened when learning is linked to everyday experiences in the work environment and is accompanied by tools that facilitate the immediate application of knowledge.

The results show that, after the implementation of the program, the risk and vulnerability of the servers showed a significant improvement. This progress is explained by the fact that leadership in risk management is not developed solely from individual experience, but from regulatory clarity, the strengthening of competencies and the ability to influence collective decisions. SINAGERD's policies establish that prevention requires leaders capable of guiding processes, coordinating actors, and promoting anticipatory actions; therefore, the observed increase confirms that the program provided effective tools for this purpose.

There is evidence of a significant decrease in perceived vulnerability, which coincides with what was expressed by Daran (2022), who argues that understanding threats and participating in practical exercises strengthen the ability to recognize risk conditions and adopt more effective preventive measures. In this study, the program allowed participants to identify more clearly the factors that increase institutional exposure, generating a more preventive and less reactive attitude towards risks. It is evident with the subsequent application of the disaster risk policy program, in the post-test it is seen that the prevention competencies of public servants in the risk and vulnerability dimension are at a high level at 66%, at a regular level at 30% and at a low level at 4%.

It is evident with the subsequent application of the disaster risk policy program, in the post-test it is seen that the prevention competencies of servants in the preventive management dimension are at a high level at 67%, at a regular level at 27%, and at a low level at 7%. (U = 10.900) and ($p < 0.05$). These results are supported by Guimarães et al. (2025) show that institutional preparedness and continuous training strengthen preventive management, increasing early response capacity by 41%. These findings coincide with the research because it improves the internal organization and the identification of risks of public servants, results consistent with the improvement observed in the preventive management of public servants.

Yildiz et al. (2024), where structured programs increased risk perception by 38% and participants' preparedness by 31%. Guerrero (2021) showed that programs significantly increase the mastery of evacuation protocols and the adoption of preventive attitudes.

The program significantly strengthened the effective communication of the servers, especially in the ability to transmit clear, timely and prevention-oriented information within their work areas. That is why in this dimension the high level is at 63%, the regular level at 33%, and the low level at 3%. (U = 10.906) and ($p < 0.05$).

Heinkel et al. (2025) state that institutional communication in risk contexts is more efficient when messages are systematized and clear flows are established between teams.

Carrasco (2024), in his results, also shows that the improvement in internal communication contributes to increasing trust and coordination between areas, in addition to strengthening institutional cohesion, as it reduces uncertainty and improves decision-making in risk scenarios.

Likewise, the results are related to Guerrero (2021), who states that continuous monitoring is consolidated when teams incorporate systematic observation into their work routine and link the data obtained with corrective actions. The improvement observed in the regional servers confirms that the intervention facilitated this process, generating more integrated and efficient risk surveillance practices. In

addition, it is noted that risk monitoring is most effective when technical capacities are strengthened and a culture of permanent vigilance is promoted. This behavior was evidenced in the way participants recorded, analyzed, and shared relevant information. It is evident with the application of the disaster risk policy program, in the post-test it is seen that the prevention competencies of servers in the continuous monitoring dimension are at a high level at 63%, at a medium level at 33%, and at a low level at 3%.

The results show that the program generated substantial improvements in the monitoring carried out by regional government officials, especially in the capacity to systematically monitor risks, record information, and provide feedback to institutional processes. This finding coincides with what our author pointed out, who emphasizes that monitoring is only effective when institutions adopt standardized protocols and fluid coordination that allows risk to be observed as a dynamic process. In this line, the trained servants demonstrated greater constancy in the reporting and evaluation of operational indicators, which contributes to institutional anticipation.

4. CONCLUSIONS

It was possible to demonstrate that the application of the program based on disaster risk policies improves prevention competencies in a Regional Government of Peru, finding significant differences between the pre-test and post-test, this is proven with the value achieved of the U of Man test = 11.136 and a level of significance less than 5% ($p < 0.05$). demonstrating that after applying the disaster risk policy program, the servers of the experimental and control groups present a significant difference, where the experimental group improved more prevention competencies than the control group; demonstrating the effectiveness of the program.

The level of prevention competencies achieved before and after the implementation of the program based on disaster risk management policies was determined, which generated relevant variations in the development of prevention competencies among the evaluated servants. In the experimental group, the low level went from 73% in the pre-test to only 6% in the post-test, while the high level rose from 1% to 68%, suggesting a positive effect attributable to the program. In contrast, the control group maintained practically unchanged proportions —89% to 90% at low level—, it was also observed that the average score in the post-test of the experimental group is 94.23 and the control group is 51.08, making an average difference of 43.16; with a value of ($p=0.000$) below 5% ($p<0.05$), which reinforces the possibility that the observed changes respond specifically to the intervention applied. From this approach, it is argued that the development of preventive competencies does not occur spontaneously, but responds to systematic processes of training, regulatory internalization, and practical application of knowledge in real contexts (Córdoba, 2024).

It was determined that the level of the dimensions of the prevention competencies of the employees before the intervention showed a predominance of the low level (71%), while, after the program, the high level of 1% amounted to 57%; Likewise, in the risk and vulnerability dimension of the servers in the experimental group, the high level went from 7% in the pre-test to 66% in the post-test, while the low level decreased from 67% to 4%; Thus, in the preventive management of the servers after the application of the Disaster Risk Policy Program in the experimental group, the low level went from 61% in the pre-test to 7% in the post-test, while the high level rose from 3% to 67%; also in the effective communication of the experimental group before the intervention, 82% were at a low level and only 1% reached a high level; however, after the implementation of the programme, 63 per cent managed to reach a high level and the low level was reduced to 3 per cent; In the same vein, continuous monitoring among the servers exposed to the program before its application, 73% were at a low level and only 3% reached a high level; however, after the intervention, 63% went to high level and low level fell to 3%. In this way, Martínez (2021) supports what Martínez (2021) points out, who points out that training programs, when they integrate structured, normative content and scenario analysis, generate sustainable changes in the preventive competencies of public servants.

The results show that the policy-based disaster risk management program generated an appreciable improvement in the regulatory knowledge of the servers. Before the intervention, the experimental group showed a predominance of the low level (71%), while after the program, the high level rose to 57%, accompanied by a reduction of the low level to 6%. This is demonstrated with the value of the statistical test is U = 10.439 and a significance level of less than 5% ($p < 0.05$). This variation suggests that the training contributed to strengthening the regulatory understanding linked to DRM. In contrast, the control group maintained similar percentages between pre-test and post-test, which reinforces the relationship between the intervention and the change observed.

The results show that the application of the program based on risk management policies

generated relevant improvements in the risk and vulnerability dimension of the servers. In the experimental group, the high level went from 7% in the pre-test to 66% in the post-test, while the low level decreased from 67% to 4%, which shows an advance in the understanding and assessment of the factors that increase institutional exposure. This is demonstrated by the value of the statistical test being U = 10.697 and a significance level of less than 5% ($p < 0.05$). In contrast, the control group maintained practically unchanged percentages, with the level remaining low at 84% after the final measurement, which suggests that the improvement identified is associated with the program applied.

The results show a significant variation in the preventive management of the servers after the application of the program based on disaster risk policies. In the experimental group, the low level went from 61% in the pre-test to 7% in the post-test, while the high level rose from 3% to 67%, suggesting a substantial strengthening of this dimension. This is demonstrated by the value of the statistical test being U = 10.900 and a significance level of less than 5% ($p < 0.05$). In contrast, the control group maintained practically unchanged values, with a persistent predominance of the low level (86% to 83%), which supports that the changes observed respond to the program and not to uncontrolled external factors.

The results allow us to appreciate a significant change in the effective communication of the experimental group. Before the intervention, 82% were at a low level and only 1% reached a high level; however, after the implementation of the programme, 63 per cent managed to reach a high level and the low level was reduced to 3 per cent. This is demonstrated by the value of the statistical test being U = 10.906 and a significance level of less than 5% ($p < 0.05$). This variation suggests that the programme contributed to strengthening the capacity of staff to convey information clearly and respond appropriately to risk situations. In contrast, the control group maintained practically the same levels, which reinforces the influence of the program as a training agent.

The results allow us to appreciate a relevant advance in the dimension of continuous monitoring among the servers exposed to the program. Before its application, 73% were at a low level and only 3% reached a high level; however, after the intervention, 63% went to high level and low level fell to 3%. This is demonstrated by the value of the statistical test being U = 10.573 and a significance level of less than 5% ($p < 0.05$). This change suggests that the programme contributed to strengthening the capacity to permanently monitor risks and institutional conditions. In contrast, the control group maintained practically unchanged percentages, which reaffirms that the improvement observed responds to the implementation of the program.

REFERENCES

National Agreement (2018). State Policy No. 32: Disaster Risk Management. https://acuerdonacional.pe/politicas-de-estado-del-acuerdo-nacional/politicas-de-estado/politicas-de-estado-castellano/iv-estado-eficiente-transparente-y-descentralizado/32-gestion-del-riesgo-de-desastres/

Álvarez-Gutiérrez, S. (2021). System of social support networks for disaster risk management. Revista Ibérica de Sistemas e Tecnologias de Informação, 2021(E44), 210–227. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85134050061&partnerID=40&md5=fbe682f82812d1552dbbd42bf6d7dd86

Aranda, E. (2023). Social representations and water culture: Daily practices and water elements of the territory in the city of Piura. Revista de Urbanismo, 48, 177–193. https://doi.org/10.5354/0717-5051.2023.67026

Aristizábal, E., De Villeros, A., & Riaño Quintanilla, A. (2021). Inventory and analysis of disasters due to natural phenomena in the department of Antioquia during the year 2018. Earth Science Bulletin, (46), 15–18. https://doi.org/10.15446/rbct.n46.77482

Arosquipa, W. (2023). Disaster risk management in environmental awareness in teachers in an educational institution. Horizontes Revista de Investigación en Ciencias de la Educación, 7(30), 1752-1760. https://doi.org/10.33996/revistahorizontes.v7i30.625

Avram, C., & Măruşteri, M. (2022). Normality assessment, few paradigms and use cases. Revista Română de Medicină de Laborator, 30(3), 251–258. https://doi.org/10.2478/rrlm-2022-0030

Ayala, E., & Sánchez, D. (2023). Government management and impact on risk and disaster prevention investment projects. Revista Alfa, 7(20), 453–463. https://doi.org/10.33996/revistaalfa.v7i20.228

Banco Mundial (2022). Reducing Disaster Risks from Natural Hazards. An Evaluation of the World Bank's Support, Fiscal Years 2010 - 20.

https://ieg.worldbankgroup.org/sites/default/files/Data/Evaluation/files/Reducing_Disaster_Risks_v3.pdf

Barra, T., Salvatierra, A., Candia, I., & Vargas, G. (2021). Disaster risk management within the framework of the preventive culture. Revista Venezolana de Gerencia, 26(94), 903-914. https://doi.org/10.52080/rvgv26n94.26

Barrow, J. M., Brannan, G. D., & Khandhar, P. B. (2022). Research ethics. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK459281/

Beck, U. (1992). Risk society: Towards a new modernity (M. Ritter, Trans.). SAGE Publications. (Original work published 1986)

Benouar, D., Benmokhtar, A. Corrigendum to: Risk governance for the implementation of the Sendai Framework for Disaster Risk Reduction in Algeria. Int J Disaster Risk Sci 16, 71 (2025). https://doi.org/10.1007/s13753-025-00626-5

Calderón, D. & Frey, K. (2017). Territorial planning for disaster risk management in Colombia. Territories, (36), 239-264. http://dx.doi.org/10.12804/revistas.urosario.edu.co/territorios/a.4795

Carrasco, S., & Ochiai, C. (2024). Social capital and community resilience in the wake of disasters, conflicts and displacements. International Journal of Disaster Risk Reduction, 115, Article 105049. https://doi.org/10.1016/j.ijdrr.2024.105049

National Center for Disaster Risk Estimation, Prevention and Reduction (CENEPRED). (2023). Law No. 29664 – Law that creates the National Disaster Risk Management System (SINAGERD). https://www.cenepred.gob.pe/web/leyes-normas/

Comfort, L. K. (1999). Shared risk: Complex systems in seismic response. Pergamon.

Córdova, H. (2020). Vulnerability and disaster risk management in the face of climate change in Piura, Peru. Economic Semester, 23(54), 85–112. https://doi.org/10.22395/seec.v23n54a5

Córdova, C., Ramos, J., & Velázquez, N. (2024). Disaster risk management and preventive culture in education in Metropolitan Lima. Horizons. Journal of Research in Education Sciences, 8(32), 174–182. https://doi.org/10.33996/revistahorizontes.v8i32.714

Corozo, J., Campos, A., & Martínez, M. (2023). Governance of disaster risk management in the canton of Gonzalo Pizarro, Ecuador. Axiom, 1(28), 17–23. https://doi.org/10.26621/ra.v1i28.860

Coto-Cedeño, W. I. (2024). A conceptual history of disasters. Metaphorical knowledge as a possibility for floods risk management in El Valle La Estrella, Limón, Costa Rica | A conceptual history of disasters. Metaphorical knowledge as a possibility in flood risk management in El Valle La Estrella, Limón, Costa Rica. Revista de História,90. https://doi.org/10.15359/rh.90.1

Creswell, J. W., & Creswell, J. D. (2017). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (5th ed.). SAGE Publications.

Darán, D. S., Briones, M. R., Álvarez, M. L., Ampo, R. C., Reyes, M. G., Cabigan, V., & Aquino, J. M. (2022). A feasibility study on disasters and awareness of disaster risk reduction factors among LSPU students. International Journal of Social Learning (IJSL), 2(3), 338–349. https://doi.org/10.47134/ijsl.v2i3.171

Demirbilek, Ö., & Aslan, R. (2025). Effect of Disaster Awareness Education on General Disaster Preparedness Beliefs: A Quasi-Experimental Study. Disaster Medicine and Public Health Preparedness, 19, e288. https://doi.org/10.1017/dmp.2025.10219

Díaz, M. (2001). Educational prevention as a management competence in education. Atlante Magazine: Cuadernos de Educación y Desarrollo.

Escobar-Pérez, J., & Cuervo-Martínez, A. M. (2008). Content Validity and Expert Judgment: An Approach to Its Use. Advances in Measurement, 6, 27–36. https://www.redalyc.org/articulo.oa?id=51405706

Escuder-Bueno, I., Yarritu-Sánchez, H., Morales-Torres, A., & Suárez, G. (2023). Recommendations for incorporating disaster risk management and climate change adaptation into infrastructure projects: Latin America and the Caribbean. https://doi.org/10.18235/0003950

Ferrando, F. (2003). On "natural" disasters: typology, concepts and reflections. INVI Journal, 18(47). https://doi.org/10.5354/0718-8358.2003.62230

Fischer-P., Bonaretti, D., & Bunker, D. (2024). Digital transformation in disaster management: A literature review, The Journal of Strategic Information Systems, 33(1). https://doi.org/10.1016/j.jsis.2024.101865.

Flanagan, B., Bostwick, K., Ogie, R., & Pradhan, S. (2021). Social vulnerability and disasters: development and evaluation of a CONVERGE training module for researchers and practitioners. Disaster Prevention

and Management, 30(3), 279–298. https://doi.org/10.1108/DPM-04-2021-0131

Fontana, S., & Conrero, S. (2023). Policies and practices for disaster risk management in Argentine local governments: A collaborative analysis between academic and governmental actors. Journal of Latin American Studies on Disaster Risk Reduction – REDER, 7(1), Article 6. https://doi.org/10.55467/reder.v7i1.104

Franco, J. O., Vera, C. E. C., & Zambrano, G. X. R. (2023). Building Sustainable, Resilient and Inclusive Cities: An Innovative Approach to Development. South Florida Journal of Development, 4(1), 497–519. https://doi.org/10.46932/sfjdv4n1-036

Gallo, A. (2023). Municipal management and disaster risk management policy in a climate change scenario in a region of Peru. Journal of Climatology, 23, 1933–1960. https://doi.org/10.59427/rcli/2023/v23cs.1933-1960

Gamo, R., & Conde, R. (2020). Cultural uprooting, effect of depopulation in Castilla La Mancha. Revista Iberoamericana de Cultura y Pensamiento, 46, 219–229. https://doi.org/10.36008/monograma.201.06.1722

Gonzales Walstrohm, C. (2023). Disaster Risk Management in Peru: A Systematic Review. Journal of Climatology, 23, 2674–2679.https://doi.org/ 10.59427/rcli/2023/v23cs.2674-2679

Guerrero, A., Rodríguez, E., & Leiva, S. (2021). Natural disasters: Risk assessment and debris flow in the San Ildefonso ravine, Trujillo, La Libertad, Peru. Arnaldoa, 28(3), 557–576. https://doi.org/10.22497/arnaldoa.283.28305

Heinkel, S., Miller, C., & Thiebes, B. (2025). Institutional risk and crisis communication on natural hazards and disaster risks in Yangon, Myanmar. International Journal of Disaster Risk Reduction, 105. https://doi.org/10.1016/j.ijdrr.2024.105064

Heo, B. Y., Kim, M. J., & Heo, W. H. (2020). An algorithm for validation of the efficiency of disaster and safety management budget investment in South Korea. International Journal of Disaster Risk Reduction, 47. https://doi.org/10.1016/j.ijdrr.2020.101566.

National Institute of Civil Defense. (2025). Disaster risk management in Peru. INDECI. https://bit.ly/3ZjJI9w

International Organization for Standardization. (2018). ISO 31000:2018 Risk Management – Guidelines. https://www.iso.org/standard/65694.html

Kunguma, O., & Mapingure, T. (2023). Review of disaster management training: A case study of a South African university. Jàmbá: Journal of Disaster Risk Studies, 15(1), Article 1342. https://doi.org/10.4102/jamba.v15i1.1342

León, F., & Cáceres, J. (2023). Disaster risk management in the urban spaces of Jesús Nazareno, Ayacucho. Alfa Journal of Research in Agronomic and Veterinary Sciences, 7(20), 354–375. https://doi.org/10.33996/revistaalfa.v7i20.221

Li, Y., Zhou, W. H., & Shen, P. (2023). Flood risk assessment of loss of life for a coastal city under the compound effect of storm surge and rainfall. Urban Climate, 47. https://doi.org/10.1016/j.uclim.2022.101396.

Macias, A., & González, L. (2022). Teaching and learning from disaster risk management: A need of these times. Conrado Magazine, 18(88), 501–509.

Macías, B. & Rodríguez, D. (2020). Building disaster-resilient cities: Transforming information management into knowledge to develop more resilient territories. https://doi.org/10.5821/siiu.9865

Martínez, C. A., Álvarez, G., & Cruz, E. (2021). Risk management and community strategies in the face of disasters in localities of the Isthmus-Costa region in Chiapas. LiminaR, 19(2), 188–200. https://doi.org/10.29043/liminar.v19i2.849

Medina, J. (2023). Vulnerability and disaster reduction: Intervention of the 068 budget program and reactive management. Management in the Third Millennium, 26(51), 271–286. https://doi.org/10.15381/gtm.v26i51.25522

Mendoza-Zamora, W., Loor-Carvajal, V., Salazar-Pin, G., & Nieto-Parrales, D. (2018). Budget allocation and its impact on public administration. Mastery of the Sciences, 4(3), 313–328. https://doi.org/10.23857/dc.v4i3.812

Niu, G., Zhou, Z., Li, X., Wu, L., & Fan, C. (2021). Enhancing resilience among Tibetan adolescents exposed to natural hazards: A culturally adapted randomized controlled trial. International Journal of Environmental Research and Public Health, 18(15), 7958. https://doi.org/10.3390/ijerph18157958

Nurjanah, S., Istiyono, E., Widihastuti, W., & Iqbal, M. (2023). The application of Aiken's V method for evaluating the content validity of instruments that measure the implementation of formative

assessments. Journal of Educational Research and Evaluation, 12(2), 125–133.
Organization for Economic Cooperation and Development (OECD). (2018). Guide for the collection and interpretation of data on innovation. https://www.madrid.org/bvirtual/BVCM001708.pdf
. Olivares, V., Valdivia, C., & Moreno, J. (2023). Opportunities and challenges for disaster risk education in Chile. Revista Educación, 47(2), 840–864. https://doi.org/10.15517/revedu.v47i2.53929
Pajares del Carpio, R. R. (2023). Labor competencies and their relationship with disaster risk management in managers of the Lima Este commonwealth (Thesis). CONCYTEC Repository – Peru.
Paredes, A., & Gutiérrez, F. (2020). Inter-institutional coordination for disaster risk management at the Peruvian regional level. Peruvian Journal of Public Policy, 10(1), 75–92.
Pécastaing, N., & Chávez, C. (2020). The impact of El Niño phenomenon on dry forest-dependent communities welfare in the northern coast of Peru. Ecological Economics, 178. https://doi.org/10.1016/j.ecolecon.2020.106820
Pineda, O., Arbeláez, J., Castaño, J., Medina, L., Roa, L., & Rojas, L. (2022). Perception of disaster risk in inhabitants of the municipality of Pijao, Quindío, Colombia. Diversitas: Perspectives in Psychology, 18(1). https://doi.org/10.15332/22563067.6374
Ponukumati, P., & Kumar, S. (2023). Development of a flood impact assessment framework integrating crowdsourced data and geospatial information for data sparse urban regions. International Journal of Disaster Risk Reduction, 106, Article 105048. https://doi.org/10.1016/j.ijdrr.2024.105048
Prada-Álvarez, A., & Arrieta-Padilla, H. (2024). Analysis of disaster risk management in the department of Piura to address the El Niño phenomenon. Kawsaypacha Journal: Society and Environment, (14), D-002. https://doi.org/10.18800/kawsaypacha.202402.d002
Presidency of the Council of Ministers. (2011). Law No. 29664 – Law that creates the National Disaster Risk Management System (SINAGERD). Official Gazette El Peruano. https://www.defensacivil.gob.pe/archivos/Ley_N_29664_2011.pdf
Pu, F., Li, Z., Wu, Y., Ma, C., & Zhao, R. (2025). Recent advances in disaster emergency response planning: Integrating optimization, machine learning, and simulation. The Journal of Strategic Information Systems, 35, Article 102345. https://doi.org/10.26599/SES.2025.9590007
Quispe, L., & Vargas, R. (2018). Citizen participation and disaster risk management in local governments in Peru. Journal of Public Management and Development, 6(2), 34–48.
Ramírez, C., & Becerril, H. (2021). Risk prevention at the local and gender-sensitive scale: Experience and learnings from Acapulco, Mexico. Journal of Latin American Studies on Disaster Risk Reduction – REDER, 5(1), Article 13. https://doi.org/10.55467/reder.v5i1.59
Renn, O. (2008). Risk governance: Coping with uncertainty in a complex world. Earthscan.
Rinaldi, A., & Bergamini, K. (2020). Inclusion of learning about natural disaster risk management in territorial planning instruments (2005–2015). Revista de Geografía Norte Grande, (75), 103–130. https://doi.org/10.4067/S0718-34022020000100103
Rubiano Vargas, D. M., & Ramírez Cortés, F. (2009). Incorporating disaster risk management into territorial planning and management: General guidelines for the formulation of plans at the local level. Project Support for Disaster Prevention in the Andean Community (PREDECAN). https://bvpad.indeci.gob.pe/doc/pdf/esp/doc1366/doc1366.htm
Sandoval, J. (2020). Vulnerability-resilience to the risk-disaster process: An analysis from political ecology. Polis (Santiago), 19(56), 214–239. https://doi.org/10.32735/s0718-6568/2020-n56-1527
Sato Yánac, J. (2018). Disaster Risk Management and Development Planning: Approaches for Effective Integration. National Center for Disaster Risk Estimation, Prevention and Reduction (CENEPRED).
Sato Yánac, J. (2018). Disaster Risk Management and Development Planning: Approaches for Effective Integration. National Center for Disaster Risk Estimation, Prevention and Reduction (CENEPRED).
Suárez-Ramos, V., Vázquez, E., & López, C. (2022). Construction and validation of a scale of community resilience against natural hazards. Psychological Sciences, 16(2), e2723. https://doi.org/10.22235/cp.v16i2.2723
UNDRR. (2025). Sendai Framework for Disaster Risk Reduction 2015–2030. United Nations Office for Disaster Risk Reduction (UNDRR). https://www.unisdr.org/files/43291_spanishsendaiframeworkfordisasterri.pdf
César Vallejo University (2024). UCV Code of Research Ethics.
Vallejo-Ilijama, M., Gavilanes-Betancourt, E., Llumitaxi-Peña, J., & Poma-Pilamunga, A. (2019). Comprehensive

disaster risk management and sustainable water management. University and Society, 11(4), 267–275. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2218-36202019000400267&lng=es&tlng=es.

Vásquez, J., & Estrada, L. (2020). Gender perspective for disaster risk management in municipal territorial planning. Prolegomena, 23(45), 67–84. https://doi.org/10.18359/prole.4144

Villa-Santillán, M., Requejo-Pacheco, G., Ruiz-Barrera, L. & Chiok-Pérez, P.M. 2024. Disaster risk management and environmental awareness in university students in Peru. Journal of Social Sciences, 30, (Jun. 2024), 240-257. https://doi.org/10.31876/rcs.v30i.42261

Yildiz, A., Dickinson, J., Priego-Hernández, J., Teeuw, R., & Shaw, R. (2023). Effects of disaster education on children's risk perception and preparedness: A quasi-experimental longitudinal study. Geographical Journal, 190(4). https://doi.org/10.1111/geoj.12556

Zakariya, Y. (2022). Cronbach's alpha in mathematics education research: Its appropriateness, overuse, and alternatives in estimating scale reliability. Frontiers in Psychology, 13, 1074430. https://doi.org/10.3389/fpsyg.2022.1074430

S. M. H. S. Rezvani, M. J. F. Silva, y N. M. De Almeida, "Urban Resilience Index for Critical Infrastructure: A Scenario-Based Approach to Disaster Risk Reduction in Road Networks", *Sustainability*, Vol. 16, No. 10, p. 4143, May 2024, DOI: 10.3390/SU16104143.

K. Riaz, M. McAfee, y S. S. Gharbia, "Management of Climate Resilience: Exploring the Potential of Digital Twin Technology, 3D City Modelling, and Early Warning Systems", *Sensors*, vol. 23, núm. 5, p. 2659, feb. 2023, doi: 10.3390/s23052659.

S. Fazeli, M. Haghani, M. Mojtahedi, y T. H. Rashidi, "The role of individual preparedness and behavioural training in natural hazards: A scoping review", *Int. J. Disaster Risk Reduct.*, vol. 105, p. 104379, abr. 2024, doi: 10.1016/j.ijdrr.2024.104379.

R. R. Parajuli, "Citizen Disaster Science Education for effective disaster risk reduction in developing countries", *Geoenvironmental Disasters*, vol. 7, núm. 1, p. 12, dic. 2020, doi: 10.1186/s40677-020-00150-2.

H. Seddighi, S. Yousefzadeh, M. López López, y H. Sajjadi, "Preparing children for climate-related disasters", *BMJ Paediatr. Open*, vol. 4, núm. 1, p. e000833, oct. 2020, doi: 10.1136/bmjpo-2020-000833.

S. Torani, P. Majd, S. Maroufi, M. Dowlati, y R. Sheikhi, "The importance of education on disasters and emergencies: A review article", *J. Educ. Health Promot.*, vol. 8, núm. 1, p. 85, 2019, doi: 10.4103/jehp.jehp_262_18.

A. B. Hamilton y E. P. Finley, "Qualitative methods in implementation research: An introduction", *Psychiatry Res.*, vol. 280, p. 112516, oct. 2019, doi: 10.1016/j.psychres.2019.112516.

B. E. Neubauer, C. T. Witkop, y L. Varpio, "How phenomenology can help us learn from the experiences of others", *Perspect. Med. Educ.*, vol. 8, núm. 2, pp. 90–97, abr. 2019, doi: 10.1007/S40037-019-0509-2.

C. Arvanitis, "Systematic literature review in five steps", *J. Acoust. Soc. Am.*, vol. 155, núm. 3_Supplement, pp. A103–A103, mar. 2024, doi: 10.1121/10.0026958.

A. P. Siddaway, A. M. Wood, y L. V. Hedges, "How to Do a Systematic Review: A Best Practice Guide for Conducting and Reporting Narrative Reviews, Meta-Analyses, and Meta-Syntheses", *Annu. Rev. Psychol.*, vol. 70, núm. 1, pp. 747–770, ene. 2019, doi: 10.1146/annurev-psych-010418-102803.

R. Cacciotti *et al.*, "Climate change-induced disasters and cultural heritage: Optimizing management strategies in Central Europe", *Clim. Risk Manag.*, vol. 32, p. 100301, 2021, doi: 10.1016/j.crm.2021.100301.

R. Der Sarkissian, M. J. Al Sayah, C. Abdallah, J.-M. Zaninetti, y R. Nedjai, "Land Use Planning to Reduce Flood Risk: Opportunities, Challenges and Uncertainties in Developing Countries", *Sensors*, vol. 22, núm. 18, p. 6957, sep. 2022, doi: 10.3390/s22186957.

T. Ma, J.-S. Kim, C. Jun, Y.-I. Moon, y H. Moon, "Optimizing urban flood management: enhancing urban drainage system efficiency under extreme rainfall events", *J. Hydroinformatics*, vol. 26, núm. 11, pp. 2704–2719, nov. 2024, doi: 10.2166/hydro.2024.067.

B. B. Mirus, T. Bogaard, R. Greco, y M. Stähli, "Invited perspectives: Integrating hydrologic information into the next generation of landslide early warning systems", *Nat. Hazards Earth Syst. Sci.*, vol. 25, núm. 1, pp. 169–182, ene. 2025, doi: 10.5194/nhess-25-169-2025.

M. Bordoni *et al.*, "Empirical and Physically Based Thresholds for the Occurrence of Shallow Landslides in a Prone Area of Northern Italian Apennines", *Water*, vol. 11, núm. 12, p. 2653, dic. 2019, doi: 10.3390/w11122653.

E. C. Abana, C. V. Dayag, V. M. Valencia, P. H. Talosig, J. P. Ratilla, y G. Galat, "Road flood warning system with information dissemination via social media", *Int. J. Electr. Comput. Eng. IJECE*, vol. 9, núm. 6, p.

4979, dic. 2019, doi: 10.11591/ijece.v9i6.pp4979-4987.

T. S. Mattos *et al.*, "Towards reducing flood risk disasters in a tropical urban basin by the development of flood alert web application", *Environ. Model. Softw.*, vol. 151, p. 105367, may 2022, doi: 10.1016/j.envsoft.2022.105367.

H. Xu, H. Li, S. Tian, y Y. Chen, "Effects of flood risk warnings on preparedness behavior: Evidence from northern China", *Int. J. Disaster Risk Reduct.*, vol. 96, p. 103971, oct. 2023, doi: 10.1016/j.ijdrr.2023.103971.

M. Diakakis, M. Skordoulis, y P. Kyriakopoulos, "Public Perceptions of Flood and Extreme Weather Early Warnings in Greece", *Sustainability*, vol. 14, núm. 16, p. 10199, ago. 2022, doi: 10.3390/su141610199.

S.-H. Moon, Y.-H. Kim, Y. H. Lee, y B.-R. Moon, "Application of machine learning to an early warning system for very short-term heavy rainfall", *J. Hydrol.*, vol. 568, pp. 1042–1054, ene. 2019, doi: 10.1016/j.jhydrol.2018.11.060.

M. Bernard y C. Gregoretti, "The Use of Rain Gauge Measurements and Radar Data for the Model-Based Prediction of Runoff-Generated Debris-Flow Occurrence in Early Warning Systems", *Water Resour. Res.*, vol. 57, núm. 3, p. e2020WR027893, mar. 2021, doi: 10.1029/2020WR027893.

Y. Qin, "Urban Flooding Mitigation Techniques: A Systematic Review and Future Studies", *Water*, vol. 12, núm. 12, p. 3579, dic. 2020, doi: 10.3390/w12123579.

M. J. Ferreira y H. R. Da Rocha, "Green roof infrastructure outperforms grey technology in flood mitigation in São Paulo's urbanized region", *Front. Built Environ.*, vol. 9, p. 1254942, nov. 2023, doi: 10.3389/fbuil.2023.1254942.

R. B. Munyai *et al.*, "Vulnerability and Adaptation to Flood Hazards in Rural Settlements of Limpopo Province, South Africa", *Water*, vol. 13, núm. 24, p. 3490, dic. 2021, doi: 10.3390/w13243490.

B. Poschlod, J. Zscheischler, J. Sillmann, R. R. Wood, y R. Ludwig, "Climate change effects on hydrometeorological compound events over southern Norway", *Weather Clim. Extrem.*, vol. 28, p. 100253, jun. 2020, doi: 10.1016/j.wace.2020.100253.

Y. Cao, B. Zhou, C. Y. Chung, T. Wu, L. Zheng, y Z. Shuai, "A Coordinated Emergency Response Scheme for Electricity and Watershed Networks Considering Spatio-Temporal Heterogeneity and Volatility of Rainstorm Disasters", *IEEE Trans. Smart Grid*, vol. 15, núm. 4, pp. 3528–3541, jul. 2024, doi: 10.1109/TSG.2024.3362344.

M. Ho, C. Wasko, D. O'Shea, R. Nathan, E. Vogel, y A. Sharma, "Changes in flood-associated rainfall losses under climate change", *J. Hydrol.*, vol. 625, p. 129950, oct. 2023, doi: 10.1016/j.jhydrol.2023.129950.

Z. Bao *et al.*, "The impact of climate variability and land use/cover change on the water balance in the Middle Yellow River Basin, China", *J. Hydrol.*, vol. 577, p. 123942, oct. 2019, doi: 10.1016/j.jhydrol.2019.123942.

L. Wang *et al.*, "Climate change impacts on magnitude and frequency of urban floods under scenario and model uncertainties", *J. Environ. Manage.*, vol. 366, p. 121679, ago. 2024, doi: 10.1016/j.jenvman.2024.121679.

J. Bly, L. Hugo Francescutti, y D. Weiss, "Disaster Management: A State-of-the-Art Review", en *Natural Hazards - Impacts, Adjustments and Resilience*, E. Noroozinejad Farsangi, Ed., IntechOpen, 2021. doi: 10.5772/intechopen.94489.

E. J. Yazo, A. Ibeas, y J. A. Herrera-Cuartas, "Integrating Sustainability into Risk Management through Analytical Network Process", *Sustainability*, vol. 16, núm. 6, p. 2384, mar. 2024, doi: 10.3390/su16062384.

A. O. Ayeni y A. G. Aborisade, "An assessment of ecosystem degradation and poverty: a case study of Obafemi-Owode local government area, Ogun State, Nigeria", *Environ. Urban.*, vol. 34, núm. 1, pp. 52–75, abr. 2022, doi: 10.1177/09562478221080456.

B. S. Underwood, G. Mascaro, M. V. Chester, A. Fraser, T. Lopez-Cantu, y C. Samaras, "Past and Present Design Practices and Uncertainty in Climate Projections are Challenges for Designing Infrastructure to Future Conditions", *J. Infrastruct. Syst.*, vol. 26, núm. 3, p. 04020026, sep. 2020, doi: 10.1061/(ASCE)IS.1943-555X.0000567.

S. Dong, T. Yu, H. Farahmand, y A. Mostafavi, "Predictive multi-watershed flood monitoring using deep learning on integrated physical and social sensors data", *Environ. Plan. B Urban Anal. City Sci.*, vol. 49, núm. 7, pp. 1838–1856, sep. 2022, doi: 10.1177/23998083211069140.

S. García y A. Franco, "Spatial Correlation between Urban Planning Patterns and Vulnerability to Flooding Risk: A Case Study in Murcia (Spain)", *Land*, vol. 12, núm. 3, p. 543, feb. 2023, doi: 10.3390/land12030543.

J. Ding *et al.*, "Forecasting of Tropospheric Delay Using AI Foundation Models in Support of Microwave Remote Sensing", *IEEE Trans. Geosci. Remote Sens.*, vol. 62, pp. 1–19, 2024, doi: 10.1109/TGRS.2024.3488727.

J. C. M. Dullaart, S. Muis, N. Bloemendaal, y J. C. J. H. Aerts, "Advancing global storm surge modelling using the new ERA5 climate reanalysis", *Clim. Dyn.*, vol. 54, núm. 1–2, pp. 1007–1021, ene. 2020, doi: 10.1007/s00382-019-05044-0.

M. Rasmy *et al.*, "Investigations of Multi-Platform Data for Developing an Integrated Flood Information System in the Kalu River Basin, Sri Lanka", *Water*, vol. 15, núm. 6, p. 1199, mar. 2023, doi: 10.3390/w15061199.

L. Gidhagen *et al.*, "Towards climate services for European cities: Lessons learnt from the Copernicus project Urban SIS", *Urban Clim.*, vol. 31, p. 100549, mar. 2020, doi: 10.1016/j.uclim.2019.100549.