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Land tenure, AI and algorethics in post-earthquake El Hatillo from comparative law

Tenencia de la tierra, IA y algorética en El Hatillo posterremoto desde el derecho comparado

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ABSTRACT

After the 2026 earthquakes, reconstruction in the Caracas metropolitan area sets the property right of Article 115 of the Constitution against the right to housing of Article 82, since a large part of the population lacks formal title. The study therefore aimed to analyze the teleology of land tenure in El Hatillo from an ontological view of AI and algorethics and from comparative law. A systematic literature review with a hermeneutic-analytical method was applied to 20 sources (1996-2026). The results showed that models privileging formal titling contain an ontological bias that perpetuates socio-spatial exclusion. It was concluded that territorial vulnerability and comprehensive reparation must be primary teleological variables.

Descriptors: land tenure; right to housing; artificial intelligence; ethics; comparative law. (Source: UNESCO Thesaurus).

RESUMEN

Tras los terremotos de 2026, la reconstrucción en el área metropolitana de Caracas enfrenta el derecho de propiedad del artículo 115 constitucional con el derecho a la vivienda del artículo 82, por cuanto buena parte de la población carece de título formal. Es así que el estudio se planteó como objetivo analizar la teleología de la tenencia de la tierra en El Hatillo desde una visión ontológica de la IA y la algorética y desde el derecho comparado. En este sentido se empleó una revisión sistemática de literatura con método hermenéutico-analítico sobre 20 fuentes (1996-2026). Entre los resultados se obtuvo que los modelos que privilegian la titulación formal contienen un sesgo ontológico que perpetúa la exclusión socioespacial. Entre las conclusiones se estableció que la vulnerabilidad territorial y la reparación integral deben ser variables teleológicas primarias.

Descriptores: tenencia de la tierra; derecho a la vivienda; inteligencia artificial; ética; derecho comparado. (Fuente: Tesauro UNESCO).

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Research Articles Section

INTRODUCTION

When the magnitude 7.2 and 7.5 earthquakes of June 24, 2026 shook northern Venezuela, west of Caracas, and triggered landslides on the coast of La Guaira, according to the report of the U.S. Geological Survey [USGS] (2026), the Caracas metropolitan area, which includes the municipality of El Hatillo, lay within the region shaken by the sequence. In line with the literature on disasters, Oliver-Smith (1996) argued that a disaster reveals the social structure that precedes it, so that reconstruction tests not only engineering but also the way a society distributes the right to occupy a place.

For her part, Fernández-Cabrera (2012) recalls that more than 56% of the population of metropolitan Caracas lives in informal settlements covering some 4500 hectares, and that the regularization of tenure began with Decree 1666 of February 2002, which created the Urban Land Committees, continued with the 2006 Special Regularization Law and was reformed in 2011. This indicates that any aid allocation or reconstruction system that takes the registered title as its starting point would leave out a considerable proportion of those affected.

At the constitutional level, the Constitution of the Bolivarian Republic of Venezuela (1999) guarantees in Article 115 the right to property, subject to the contributions, restrictions and obligations established by law for purposes of public utility or general interest, and recognizes in Article 82 the right to adequate, safe, comfortable and hygienic housing, with a “habitat that humanizes family, neighborhood and community relations”. At the same time, reconstruction increasingly relies on artificial intelligence [AI] systems to map damage and prioritize aid (Sun, et al., 2020), while algorethics requires these systems to be subordinated to human dignity (Gamboa-Bernal, 2024).

But what happens when a reconstruction algorithm recognizes as a subject of rights only those who hold a title, and what does comparative law teach about the relationship between property and housing? Based on the above, the research aims to analyze the teleology of land tenure in El Hatillo after the earthquake, contrasting the right to property in Article 115 with the social function of the habitat in Article 82, through an ontological view of AI and algorethics and from comparative law.

METHOD

The methodology used is qualitative, with a systematic literature review design and the hermeneutic-analytical method, which made it possible to analyze national norms, comparative law studies, evaluations of titling programs and algorithmic foundations applicable to regularization and reconstruction. 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*.

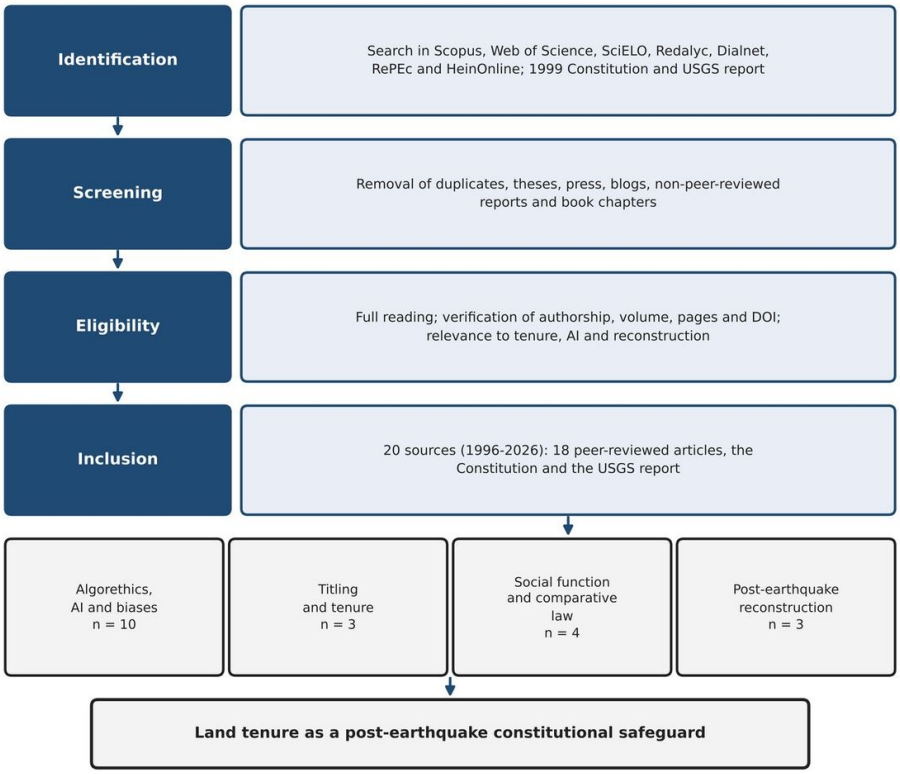
Element	Description
Design	Systematic literature review with a hermeneutic-analytical method
Databases and repositories	Scopus, Web of Science, SciELO, Redalyc, Dialnet, RePEc and HeinOnline
Search terms	("land titling" OR "tenencia de la tierra" OR "regularización") AND ("informal settlements" OR "barrios"); ("social function of property" OR "función social de la propiedad"); ("algorithmic bias" OR "algorética") AND ("disaster" OR "reconstruction")
Period	1996-2026
Inclusion criteria	Peer-reviewed articles with a verifiable record; constitutional norm; official data on the 2026 seismic sequence
Exclusion criteria	Theses, press, blogs, book chapters, non-peer-reviewed reports and unconsolidated damage figures
Axes of analysis	Algorethics, AI and biases (n = 10); titling and tenure (n = 3); social function and comparative law (n = 4); post-earthquake reconstruction (n = 3)

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 with AI and its biases, titling and tenure, the social function of property in comparative law, and post-earthquake reconstruction, 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 individual cadastral data, and the use of figures on casualties or homes damaged by the 2026 earthquakes, not yet consolidated, 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:

Formal titling and its limits

First, the idea that the property title is the key to development has been subjected to empirical evaluation, and Payne, et al., (2009) concluded, after reviewing numerous programs, that titling did not significantly increase investment in housing, access to formal credit or municipal revenue, that there is no significant evidence that it reduces poverty and that, in many countries, a title does not reliably protect against eviction. By contrast, Galiani & Schargrodsky (2010) took advantage of a natural experiment in Buenos Aires, where squatters from 1981 did or did not receive titles depending on the outcome of litigation unrelated to them, and found that titled families invested more in their homes and in their children's education, although not because of greater access to credit.

Similarly, Fernández-Cabrera (2012) documents that in Venezuela titling on private land requires judicial procedures that many residents cannot afford, while part of the Urban Land Committees movement began to demand collective forms of property to avoid the fragmentation of the barrios.

The social function of property in comparative law

Second, Foster & Bonilla (2011) recall that Léon Duguit formulated in 1911, in his Buenos Aires lectures, the theory of property as a social function, and that this idea entered the 1917 Mexican Constitution, the 1925 Chilean constitutional debate, Article 14.2 of the 1949 German Basic Law, according to which property entails obligations, Article 5, item XXIII, of the Brazilian Constitution and Article 58 of the Colombian Constitution. For his part, Bonilla (2011) analyzes how the Constitutional Court of Colombia, in judgment C-595 of 1999, declared unconstitutional the parts of Article 669 of the Civil Code that were incompatible with the social function and conceived of property as a right-duty that imposes obligations on its holder.

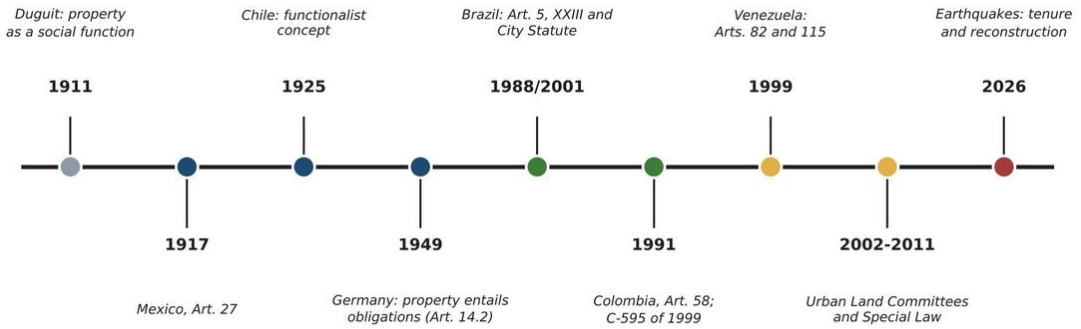
In the Brazilian case, Fernandes (2007) explains how the 2001 City Statute developed the constitutional articles on urban policy and gave legal form to the right to the city, with instruments to regularize settlements and penalize the speculative retention of land. Table 2 and Figure 2 thus summarize this trajectory.

Table 2. *Property and habitat in comparative law*.

Country	Norm	Relevant content
Mexico	1917 Constitution, Art. 27	First Latin American constitutional reception of the social function
Germany	1949 Basic Law, Art. 14.2	Property entails obligations and its use must serve the public good
Brazil	Constitution, Art. 5, XXIII; City Statute (2001)	Property fulfills its social function; regularization instruments and right to the city
Colombia	1991 Constitution, Art. 58; judgment C-595 of 1999	Social and ecological function; property as a right-duty; protection of associative forms
Venezuela	1999 Constitution, Arts. 82 and 115; Special Regularization Law (2006, reformed in 2011)	Property subject to restrictions of public utility or general interest; right to housing and habitat; Urban Land Committees

Note: developed in-house from Foster & Bonilla (2011), Bonilla (2011), Fernandes (2007), Fernández-Cabrera (2012) and Constitution (1999).

Figure 2. *Trajectory of the social function of property up to the post-earthquake Venezuelan context*.



Note: developed in-house from Foster & Bonilla (2011), Bonilla (2011), Fernandes (2007), Fernández-Cabrera (2012) and USGS (2026).

The ontological bias of regularization algorithms

Third, the ontological view of AI asks which entities a system recognizes as existing and relevant, and this is where bias appears, since Kuffer, et al., (2016) reviewed fifteen years of remote-sensing mapping of informal settlements and warned that the results depend on how a settlement is defined and on the morphological diversity of each city, while Obermeyer, et al., (2019) demonstrated that a health algorithm that used spending as an indicator of need systematically underestimated one population group, and that when the indicator was corrected the proportion of that group receiving additional help rose from 17.7% to 46.5%.

Algorethics and post-earthquake reconstruction

Fourth, Floridi, et al., (2018) propose five principles for an AI that is good for society, namely beneficence, non-maleficence, autonomy, justice and explicability, and Pegoraro & Curzel (2023) analyze the Rome Call for AI Ethics as the origin of a movement that demands transparency, inclusion, responsibility, impartiality, reliability, security and privacy. Along the same lines, Villalba (2020) and Gamboa-Bernal (2024) develop algorethics as an ethics of algorithms, and Carreño-Vélez (2025) conceives it as an onto-epistemic and humanizing constitutional guarantee, a perspective that makes it possible to read reconstruction as a bioethical space of constitutional safeguard.

Another aspect that should be examined is the humanitarian governance of these systems, since Beduschi (2022) identifies risks of discrimination and data protection in AI applied to aid, and Coppi, et al., (2021) argue that explicability is a condition of legitimacy before affected communities. Likewise, Aldrich & Meyer (2015) attribute a decisive role to social capital in the recovery of communities after a disaster.

DISCUSSION

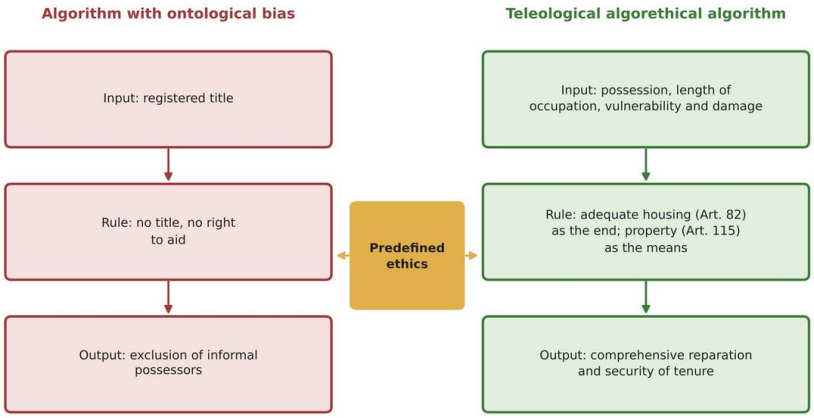
The findings are discussed below and contrasted with what was set out in the introduction:

The results confirm what was anticipated in the introduction, since security of tenure is not reduced to a title and can derive from recognized possession, community organization and protection against eviction, a conclusion shared by the evaluation of Payne, et al., (2009) and the experience of the Urban Land Committees described by Fernández-Cabrera (2012).

Accordingly, the 1999 Venezuelan Constitution belongs to a regional tradition that subordinates property to social ends, although without expressly enshrining the social function formula, so that harmonizing Articles 115 and 82 is left to legislation, case law and, increasingly, the systems that operate reconstruction.

Consequently, a reconstruction algorithm that uses the registered title as an indicator of entitlement reproduces the same error, because it confuses legal form with need and turns informality into nonexistence. Hence an intrinsic challenge for El Hatillo and for the rest of the metropolitan area, where residential developments with registered titles coexist with barrios under informal possession, since the same earthquake can produce similar damage and opposite institutional responses depending on the registration status of the person affected, as represented in Figure 3.

Figure 3. *From ontological bias to a teleological algorethical algorithm*.



Note: developed in-house; authors' inference from Payne, et al., (2009), Obermeyer, et al., (2019) and Constitution (1999).

In light of the above, the authors propose, as an inference, a comparative model in which the adequate housing of Article 82 operates as the end and the property of Article 115 as the means, and in which the algorithm recognizes as primary variables possession, length of occupation, territorial vulnerability and damage, in order to achieve comprehensive reparation and security of tenure, as detailed in Table 3.

Table 3. *Variables of a reconstruction algorithm with an algorethical approach*.

Variable	Title-centered model	Teleological algorethical model
Recognized subject	Registered owner	Every person living in the property, with or without title
Proof of connection	Registry document	Possession, length of occupation and community recognition
Priority criterion	Value of the property	Damage, territorial vulnerability and landslide risk
Outcome	Compensation to the titleholder	Comprehensive reparation and security of tenure
Oversight	Opaque and centralized	Explainable, audited and reviewable by those affected

Note: developed in-house; authors' inference from Payne, et al., (2009), Obermeyer, et al., (2019), Floridi, et al., (2018) and Constitution (1999).

CONCLUSIONS

In sum, the review makes it possible to state that regularization and aid allocation models that privilege formal titling contain an ontological bias that perpetuates socio-spatial exclusion, since comparative evidence shows that a title is not the only source of tenure security and that the population of the barrios of Caracas, mostly without title, would be left out of a system that only recognizes registered owners. Likewise, comparative law, from Duguit to the constitutions of Mexico, Germany, Brazil and Colombia, provides grounds for subordinating property to the protection of the habitat, a tradition to which Articles 115 and 82 of the Venezuelan Constitution belong. Similarly, the Constitution requires an algorethical reconfiguration in which territorial vulnerability and comprehensive reparation are primary teleological variables, so that tenure is redefined as a bioethical space of constitutional safeguard rather than as a registration requirement.

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Non-monetary.

CONFLICT OF INTEREST

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

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AUTHOR CONTRIBUTIONS

Andreas Georgius Prypchan-Miszkewycz: conception of the study and writing of the introduction and of the titling and tenure axis.

Chakjaen Alberto De-Beneditis-González: analysis of the social function of property in comparative law 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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