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Education-work, humanized AI and algorethics in post-earthquake fishing communities from sexual and reproductive health

Educación-trabajo, IA humanizada y algorética en comunidades pesqueras posterremoto desde la salud sexual y reproductiva

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ABSTRACT

The fishing communities of the Venezuelan coast affected by the 2026 earthquakes rely on poorly recorded female labor, since algorithmic aid systems may render their labor and reproductive needs invisible. The study therefore aimed to analyze the humanized education-work pairing through algorethics, from the teleology of Article 3 of the Constitution, in post-earthquake fishing communities with a sexual and reproductive health approach. A systematic literature review with a hermeneutic-analytical method was applied to 20 sources (2007-2026). The results showed that fisheries and health data omit women's catch, care work and reproductive health. It was concluded that post-earthquake algorethics must integrate sexual and reproductive health as a cross-cutting variable.

Descriptors: artificial intelligence; ethics; fishing; reproductive health; natural disasters. (Source: UNESCO Thesaurus).

RESUMEN

Las comunidades pesqueras del litoral venezolano afectadas por los terremotos de 2026 dependen de un trabajo femenino poco registrado, por cuanto los sistemas algorítmicos de ayuda pueden invisibilizar sus necesidades laborales y reproductivas. Es así que el estudio se planteó como objetivo analizar el binomio educación-trabajo humanizado mediante la algorética, desde la teleología del artículo 3 constitucional, en comunidades pesqueras posterremoto con enfoque de salud sexual y reproductiva. En este sentido se empleó una revisión sistemática de literatura con método hermenéutico-analítico sobre 20 fuentes (2007-2026). Entre los resultados se obtuvo que los datos pesqueros y sanitarios omiten la captura, el cuidado y la salud reproductiva de las mujeres. Entre las conclusiones se estableció que una algorética posterremoto debe integrar la salud sexual y reproductiva como variable transversal.

Descriptores: inteligencia artificial; ética; pesca; salud reproductiva; desastre natural. (Fuente: Tesauro UNESCO).

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Research Articles Section

INTRODUCTION

When the Constitution of the Bolivarian Republic of Venezuela (1999) established in Article 3 that the essential aims of the State are the defense and development of the person and respect for human dignity, and that education and work are the fundamental processes for achieving these aims, it set out a teleology of social development that makes no distinction among the classroom, the port and the home. In line with this mandate, Article 305 obliges the State to protect the settlements and communities of artisanal fishers, while Article 88 recognizes household work as an economic activity that creates added value, so that the constitutional text already contains the elements for thinking about women's fishing work.

For their part, the earthquakes of June 24, 2026 triggered landslides in Catia La Mar, Playa Grande and the coastal mountains from La Guaira to Naiguatá, and the U.S. Geological Survey [USGS] (2026) identified potentially isolated communities due to the blocking of the coastal road between Catia La Mar and Puerto Cruz, a coastline where artisanal fishing populations are settled. This indicates that reconstruction will have to decide whom to assist first, with what data and with what criteria, decisions that increasingly rely on artificial intelligence [AI] systems (Sun, et al., 2020).

At the ethical level, Gamboa-Bernal (2024) and Villalba (2020) describe algorethics as the reflection that requires algorithms to be subordinated to human dignity, and Floridi, et al., (2018) propose five principles for an AI that is good for society, namely beneficence, non-maleficence, autonomy, justice and explicability. However, Kleiber, et al., (2015) reviewed 106 case studies of small-scale fisheries and concluded that the lack of data on women fishers is the most common obstacle to gender analysis, so that systems that learn from these records inherit their blindness.

But how can a humanized algorethics prevent post-earthquake aid from reproducing the invisibility of women's work and reproductive health in fishing communities? Based on the above, the research aims to analyze the reconfiguration of the education-work pairing in post-earthquake fishing communities through a humanized AI grounded in algorethics, based on the teleology of social development in Article 3 of the Constitution and with a sexual and reproductive health approach.

METHOD

The methodology used is qualitative, with a systematic literature review design and the hermeneutic-analytical method, which made it possible to analyze norms, algorithmic foundations and studies on sexual and reproductive health and fishing work in coastal areas affected by disasters. Accordingly, the phases of identification, screening, eligibility and inclusion were followed, and their criteria are summarized in Table 1, so that each selection decision was documented; documentary analysis was used as the technique and a recording matrix per source (author, year, type of document, finding and axis) as the instrument, and its data were subjected to content analysis by axis.

Table 1. *Systematic review protocol*.

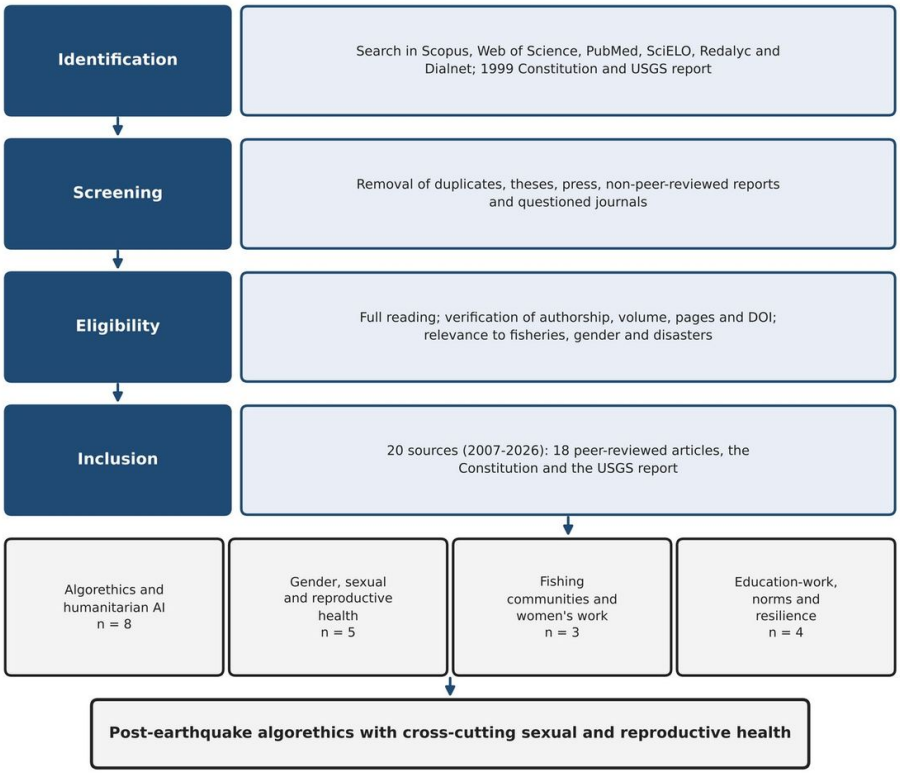
Element	Description
Design	Systematic literature review with a hermeneutic-analytical method
Databases and repositories	Scopus, Web of Science, PubMed, SciELO, Redalyc and Dialnet
Search terms	("algorética" OR "AI ethics" OR "algorithmic bias") AND ("disaster" OR "sismo"); ("women" OR "mujeres") AND ("small-scale fisheries" OR "pesca artesanal"); ("reproductive health" OR "salud reproductiva") AND ("earthquake" OR "desastre")
Period	2007-2026
Inclusion criteria	Peer-reviewed articles with a verifiable record; constitutional norm; official data on the 2026 seismic sequence
Exclusion criteria	Theses, press, blogs, non-peer-reviewed reports, questioned journals and unconsolidated casualty figures
Axes of analysis	Algorethics and humanitarian AI (n = 8); gender and sexual and reproductive health (n = 5); fishing communities and women's work (n = 3); education-work, norms and resilience (n = 4)

Note: developed in-house.

As for its composition, the corpus comprised 20 sources, of which 18 are articles in peer-reviewed journals, to which are added the 1999 Constitution, as the primary normative source, and the

USGS (2026) report, used as official contextual data. Subsequently, the sources were organized into four axes, namely algorethics and humanitarian AI, gender and sexual and reproductive health in disasters, fishing communities and women's work, and the education-work relationship with community resilience, as represented in Figure 1.

Figure 1. *Phases of the systematic review and axes of analysis*.



Note: developed in-house.

Finally, since this is a documentary study, no work was carried out with people or clinical data, and the use of casualty figures for the 2026 earthquakes, still disputed, was avoided, so as to distinguish what the sources state from what is proposed as the authors' inference.

RESULTS

The results of the research are described below, organized according to the four axes of the corpus:

The constitutional teleology of the education-work pairing

First, a reading of Article 3 makes it possible to understand education and work not as means for productivity but as processes for the fulfillment of the person, an idea that Hernández (2014) also finds in Article 293 of the Organic Labor Law for Male and Female Workers, according to which both processes are fundamental for the creation and fair distribution of wealth.

Similarly, Aldrich & Meyer (2015) show that social capital, formed by bonds among neighbors, bridges between groups and links with institutions, explains a community's recovery better than material aid alone.

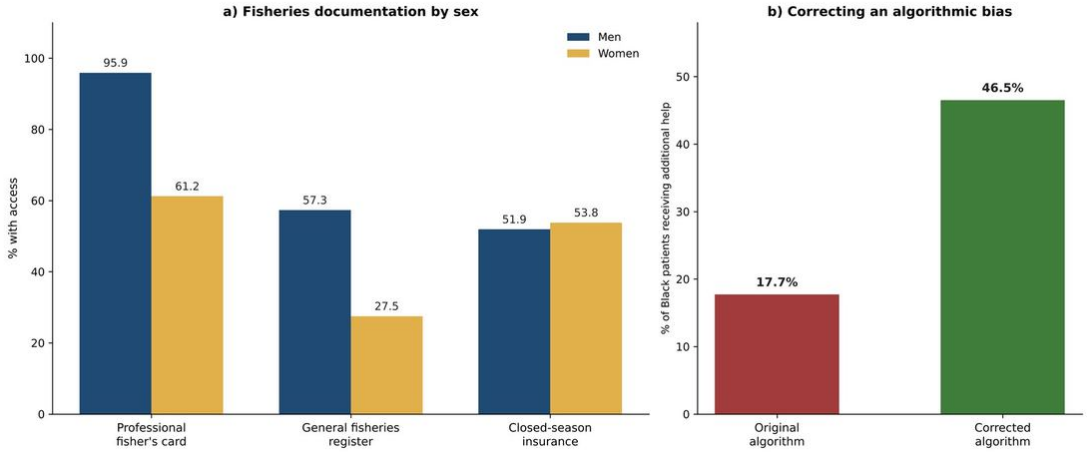
The invisible work of women in fishing

Second, Harper, et al., (2013) estimated that in the Pacific women account for 56% of the annual catch of small-scale fisheries, with an economic impact of about 363 million dollars, contributions that official statistics did not record. In Latin America, de Souza & Marinho (2021) studied the fishing communities of the oil-producing municipalities of the Campos Basin in Brazil and found that 55.5% of economically active women had their main occupation in the fishing chain, but that their average income was about 60% lower than that of men and that less than 3% had formal

employment.

Along the same lines, these authors recorded that 95.9% of men and only 61.2% of women held a professional fisher's card, and that in the general fisheries register the proportion was 57.3% compared with 27.5%, a phenomenon they called invisibility from within, because many women do not recognize themselves as fishers (de Souza & Marinho, 2021). Figure 2 represents these documentation gaps.

Figure 2. *Documentation gaps in the fishing chain and the effect of correcting an algorithmic bias.*



Note: developed in-house from de Souza & Marinho (2021) and Obermeyer, et al., (2019).

Sexual and reproductive health after disasters

Third, Neumayer & Plümper (2007) analyzed up to 141 countries between 1981 and 2002 and found that disasters reduce women's life expectancy more than men's, an effect that is attenuated where women's socioeconomic status is better, which shows that gender vulnerability is socially constructed. In the reproductive sphere, Behrman & Weitzman (2016) compared Haiti's 2005 and 2012 demographic and health surveys and found that greater intensity of the 2010 earthquake reduced the use of injectable contraceptives, increased unwanted pregnancies and raised the unmet need for family planning.

Likewise, Velázquez-Gutiérrez (2018) recalls that after the 2017 Mexican earthquakes the reports of the United Nations Population Fund recorded increases in pregnancies, sexually transmitted infections and sexual violence, and argues that reconstruction should be oriented toward social justice.

Algorithmic biases and post-earthquake algorethics

Fourth, the evidence on biases shows how algorithms can aggravate these omissions, since Obermeyer, et al., (2019) demonstrated that an algorithm used in the United States to allocate care programs used health spending as an indicator of need and underestimated the illness of Black patients, and that when it was corrected the proportion of these patients receiving additional help rose from 17.7% to 46.5%, while Cirillo, et al., (2020) documented the underrepresentation of women in biomedical data and warned that models built without correcting it widen inequalities. Table 2 thus transfers these findings to the context of fishing communities.

Table 2. *Structural biases and their effect on post-earthquake fishing communities*.

Bias	Evidence	Possible effect on the Venezuelan coast
Underreporting of women's catch	56% of small-scale catches in the Pacific (Harper, et al., 2013); lack of data in 106 cases (Kleiber, et al., 2015)	Aid calculated only on boat-based fishing
Documentation gap	Professional card: 95.9% of men and 61.2% of women (de Souza & Marinho, 2021)	Exclusion of women from beneficiary lists
Biased proxy indicator	Spending as a proxy for need; 17.7% compared with 46.5% after correction (Obermeyer, et al., 2019)	Prioritizing those who already had access to services before the earthquake
Male-dominated biomedical data	Underrepresentation of women in trials and databases (Cirillo, et al., 2020)	Triage and health logistics that omit obstetric needs
Reproductive omission	More unwanted pregnancies and unmet need in Haiti (Behrman & Weitzman, 2016)	Interruption of contraception and prenatal care

Note: developed in-house; the last column is the authors' inference.

DISCUSSION

The findings are discussed below and contrasted with what was set out in the introduction:

The results confirm what Kleiber, et al., (2015) warned in the introduction, since the lack of data on women fishers is reproduced in official registers and in the systems that learn from them. Hence an intrinsic challenge for the Venezuelan coast, since an aid allocation system based on fisher registers would leave out a large proportion of the women who sustain the fishing economy, in the same way that the algorithm studied by Obermeyer, et al., (2019) underestimated the need of a population group by using a biased proxy indicator.

Accordingly, a reconstruction that restores boats and engines without training communities, or that provides training without recognizing the processing, selling and care work carried out by women, contradicts the purpose of Article 3 of the Constitution. This invites reflection on education as the formation of the social capital networks described by Aldrich & Meyer (2015), so that the education-work pairing in the post-earthquake context should include data literacy for the communities themselves.

Likewise, sexual and reproductive health is not an ancillary emergency service but a dimension of social development that conditions women's return to work and education, as suggested by the effects of the 2010 Haiti earthquake documented by Behrman & Weitzman (2016).

Another aspect that should be examined is the governance of humanitarian AI, since Beduschi (2022) identifies, alongside the opportunities, risks of data protection and discrimination, and Coppi, et al., (2021) argue that explicability is a condition for affected communities to trust automated decisions. In light of the above, the Rome Call for AI Ethics, which Pegoraro & Curzel (2023) analyze as the origin of a movement, offers principles of transparency, inclusion, responsibility, impartiality, reliability, security and privacy that can be operationalized in reconstruction, as proposed in Table 3.

Table 3. *Algorethical principles and operational requirements for fisheries reconstruction*.

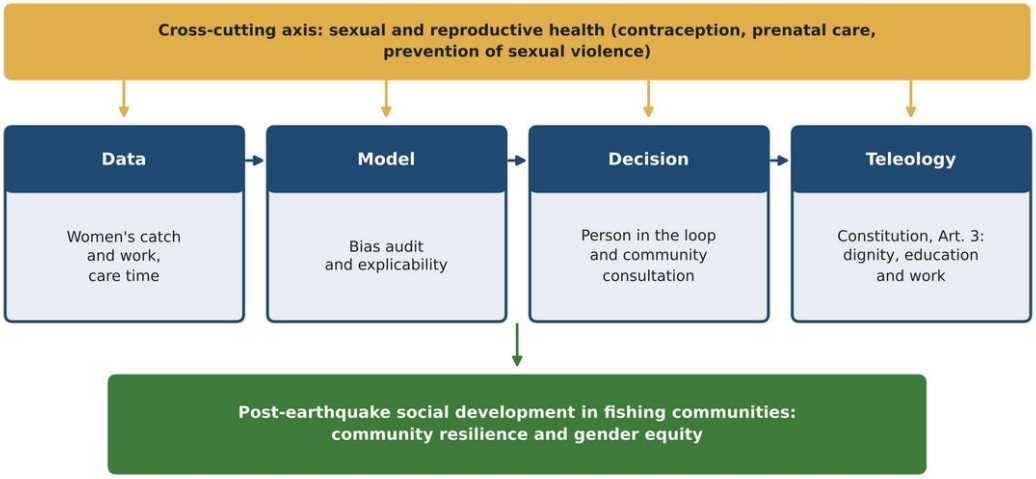
Principle	Source	Operational requirement
Justice and inclusion	Floridi, et al., (2018); Pegoraro & Curzel (2023)	Record the catch, processing and care work carried out by women
Explicability	Coppi, et al., (2021)	Explain to the community why a household does or does not receive aid
Non-maleficence	Beduschi (2022)	Protect reproductive data and prevent discriminatory uses
Responsibility	Gamboa-Bernal (2024); Villalba (2020)	Keep a person accountable for each automated decision
Dignity as an end	Constitution (1999), Art. 3; Carreño-Vélez (2025)	Evaluate systems by their contribution to education, work and health

Note: developed in-house; authors' inference from the sources cited.

On this basis, the authors propose, as an inference, a four-stage model, data, model, decision and teleology, crossed by sexual and reproductive health as a cross-cutting axis, in which the data include women's catch and work and their care time, the models are audited to detect biases, decisions keep a person accountable and the community in the loop, and the whole is oriented

toward the aims of Article 3 of the Constitution, as represented in Figure 3. Similarly, Carreño-Vélez (2025) proposes an onto-epistemic and humanizing algorethics as a constitutional guarantee, a perspective that coincides with the need to subordinate productivity to social justice.

Figure 3. *Post-earthquake algorethics model with cross-cutting sexual and reproductive health*.



Note: developed in-house; authors' inference.

CONCLUSIONS

In sum, the review makes it possible to state that the teleology of Article 3 of the 1999 Constitution provides a foundation for reconfiguring the education-work pairing in the fishing communities affected by the 2026 earthquakes, provided that the catching, processing, selling and care work carried out by women is recognized. Likewise, the evidence shows structural biases that render their labor and reproductive needs invisible, both in fisheries registers and in health algorithms, biases that fracture post-disaster social cohesion and territorial equity. Similarly, the effective humanization of AI requires an epistemic and technical redesign that subordinates productivity to social justice, so that, based on the data reviewed, post-earthquake algorethics should integrate sexual and reproductive health as a cross-cutting variable of human development.

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CONFLICT OF INTEREST

There is no conflict of interest with any individuals or institutions related to this research.

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AUTHOR CONTRIBUTIONS

Bellis Margarita Astudillo: conception of the study and writing of the introduction and of the sexual and reproductive health axis.

José Adrián Barazarte-Urbina: review of the constitutional teleology of the education-work pairing and writing of the results.

Noemí del Carmen Navarro-Villarroel: search, screening and verification of sources, and preparation of tables and figures.

Carlos Manuel Carreño-Vélez: algorethical analysis and writing of the discussion and the

conclusion. The authors participated in the critical revision of the manuscript and approved the final version.

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