Games for humanitarian logistics and disaster management: a systematic review

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Abstract

Purpose – This study aims to investigate the use of games in humanitarian logistics and disaster management by conducting a systematic review of academic literature to identify trends, gaps and practical contributions over the past decade.

Design/methodology/approach – The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 protocol and included peer-reviewed articles published between 2014 and 2024 in English. Searches were conducted in Scopus and Web of Science, last updated in January 2025. A total of 59 studies were included, describing 65 games. Data extraction considered disaster phase, type, game genre, mode, platform, application, audience and time interval.

Findings – Most games focus on disaster response (25), with hydrometeorological events (22) being the most addressed. Digital (39), multiplayer (43) and simulation-based games (40) are predominant. The main application is education and training (33), and most games target professionals (34). A significant increase in publications occurred from 2020 onward. Gaps were identified in games addressing mitigation, reconstruction, social disasters and community engagement.

Research limitations/implications – The review included only peer-reviewed articles in English indexed in Scopus and Web of Science, excluding games outside academic literature. Game availability and usability were also not verified, suggesting future research should address these gaps.

Practical implications – The study offers a structured overview and the creation of an online repository (https://jogoshumanitarios.unimar.br) to facilitate access and adoption of games by researchers, developers and practitioners.

Social implications – By promoting awareness, preparedness and decision-making skills, the use of serious games in humanitarian contexts can enhance disaster resilience and community engagement. Broad adoption may support more inclusive, collaborative and socially responsive crisis management strategies.

Originality/value – To the best of the authors' knowledge, this is the first systematic review to map and categorize academic literature on games in humanitarian logistics and disaster management, providing an open-access repository that bridges knowledge gaps and supports more effective and inclusive game development for crisis preparedness.

Keywords Humanitarian logistics, Disaster management, Games, Systematic review, Repository

Paper type Literature review

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1. Introduction

Disaster management and humanitarian logistics require innovative solutions to mitigate impacts and improve emergency response (Falagara Sigala and Wakolbinger, 2019).The increasing frequency and severity of disasters highlights the need to improve disaster management strategies. In this context, games offer a promising tool, combining game design with humanitarian logistics to simulate scenarios, strengthen resilience and optimize decision-making in crises (Lukosch and Comes, 2019; Mokhtar *et al.*, 2021). Studies suggest that games enhance experiential learning, foster stakeholder interaction and improve response efficiency (Boyle *et al.*, 2016; Garris *et al.*, 2002). They also provide immediate feedback, enabling adjustments and personalized guidance (Connolly *et al.*, 2012; Garris *et al.*, 2002), while transferring skills to real-world tasks, enhancing professional performance (Boyle *et al.*, 2016; Wouters *et al.*, 2013).

Despite these advances, games applied to disaster management and humanitarian logistics lack systematic analysis. Critical questions remain: What types of disasters do they address? Which phases of the disaster cycle are covered? Are they primarily designed for education, training or awareness-raising? What mechanics and competencies do they develop? Do they realistically simulate field conditions and influence decision-making? The dispersion of information and the absence of a consolidated analytical framework make it difficult to gain a clear overview of existing initiatives. This not only hinders strategic use by researchers and practitioners but also limits innovation in game development and rigorous impact assessment.

To address this gap, this study presents a systematic literature review (SLR) on games applied to humanitarian logistics and disaster management, covering the last 10 years (2014–2024). Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 protocol (Page, *et al.*, 2021a), the review synthesizes and categorizes the games described in academic literature, generating a detailed repository of their characteristics and applications. This mapping allows for the identification of recurring patterns, emerging trends and overlooked areas, offering a foundation to guide future research and development. Specifically, the study answers the following research questions:

RQ1. What are the predominant characteristics of games used in humanitarian logistics and disaster management?

RQ2. How have these games evolved over the last decade?

RQ3. What gaps remain in the literature on this topic?

A central contribution of this SLR is the creation of an open-access online repository (https://jogoshumanitarios.unimar.br), which addresses the fragmentation of information by providing a structured, searchable database. This resource enables researchers, developers and practitioners to filter games by disaster phase, disaster type, application, genre, platform and target audience, thereby enhancing their accessibility and applicability. By bridging the fields of game design and humanitarian logistics, this study offers a comprehensive overview and strategic reference for researchers, developers and decision-makers. It consolidates dispersed knowledge, critically analyzes the evolution of game-based tools in disaster contexts and aims to serve as a milestone for future initiatives in crisis preparedness, response and resilience building.

This article is structured as follows: Section 2 outlines the SLR methodology, including criteria, data sources and selection process; Section 3 presents the results, highlighting key game characteristics; Section 4 discusses findings in relation to existing literature; and Section 5 concludes with practical implications and future research directions.

2. Methodology

This study adopts a SLR as its primary methodological approach to examine games applied to humanitarian logistics and disaster management. The review follows the PRISMA 2020 guidelines to ensure transparency, methodological rigor and replicability (Page, *et al.*, 2021a, 2021b) A combination of clearly defined inclusion and exclusion criteria, along with independent data screening and extraction by multiple reviewers, enhances the accuracy and reliability of the review process. The following subsections detail the specific steps adopted in conducting the SLR.

2.1 Eligibility criteria

Eligible studies were those that focused on games designed to support humanitarian logistics and disaster management, with the aim of enhancing learning, engagement or behavioral change. To ensure relevance and methodological consistency, this review included only peer-reviewed academic articles published in English and indexed in Scopus or Web of Science within the 2014 and 2024 were included. Exclusion criteria were applied to studies older than 10 years, duplicates, unavailable full texts, nonarticle formats (e.g. theses, conference abstracts) and publications in languages other than English.

It is important to note that this review does not represent a state-of-the-art survey of all existing humanitarian logistics and disaster management games. As such, relevant games not covered in the academic literature were not included in this analysis.

2.2 Sources of information and search strategies

The search was conducted in the Scopus and Web of Science databases, with the last update performed on January 24, 2025. The search strategy used Boolean operators and the following keywords: ("humanitarian logistics" OR "disaster management") AND ("gamification" OR "game"). These terms were applied to article titles, abstracts and keywords to capture relevant publications.

2.3 Selection process and collection of data

The inclusion criteria were applied independently by two reviewers, with disagreements resolved by consensus or a third reviewer. The selection followed three stages:

1 Title and abstract screening, where four reviewers excluded non-relevant studies;
2 Full-text evaluation for final eligibility;
3 Final inclusion of studies meeting the criteria.

2.4 Study data

Data extraction was conducted independently by four reviewers, who identified the information outlined in Table 1 and recorded it in an Excel spreadsheet. This categorization was based on established concepts from key literature in humanitarian logistics, disaster management and game development (Leiras *et al.*, 2017; Marczewski, 2015; Novak, 2017; Rogers, 2013; Salen and Zimmerman, 2003; UNDRR, U.N.O.F.D.R.R, 2020; Wiemker *et al.*, 2015).

To ensure accuracy, a cross-check was conducted using a spreadsheet formula to verify reviewer agreement, generating a true or false value. Discrepancies were resolved by consensus. Missing or unclear data were considered unavailable, and game developers were contacted when necessary. In some cases, when the article did not provide sufficient information for categorization – such as platform, disaster phase or gameplay mode – and when developer or institutional contact information was available, the game developers were contacted for clarification. However, when the articles provided complete data, or when contact details were unavailable or unresponsive, no further action was taken.

2.5 Assessment of risk of bias in studies

Two reviewers independently assessed each study for bias, working without knowledge of each other's evaluations. No automation tools were used in the bias assessment process. Instead, each study was independently reviewed by two researchers, following a standardized evaluation protocol. This manual and double-blind approach contributed to maintaining consistency and methodological rigor throughout the analysis.

2.6 Synthesis method

After reading, cross-referencing and analyses, the authors consolidated the results using a structured spreadsheet,

Table 1 Categorization of data to be extracted from studies included in the SLR

Concepts	Category	Result to be reported	Description
Humanitarian logistics concepts	Disaster phase	Mitigation	Game targets vulnerabilities, risks and resilience
		Preparation	Game builds disaster management and recovery skills
		Response	Game addresses ongoing disasters (monitoring, evacuation, emergency needs, etc.)
		Reconstruction	Game focuses on restoring normalcy post-disaster
	Disaster	Hydrometeorological	Blizzard, flood, cyclone, tsunami, etc.
		Extraterrestrial	Meteorite impact, solar storm, UV radiation, etc.
		Geological risk	Earthquake, landslide, lava flows, etc.
		Environmental	Air pollution, deforestation, wildfires, etc.
		Chemist	Toxic substances, oil spills, pesticides, etc.
		Biological	COVID-19, malaria, zika, rabies, etc.
		Technological	Air crash, cyberattacks, infrastructure failure, etc.
		Social	Armed conflict, terrorism, economic crisis, etc.
Concepts about games	Application	Entertainment	Game for distraction
		Community building	Game for social interaction
		Education	Game teaches real-world events
		Training	Game enhances physical/mental skills
		Marketing and advertising	Game promotes products
	Platform	Digital	Computer, console, smartphone, tablet
		Board games	Cards, dice, boards, pieces
	Time interval	Turn-based	Players act in turns, allowing reflection
		Real time	Continuous play, requiring quick reflexes
		Limited time	Players have a set time per turn
	Gamer mode	Singleplayer	One player vs AI or NPCs
		Two players	Competitive or cooperative play
		Multiplayer	Multiple players locally or online
	Genre	Arcade	Destroy enemies while surviving
		Adventure	Solving puzzles, exploration
		Action-adventure	Mix of action and puzzles
		Casino	Gambling-inspired mechanics
		Puzzle	Solving challenges without character control
		RPG	Narrative-driven, heroic journeys
		Simulations	Real-world system replication
		Strategy	Managing resources to win
	Target Audience	Professionals	Humanitarian logistics and disaster management experts
		Community	Vulnerable residents, students, volunteers, leaders

Source(s): Adapted from Leiras *et al.* (2017); Marczewski (2015); Novak (2017); Rogers (2013); Salen and Zimmerman (2003); UNDRR, (2020); Wiemker *et al.* (2015)

which served as the foundation for the development of the online database. This led to the creation of the repository https://jogoshumanitarios.unimar.br, providing easy access to the games for researchers, developers and professionals.

Subsequently, each category was analyzed by counting the number of games that fell into it to identify predominant characteristics and detect patterns. In addition, the evolution of these characteristics over the 10-year period (2014–2024) was examined to reveal trends and changes in game development.

3. Systematic literature review results

The results of this SLR follow the PRISMA 2020 guidelines, ensuring a transparent and detailed process. This section presents the study selection flow through the PRISMA diagram, detailing the records identified, selected, excluded and included. It also categorizes the selected studies by disaster phase, disaster type, application, player mode, genre, platform, target audience, interval time.

3.1 Selection of studies

The survey initially identified 460 scientific articles. Applying exclusion criteria, 102 were removed due to age (84), duplication (16), format (1) and language (1).

Next, titles, abstracts and keywords were screened, leading to the removal of 283 articles unrelated to humanitarian logistics and disaster management. Two publications were excluded for lack of full-text access, and after a full reading, 14 more were removed for not aligning with the study's intervention.

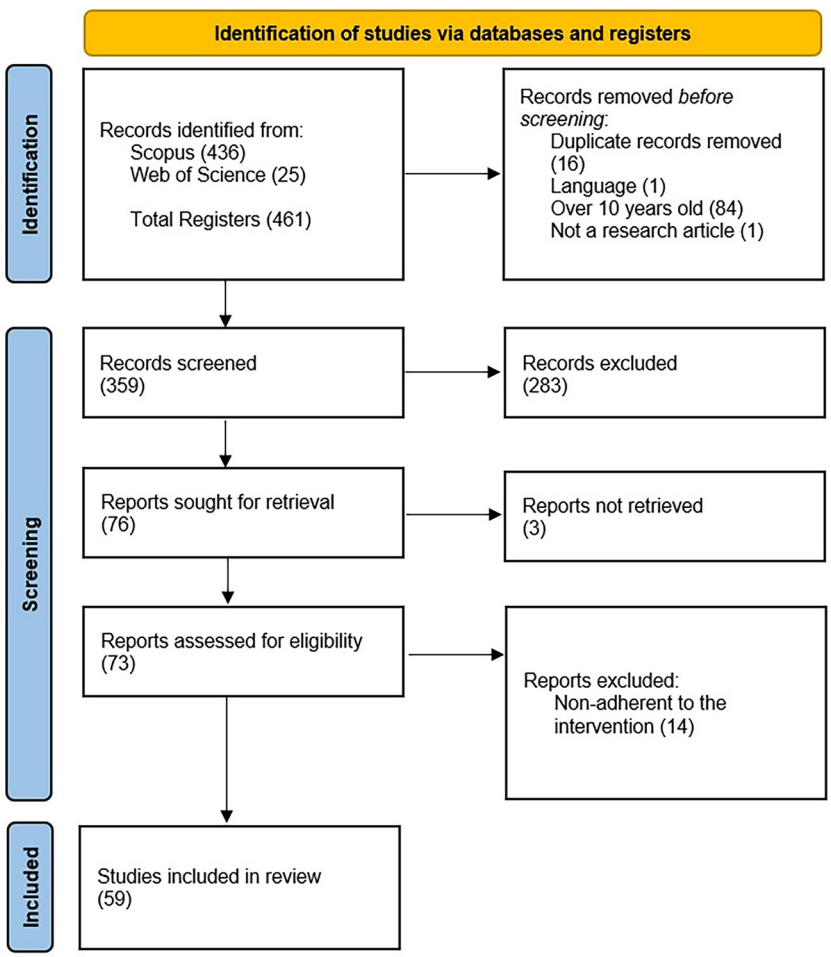
Ultimately, 59 articles were included in this systematic review, with the PRISMA protocol detailed in Figure 1.

3.2 Study characteristics

The 59 studies included in the systematic review present 65 games with a variety of characteristics. Table 2 summarizes the main characteristics of the analyzed studies.

Some games appear in multiple articles, such as *Treme-Treme* and *Do it right: be safer!. Others discuss several games simultaneously, including Hinanjo Unei, Crossroad* and *Evacuation Simulation Training* (Le Dé *et al.*, 2021; Marahatta *et al.*, 2024; Musacchio

Figure 1 PRISMA protocol



Source: Authors' own work

Table 2 Main characteristics of the included studies

Authors	Title	Year	Game	Game intervention
1. Arrighi, Walker	Participatory Video and games for a new climate	2014	Ready!	Disaster preparedness ideas
2. Wolf-Fordham *et al.*	Educating first responders to provide emergency services to individuals with disabilities	2014	Rescue-D	Emergency response for people with disabilities
3. Özpolat *et al.*	Engaging donors in smart compassion: USAID CIDI's greatest good donation calculator	2015	Greatest good donation calculator	Monetary vs material donations
4. Radianti *et al.*	Fire simulation-based adaptation of SmartRescue app for serious game: design, setup and user experience	2015	Disaster in my backyard game	Search and rescue simulation
5. Suarez	Rethinking engagement: innovations in how humanitarians explore geoinformation	2015	UpRiver	Flood prediction and preparedness
6. Tsai *et al.*	Exploring the effects of a serious game-based learning package for disaster prevention education: the case of battle of flooding protection	2015	Water game	Flood management and mitigation
7. Dethridge, Quinn	Realtime emergency communication in virtual worlds	2016	Second life	Emergency scenario training
8. Mossoux *et al.*	Hazagora: will you survive the next disaster? a serious game to raise awareness about geohazards and disaster risk reduction	2016	Hazagora	Community resilience to geological hazards
9. Rauner *et al.*	A policy management game for mass casualty incidents: an experimental study	2016	AMP-management game	Emergency medical training and resource planning
10. Musacchio *et al.*	Education: can a bottom-up strategy help for earthquake disaster prevention?	2016	Treme-treme	Earthquake safety for children
11. Tena-Chollet *et al.*	Training decision-makers: existing strategies for natural and technological crisis management and specifications of an improved simulation-based tool	2016	Name not mentioned	Decision-making, communication and coordination in crises
12. Pardede *et al.*	Animating cows to follow player	2017	Name not mentioned	Volcanic eruption mitigation education
13. Andrews *et al.*	High-risk high-reward investments to mitigate climate change	2018	Climate game	Decision-making in climate change
14. Bertazzo *et al.*	Coordination mechanisms in humanitarian operations management: a conceptual model of a simulator and a proposal for a humanitarian logistics game	2018	Name not mentioned	Decision-making in disaster contexts
15. Chen *et al.*	Research on emergency rescue of urban flood disaster based on wargame simulation	2018	Wargame-based simulation	Urban disaster management training
16. Onencan and Van de Walle	From Paris agreement to action: enhancing climate change familiarity and situation awareness	2018	Nzoia WeShareIt	Climate risk awareness for policymakers
17. Pillai	Emergency preparedness through game playing	2018	Name not mentioned	Disaster education and preparedness
18. William *et al.*	Extendable board game to facilitate learning in supply chain management	2018	ThinkLog	Optimizing disaster relief logistics
19. Aldunate *et al.*	Video game-based platform to improve decision making during response to large scale natural disasters	2019	Disaster management video game	Decision-making in disasters
20. Caroca *et al.*	Epistemic video game for education in wildfire response: a pilot study	2019	Epistemic video game	Disaster risk management education
21. Komori *et al.*	QR HUG: a study on the development of a game to manage a shelter using QR codes	2019	HUG e QR HUG	Shelter management training
22. Lukosch, Comes	Gaming as a research method in humanitarian logistics	2019	PLAITRA	Humanitarian logistics processes
23. Achatz *et al.*	Terror and disaster surgical care: training experienced trauma surgeons in decision making for a MASCAL situation with a tabletop simulation game	2020	TDSC	Hospital management of multi-casualty incidents
24. Booth *et al.*	Simulating synergies between climate change adaptation and disaster risk reduction stakeholders to improve management of transboundary disasters in Europe	2020	RAMSETE I, II, III	Stakeholder interactions and collective decision-making
25. Fleming *et al.*	The use of serious games in engaging stakeholders for disaster risk reduction, management and climate change adaption information elicitation	2020	RAMSETE	Climate adaptation and disaster risk reduction
26. Kerlow *et al.*	Earth girl volcano: characterizing and conveying volcanic hazard complexity in an interactive casual game of disaster preparedness and response	2020	Earth girl volcano	Awareness and resilience to volcanic hazards

(***continued***)

Table 2

Authors	Title	Year	Game	Game intervention
27. Kremer *et al.*	Using serious gaming to explore how uncertainty affects stakeholder decision-making across the science-policy divide during disasters	2020	ESpresso	Crisis decision-making simulation
28. Mueller *et al.*	MANTRA: development and localization of a mobile educational health game targeting low literacy players in low and middle income countries	2020	MANTRA	Health and geological hazard education
29. Sato *et al.*	Sustainable community development for disaster resilience and human resources development for disaster risk reduction – growth and community contribution of the Katahira children's board for community development	2020	DRRTHG	Resilience and disaster mitigation awareness
30. Sermet *et al.*	A serious gaming framework for decision support on hydrological hazards	2020	Multihazard tournament	Community mitigation decision-making
31. Solarino Ferreira *et al.*	What scientific information on the seismic risk to non-structural elements do people need to know?	2020	Do it right: be safer!	Mitigation of nonstructural earthquake risks
32. Solarino Musacchio *et al.*	Playing games for risk prevention: design, implementation and testing of serious games in recent European projects UPStrat-MAFA and knowRISK	2020	Treme-treme; do it right: be safer!; find the difference: be safer!	Earthquake preparedness education
33. Tomaszewski *et al.*	Supporting disaster resilience spatial thinking with serious GeoGames: project lily pad	2020	Project lily pad	Disaster resilience and GIS skills
34. Toyoda	A framework of simulation and gaming for enhancing community resilience against large-scale earthquakes: application for achievements in Japan	2020	Hinanjo unei; crossroad; evacuation simulation training; saske-nable	Evacuation and shelter management
35. Tsai *et al.*	Game-based education for disaster prevention	2020	Battle of flooding protection	Disaster prevention and citizen action
36. Catedrilla *et al.*	An android-based mobile educational game for disaster preparedness: an input to risk reduction management	2021	Rules of disaster	Disaster awareness and preparedness
37. De Ruiter *et al.*	Breaking the silos: an online serious game for multi-risk disaster risk reduction (DRR) management	2021	Breaking the silos	Understanding disaster management complexities
38. Le Dé *et al.*	Fostering children's participation in disaster risk reduction through play: a case study of LEGO and Minecraft	2021	LEGO; minecraft	Disaster risk reduction for children
39. Mokhtar *et al.*	Applying serious game elements to enhance flood safety training management	2021	Flood safety training game	Flood preparedness and safety
40. Mullin, 41. Milburn	Logistics to the rescue: an elementary introduction to planning in disaster response decision environments	2021	Logistics to the rescue	Introduce search and rescue concepts and planning at various stages
41. Weyrich *et al.*	Using serious games to evaluate the potential of social media information in early warning disaster management	2021	SANYCaRE	Decision-making in emergencies and social media use
42. Bogdan, Cottar	A serious role-playing game as a pedagogical innovation to strengthen flood resilience	2022	Flood resilience challenge	Increase flood resilience
43. Conte	A natural disaster framed common pool resource game yields no framing effects among mongolian pastoralists	2022	Common pool resource game	Resource management in disasters
44. Hosseini *et al.*	Game-based vs case-based training for increasing knowledge and behavioral fluency of nurse students regarding crisis and disaster management; a quasi-experimental study	2022	Name not mentioned	Crisis management training for nursing students
45. Klein *et al.*	Teaching humanitarian logistics with the disaster response game	2022	Disaster response game	Coordination and logistics in disasters
46. Olivares-Rodríguez *et al.*	Costa resiliente: a serious game co-designed to foster resilience thinking	2022	Costa resiliente	Coastal community resilience
47. Rismayani *et al.*	Fundamental design of flood management educational games using virtual reality technology	2022	Flood disaster management simulation	VR training in flood disaster management

(***continued***)

Table 2

Authors	Title	Year	Game	Game intervention
48. Xu and Dai	Immersive disaster training schema based on team role-playing	2022	VR and role-playing	Decision-making in disasters
49. Chew *et al.*	Tutorless board game as an alternative to tabletop exercise for disaster response training: perception of interaction engagement and behavioral intention	2023	SMARTriage	Disaster response training for medical students
50. D'Amico *et al.*	A nonimmersive virtual reality serious game application for flood safety training	2023	Name not mentioned	Flood awareness and preparedness
51. Feizizadeh; Adabikhosh; Panahi	A scenario-based and game-based geographical information system (GIS) approach for earthquake disaster simulation and crisis mitigation	2023	GISscience	Optimize the effectiveness of rescue teams and crisis management facilities
52. Purnama Sari *et al.*	Development of "Moroca" as a learning media for reproductive health services in disaster situations	2023	Moroca	Reproductive health in disasters
53. Toyoda; Tanwattana	Extracting local disaster knowledge through gamification in a flood management model community in Thailand	2023	Local disaster knowledge game	Extracting local flood management knowledge
54. Solarino S. *et al.*	Inundation: a gaming app for a sustainable approach to sea level rise	2024	Inundation	Youth engagement in sea level rise issues
55. Asgary *et al.*	Road to resettlement: understanding post-disaster relocation and resettlement challenges and complexities through a serious game	2024	Road to resettlement	Understanding challenges in resettlement
56. Arakawa; Sister Yamada; Sugimori	Development and evaluation of a game to foster sustainable self-help and mutual help education for disaster prevention	2024	Name not mentioned	Community education for disaster prevention
57. Marahatta; Ghimire; Poplin,	Designing and evaluating games for landslides, earthquakes and fires: lesson learned from schools in Nepal	2024	Snakes and ladders Game for landslides awareness building; picture story game for fire safety; relay Game for earthquake awareness	Emergency response training
58. Naeemi *et al.*	Pandemic resilience serious game: crafting an educational strategy board game	2024	PRSG	Pandemic decision-making and management
59. Tzioutzios *et al.*	Serious gaming for Natech risk awareness: introducing EGNARIA	2024	EGNARIA	Community awareness of Natech accidents

Source(s): Adapted from Achatz *et al.* (2020), Aldunate *et al.* (2019), Andrews *et al.* (2018), Arakawa *et al.* (2024); Arrighi and Walker (2014); Asgary *et al.* (2024); Bertazzo *et al.* (2018); Bogdan and Cottar (2022); Booth *et al.* (2020); Caroca *et al.* (2019); Catedrilla *et al.* (2021); Chen *et al.* (2018); Chew *et al.* (2023); Conte (2022); D'Amico *et al.* (2023); Le Dé *et al.* (2021); Dethridge and Quinn (2016); Feizizadeh *et al.* (2023); Fleming *et al.* (2020); Hosseini *et al.* (2022); Kerlow *et al.* (2020); Klein *et al.* (2022); Komori *et al.* (2019); Kremer *et al.* (2020); Lukosch and Comes (2019); Marahatta *et al.* (2024); Mokhtar *et al.* (2021); Mossoux *et al.* (2016); Mueller *et al.* (2020); Mullin and Milburn (2021); Musacchio *et al.* (2016); Naeemi *et al.* (2024); Olivares-Rodríguez *et al.* (2022); Onencan and Van de Walle (2018); Özpolat *et al.* (2015); Pardede *et al.* (2017); Pillai *et al.*, (2019); Purnama Sari *et al.* (2023); Radianti *et al.* (2015); Rauner *et al.* (2016); Rismayani *et al.* (2022); De Ruiter *et al.* (2021); Sato *et al.* (2020); Sermet *et al.* (2020); Solarino *et al.* (2024); Solarino *et al.*, (2020a); Solarino *et al.* (2020b); Suarez (2015); Tena-Chollet *et al.* (2016); Tomaszewski *et al.* (2020); Toyoda (2020); Toyoda and Tanwattana (2023); Tsai *et al.* (2015, 2020); Tzioutzios *et al.* (2024); Weyrich *et al.* (2021); William *et al.* (2018); Wolf-Fordham *et al.* (2014); Xu and Dai (2022)

et al., 2016; Solarino, et al., 2020a, 2020b; Toyoda, 2020). Some studies adapt existing platforms such as Lego, Minecraft and Second Life due to their high customizability, open-ended design and user-generated content capabilities. These features allow users to construct virtual environments, simulate infrastructure and model complex logistical or evacuation scenarios, making them particularly suited for disaster preparedness and response training (Le Dé et al., 2021; Marahatta et al., 2024; Toyoda, 2020). In addition, seven studies did not specify game names, suggesting custom simulations or a lack of methodological detail (Arakawa et al., 2024; Bertazzo et al., 2018; D'Amico et al., 2023; Hosseini et al., 2022; Pardede et al., 2017; Pillai et al., 2019; Tena-Chollet et al., 2016).

3.3 Results of the summaries

The 65 games identified in the analyzed studies were examined based on the categories presented above in Table 1. This classification allowed us to identify patterns and trends in the approaches used.

Table 3 presents the distribution of the predominant characteristics in the games, showing significant trends.

Table 3 Predominant characteristics in the games analyzed

Category	Predominant characteristic	Qty games
Phase	Response	25
Disaster	Hydrometeorological	22
Application	Education and training	33
Gamer mode	Multiplayer	43
Genre	Simulation	40
Target audience	Professionals	34
Platform	Digital games	39
Time interval	Turn based	30

Source(s): Authors' own work

Analysis of the 65 games revealed striking trends in their characteristics. The most discussed phase is the disaster response present in 25 games. As for the type of disaster, hydrometeorological hazards predominate with 22 games with flooding standing out as the most represented disaster (13 games) (Asgary et al., 2024; Bogdan and Cottar, 2022; Chen et al., 2018; D'Amico et al., 2023; Mokhtar et al., 2021; Rismayani et al., 2022; Sermet et al., 2020; Solarino et al., 2024; Suarez, 2015; Toyoda and Tanwattana, 2023; Tsai et al., 2015, 2020; Weyrich et al., 2021).

The main application of games is education and training (33 games) and most of the experiences are multiplayer (43 games). In the genre, simulation largely predominates (40 games), being aimed mainly at professionals in the field (34 games). In terms of platform, digital games are recurrent (39 games) and most of the dynamics take place in a turn-based format (30 games).

The analysis of the evolution of games over the past decade shows a significant increase, particularly from 2020 onward, as illustrated in Figure 2.

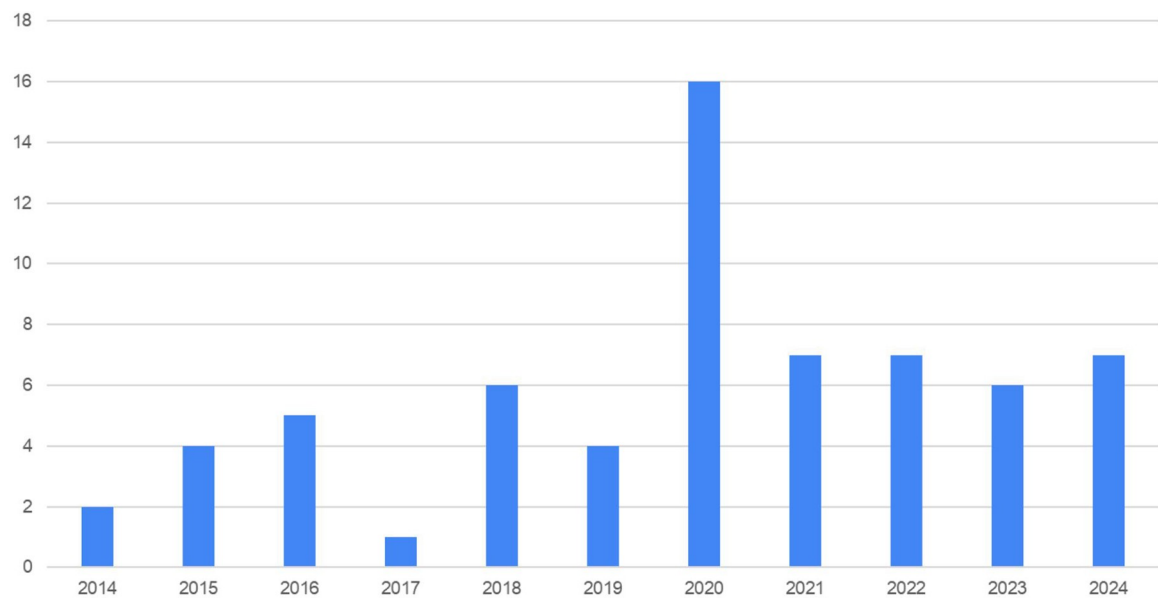
Between 2014 and 2019, game production was modest, peaking at six releases in 2018. From 2020, it surged, reaching 16 games, likely due to rising disaster concerns, COVID-19 and advancements in simulation technologies. Although releases declined after 2020, production remained stable.

The next sections provide a detailed analysis of game characteristics, identifying patterns and trends across disaster phase, type, application, game mode, genre, audience, platform and time interval.

3.3.1 *Phase of the disaster addressed by the games*

Disaster risk management is typically structured around four main phases: mitigation, which refers to actions aimed at reducing or preventing the impact of hazards; preparedness, involving planning and capacity building for potential events; response, which includes immediate actions taken during and after a disaster to save lives and reduce harm; and reconstruction (or recovery), focused on restoring infrastructure, services and

Figure 2 Evolution of games in humanitarian logistics and disaster management (2014–2024)



Source: Authors' own work

communities after the event. Some games address only one of these phases, while others span multiple phases, as detailed in the following analysis.

The analyzed games were categorized by the disaster phase they address, as shown in Table 1. Some games span multiple phases. Table 4 details their distribution, highlighting their respective titles.

Analysis of the distribution of games according to the phases of the disaster revealed significant trends. The response phase is the most addressed, being present in 25 games, followed by preparation, which appears in 11 titles. Mitigation is explored in six games, while reconstruction appears in isolation in only one. In addition, some games integrate multiple phases, such as the combination of preparation and response (six games) and the full approach of mitigation, preparation, response and reconstruction (four games). Other hybrid formats include mitigation and preparedness (four games) and preparedness, response and reconstruction (two games).

The 10-year analysis highlights trends in disaster phase distribution. Figure 3 shows how mitigation, preparation, response and reconstruction were addressed in games from 2014 to 2024, revealing growth patterns, stagnation or shifts in emphasis over time.

Until 2018, games focused on response, with preparation growing from 2019. In the following years, diversification increased, with mitigation and reconstruction emerging, though less frequently. This indicates a shift toward more integrated approaches in humanitarian logistics games.

3.3.2 Type of disaster addressed by the games

To determine the predominant characteristics of games in humanitarian logistics and disaster management, the UNDRR-ISC Hazard Definition and Classification Review was used to categorize them by disaster type (UNDRR, U.N.O.F.D.R.R, 2020). The extracted data grouped the games into six disaster categories: hydrometeorological, geological, environmental, biological, technological and social, as shown in Table 1. In addition, some games covered multiple disasters or lacked a specified type. Table 5 details the distribution of games by disaster type and title.

Hydrometeorological disasters were the most represented, being the central theme in 22 games. This result highlights the relevance of events such as floods, cyclones and tsunamis in the literature of games focused on this area, possibly due to their global recurrence and significant impact on vulnerable communities.

Geological disasters also had an expressive presence, with 15 games, exclusively addressing this theme. This emphasis may be related to the need to prepare populations for events of great magnitude, such as earthquakes and landslides, which require quick and effective responses.

Environmental disasters were addressed in isolation in five games. The presence of this theme indicates a growing interest in simulating scenarios related to issues such as deforestation, pollution and biodiversity loss, aligning with contemporary environmental concerns.

Social and technological disasters had lower representation, appearing in five and four games, respectively. Similarly, biological disasters have been involved in only one game, which focuses specifically on pandemics. This result suggests that, although these categories are relevant to crisis management, their incorporation into games may still be under development, possibly due to the complexity of their dynamics and the need for more specific approaches to simulation.

Eleven games address different types of disasters simultaneously, reflecting the interconnectedness between the various risks faced in crisis scenarios. Finally, four games did not clearly specify the type of disaster addressed, which may indicate limitations in the description of the scenarios, or a more generalist focus on emergency management.

The 10-year evolution of disaster types in humanitarian logistics games reveals notable trends. Figure 4 illustrates the frequency of games on mixed, technological, climatological, geological and hydrological disasters in the analyzed games.

Hydrometeorological disasters dominated with 22 games, particularly between 2020 and 2023, reflecting rising concerns over extreme events. Geological disasters followed with 15 games, peaking in 2020 with 8. Environmental and social disasters appeared in five games, while hybrid disasters totaled nine, highlighting an underexplored integrated approach. Technological disasters were the least represented, with only two games. Despite this dominance, recent trends indicate a growing thematic diversification in humanitarian logistics games.

3.3.3 Application of the game addressed by the games

The games analyzed in the SLR were categorized according to predefined criteria in Table 1, allowing the identification of games in the Education and Training categories, as well as mixed games that encompass both applications. Table 6 presents the distribution of the games analyzed according to their applications in disaster contexts.

The results of the analysis indicate that the predominant category is Education and Training, with a total of 33 games identified. This suggests a significant trend in the use of serious games as hybrid tools, combining educational elements with hands-on training.

Next, the Education category is observed, which has 25 games, demonstrating the interest in the use of these resources to disseminate knowledge about disasters. Finally, the Training category appears with 7 games, indicating a smaller number of games dedicated exclusively to professional training, possibly due to the complexity involved in the development of realistic simulations. The evolution of the distribution of game applications over the last ten years demonstrates trends that can be observed in Figure 5.

Until 2018, games focused on education and training, with education growing independently from 2020. That year saw a peak, likely due to COVID-19, reinforcing education and training as the most frequent application, totaling 33 games. In the following years, education remained strong (25 games), while training appeared more sporadically (7 games). This suggests a shift toward more specialized applications in humanitarian logistics games.

3.3.4 Player mode covered by the games

The games analyzed were classified according to the player mode for which they were developed. Categories include:

- multiplayer;
- singleplayer;
- multiplayer and singleplayer;
- two players; and
- unspecified.

Table 4 Distribution of games by disaster phases

Phase	Qty	Game	Studies
R	25	Disaster in my backyard game	Radianti *et al.* (2015)
		Second life	Dethridge & Quinn (2016)
		AMP-management game	Rauner *et al.* (2016)
		Wargame-based simulation	Chen *et al.* (2018)
		Disaster management video game	Aldunate *et al.* (2019)
		Epistemic video game	Caroca *et al.* (2019)
		HUG e QR HUG	Komori *et al.* (2019)
		PLAITRA	Lukosch & Comes (2019)
		TDSC	Achatz *et al.* (2020)
		ESpresso	Kremer *et al.* (2020)
		Project lily pad	Tomaszewski *et al.* (2020)
		Hinanjo unei	Toyoda (2020)
		Crossroad	Toyoda (2020)
		Evacuation simulation training	Toyoda (2020)
		Saske-nable	Toyoda (2020)
		Logistics to the rescue	Mullin & Milburn (2021)
		Common pool resource game	Conte (2022)
		Disaster response game	Klein *et al.* (2022)
		Moroca	Purnama Sari et al. (2023)
		Inundation	Solarino *et al.* (2024)
		GISscience	Feizizadeh *et al.* (2023)
		SMARTriage	Chew *et al.* (2023)
		Name not mentioned (3 study)	Tena-Chollet *et al.* (2016) Hosseini *et al.* (2022) D'Amico *et al.* (2023)
P	11	Ready!	Arrighi & Walker (2014)
		Nzoia WeShareIt	Onencan & Van de Walle (2018)
		PRSG	Naeemi *et al.* (2024)
		MANTRA	Mueller *et al.* (2020)
		Rules of disaster	Catedrilla *et al.* (2021)
		LEGO	Le Dé *et al.* (2021)
		Minecraft	Le Dé *et al.* (2021)
		Flood safety training game	Mokhtar *et al.* (2021)
		VR and role-playing	Xu & Dai (2022)
		EGNARIA	Tzioutzios *et al.* (2024)
		Name not mentioned (1 study)	Pillai *et al.* (2019)
M	7	Water game	Tsai *et al.* (2015)
		Picture story game for fire safety	Marahatta *et al.* (2024)
		Climate game	Andrews *et al.* (2018)
		DRRTHG	Sato *et al.* (2020)
		Multi-hazard tournament	Sermet *et al.* (2020)
		Battle of flooding protection	Tsai *et al.* (2020)
		Name not mentioned (1 study)	Pardede *et al.* (2017)
PR	6	ThinkLog	William *et al.* (2018)
		SANYCaRE	Weyrich *et al.* (2021)
		Costa resiliente	Olivares-Rodríguez *et al.* (2022)
		Snakes and ladders game for landslides awareness building	Marahatta *et al.* (2024)
		Relay game for earthquake awareness	Marahatta *et al.* (2024)
		Name not mentioned (1 study)	Arakawa *et al.* (2024)
MPRRc	4	Rescue-D	Wolf-Fordham et al. (2014)
		Flood resilience challenge	De Ruiter *et al.* (2021)
		Breaking the Silos	Bogdan & Cottar (2022)
		Name not mentioned (1 study)	Bertazzo *et al.* (2018)
MP	4	Ramsete I, II and III	Booth *et al.* (2020)
		Treme-treme	Solarino *et al.* (2020b) Musacchio *et al.* (2016)
		Do it right: be safer!	Solarino *et al.* (2020a), (2020b)
		Find the difference: be safer!	Solarino *et al.* (2020b)

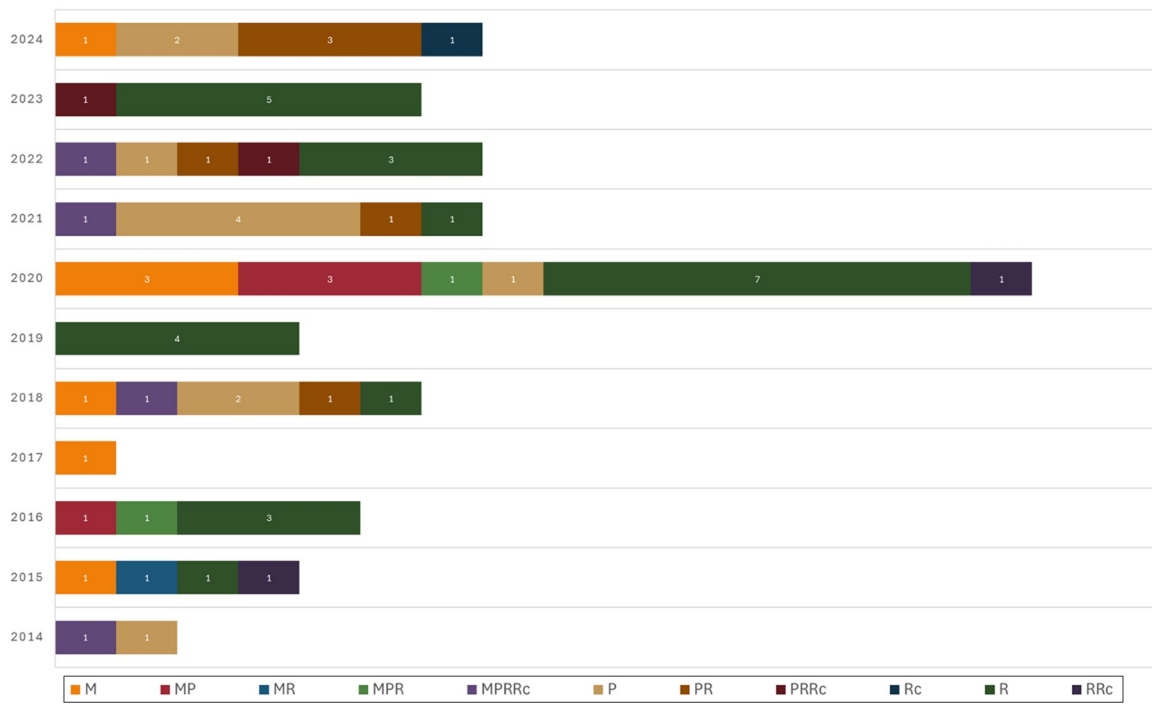
(***continued***)

Table 4

Phase	Qty	Game	Studies
MPR	2	Hazagora	Mossoux *et al.* (2016)
		Earth girl volcano	Kerlow *et al.* (2020)
PRRc	2	Flood disaster management simulation	Rismayani *et al.* (2022)
		Local disaster knowledge game	Toyoda and Tanwattana (2023)
RRc	2	Greatest good donation calculator	Özpolat *et al.* (2015)
		RAMSETE	Fleming *et al.* (2020)
MR	1	UpRiver	Suarez (2015)
Rc	1	Road to resettlement	Asgary *et al.* (2024)

Note(s): M = Mitigation; MP = Mitigation and preparedness; MR = Mitigation and response; MPR = Mitigation, Preparedness and response; MPRRc Mitigation, Preparedness, Response and reconstruction; P = Preparation; PR = Preparedness and response; PRRc = Preparedness, Response and reconstruction; Rc = Reconstruction; R = Response; RRc = Response and reconstruction
Source(s): Authors' own work

Figure 3 Distribution of games by disaster phases between 2014 and 2024



Note: M: Mitigation; MP: Mitigation and preparedness; MR: Mitigation and response; MPR: Mitigation, Preparedness and response; MPRRc Mitigation, Preparedness, Response and reconstruction; P: Preparation; PR: Preparedness and response; PRRc: Preparedness, Response and reconstruction; Rc: Reconstruction; R: Response; RRc: Response and reconstruction
Source: Authors' own work

Table 7 shows the distribution of the games analyzed according to the player mode.

The results of the analysis indicate that the predominant category is that of multiplayer, with a total of 43 games identified. This predominance can be explained by the emphasis on collaboration and learning based on social interaction, fundamental aspects in disaster management scenarios.

Next, the singleplayer category is observed, with 16 games, indicating that there is a significant number of games aimed at individualized learning. The multiplayer and singleplayer categories have three games, while the two players category has a single game registered. Finally, two games did not specify the player mode in the analyzed study. Figure 6 shows the evolution of the distribution of the mode played in the games over the last 10 years.

Multiplayer games grew significantly over time, peaking in 2020 (12 games) amid the rise of educational simulations during COVID-19. While multiplayer remains dominant, single-player games have shown stable distribution without

Table 5 Distribution of games by type of disaster

Type disaster	Qty	Game	Studies
HM	22	Ready!	Arrighi and Walker (2014)
		Rescue-D	Wolf-Fordham *et al.* (2014)
		UpRiver	Suarez (2015)
		Water game	Tsai *et al.* (2015)
		Climate game	Andrews et al. (2018)
		Wargame-based simulation	Chen *et al.* (2018)
		Nzoia WeShareIt	Onencan & Van de Walle (2018)
		ESpresso	Kremer *et al.* (2020)
		Multihazard tournament	Sermet *et al.* (2020)
		Project lily pad	Tomaszewski *et al.* (2020)
		Battle of flooding protection	Tsai et al. (2020)
		Breaking the silos	De Ruiter *et al.* (2021)
		Flood safety training game	Mokhtar *et al.* (2021)
		SANYCaRE	Weyrich *et al.* (2021)
		Flood resilience challenge	Bogdan and Cottar (2022)
		Common pool resource game	Conte (2022)
		Costa resiliente	Olivares-Rodríguez *et al.* (2022)
		Flood disaster management simulation	Rismayani *et al.* (2022)
		Inundation	Solarino *et al.* (2024)
		Road to resettlement	Asgary *et al.* (2024)
		Local disaster knowledge game	Toyoda & Tanwattana (2023)
		Name of game not mentioned (1 study)	D'Amico *et al.* (2023)
GR	15	Relay game for earthquake awareness	Marahatta *et al.* (2024)
		HUG e QR HUG	Komori *et al.* (2019)
		Earth girl volcano	Kerlow *et al.* (2020)
		MANTRA	Mueller *et al.* (2020)
		Treme-treme	Musacchio *et al.* (2016) s
		Do it right: be safer!	Solarino *et al.* (2020a), (2020b)
		Find the difference: be safer!	Solarino *et al.* (2020b)
		Hinanjo Unei	Toyoda (2020)
		Crossroad	Toyoda (2020)
		Evacuation simulation training	Toyoda (2020)
		Saske-Nable	Toyoda (2020)
		GISscience	Feizizadeh *et al.* (2023)
		SMARTriage	Chew *et al.* (2023)
		Snakes and ladders game for landslides awareness building	Marahatta *et al.* (2024)
		Name of game not mentioned (1 study)	Pardede *et al.* (2017)
SC	5	ThinkLog	William *et al.* (2018)
		PLAITRA	Lukosch & Comes (2019)
		TDSC	Achatz et al. (2020)
		Game name not mentioned (2 studies)	Bertazzo *et al.* (2018) Hosseini *et al.* (2022)
EN	5	Second life	Dethridge & Quinn (2016)
		Disaster management video game	Aldunate *et al.* (2019)
		Epistemic video game	Caroca *et al.* (2019)
		Picture story game for fire safety	Marahatta *et al.* (2024)
		Name of game not mentioned (1 study)	Arakawa *et al.* (2024)
HMGR	4	Hazagora	Mossoux *et al.* (2016)
		Moroca	Purnama Sari *et al.* (2023)
		VR and role-playing	Xu & Dai (2022)
		Name of game not mentioned (1 study)	Pillai *et al.* (2019)
ENHMGR	3	Rules of disaster	Catedrilla *et al.* (2021)
		LEGO	Le Dé *et al.* (2021)
		Minecraft	Le Dé *et al.* (2021)
TC	2	Disaster in my backyard game	Radianti *et al.* (2015)
		EGNARIA	Tzioutzios *et al.* (2024)

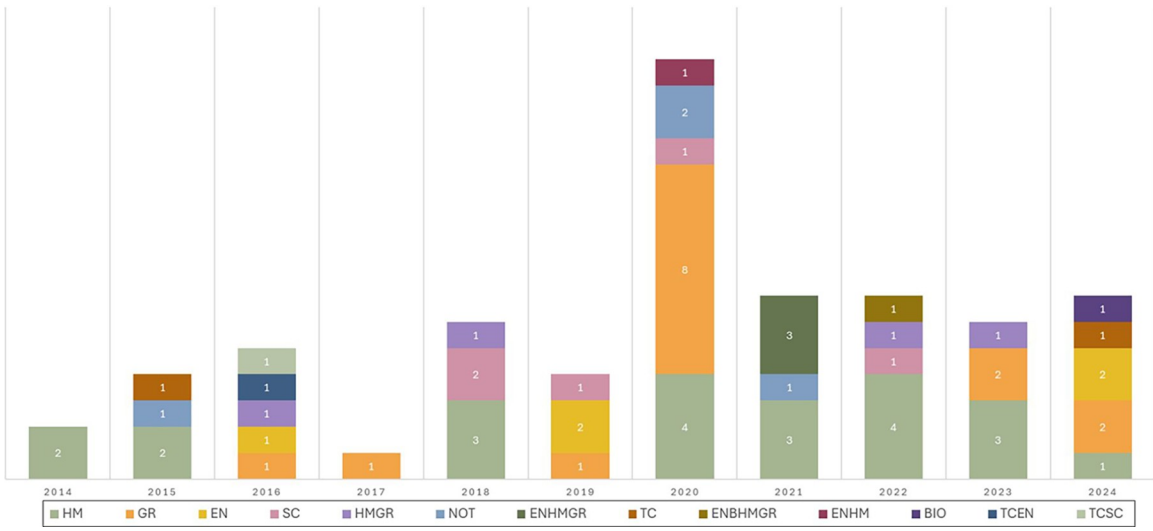
(***continued***)

Table 5

Type disaster	Qty	Game	Studies
ENBHMGR	1	Disaster response game	Klein *et al.* (2022)
ENHM	1	RAMSETE	Fleming *et al.* (2020)
BIO	1	PRSG	Naeemi *et al.* (2024)
TCEN		Name of game not mentioned (1 study)	Tena-Chollet *et al.* (2016)
TCSC		AMP-management game	Rauner *et al.* (2016)
NOT	4	Greatest good donation calculator	Özpolat *et al.* (2015)
		Ramsete I, II and III	Booth *et al.* (2020)
		DRRTHG	Sato *et al.* (2020)
		Logistics to the rescue	Mullin & Milburn (2021)

Note(s): HM = Hydrometeorological; GR = Geological Risk; HMGR = Hydrometeorological/Geological Risk; SC = Social; EN = Environmental; NOT = Not Specified; ENHMGR = Environmental/Hydrometeorological/Geological Risk; ENBHMGR = Environmental/Biological/Hydrometeorological/Geological Risk; ENHM = Environmental/Hydrometeorological; BIO = Organic; TCEN = Technological/Environmental; TCSC = Tecnológico/Social
Source(s): Authors' own work

Figure 4 Distribution of games according to disaster between 2014 and 2024



Note: HM: Hydrometeorological; GR: Geological risk; HMGR: Hydrometeorological/geological risk; SC: Social; EN: Environmental; NOT: Not specified; ENHMGR: Environmental/hydrometeorological/geological Risk; ENBHMGR: Environmental/biological/hydrometeorological/geological risk; ENHM: Environmental/hydrometeorological; BIO: Organic; TCEN: Technological/environmental; TCSC Technological/Social
Source: Authors' own work

major peaks. This trend highlights the focus on collaborative experiences in humanitarian logistics, reflecting the need to simulate crisis coordination. However, the slower growth of single-player games and limited hybrid modes suggest opportunities for more flexible and customizable approaches.

3.3.5 Game *genre* covered by games

In this context, *game* genre refers to the classification of games according to their gameplay structure and core mechanics, following definitions established in the literature on game design and serious games (Marczewski, 2015; Novak, 2017; Salen and Zimmerman, 2003; Wiemker *et al.*, 2015).

The game classification by genre, based on the reviewed articles and Table 1, includes simulation; simulation and strategy; strategy; simulation and role-playing game (RPG); and puzzle and adventure. Table 8 presents the frequency of genres in humanitarian logistics games between 2014 and 2024.

The analysis revealed that the simulation category was the predominant one, with 40 games identified. This predominance reinforces the importance of the simulation-based approach to capacity building in humanitarian logistics and disaster management.

The simulation and strategy category presented 13 games, demonstrating a significant presence of approaches that combine strategic analysis with immersive experiences. The Strategy category was represented by 8, showing a lower presence of games

Table 6 Distribution of games by application

Application	Qty of games	Game	Studies
Education and Training	33	Ready!	Arrighi & Walker (2014)
		Rescue-D	Wolf-Fordham *et al.* (2014)
		UpRiver	Suarez (2015)
		Second Life	Dethridge & Quinn (2016)
		Hazagora	Mossoux *et al.* (2016)
		AMP-management game	Rauner *et al.* (2016)
		Nzoia WeShareIt	Onencan & Van de Walle (2018)
		ThinkLog	William *et al.* (2018)
		Epistemic video game	Caroca *et al.* (2019)
		HUG e QR HUG	Komori *et al.* (2019)
		PLAITRA	Lukosch & Comes (2019)
		Ramsete I, II and III	Booth *et al.* (2020)
		RAMSETE	Fleming *et al.* (2020)
		Earth girl volcano	Kerlow *et al.* (2020)
		ESpresso	Kremer *et al.* (2020)
		Multihazard tournament	Sermet *et al.* (2020)
		Find the difference: be safer!	Solarino *et al.* (2020b)
		Project lily pad	Tomaszewski *et al.* (2020)
		Hinanjo unei	Toyoda (2020)
		Crossroad	Toyoda (2020)
		Evacuation simulation training	Toyoda (2020)
		Saske-Nable	Toyoda (2020)
		Breaking the Silos	De Ruiter *et al.* (2021)
		SANYCaRE	Weyrich *et al.* (2021)
		Flood resilience challenge	Bogdan & Cottar (2022)
		Disaster response game	Klein *et al.* (2022)
		Costa resiliente	Olivares-Rodríguez *et al.* (2022)
		VR and role-playing	Xu & Dai (2022)
		PRSG	Naeemi *et al.* (2024)
		Game name not mentioned (4 studies)	Tena-Chollet *et al.* (2016) Bertazzo *et al.* (2018) Pillai *et al.* (2019) Hosseini *et al.* (2022)
Education	25	Greatest good donation calculator	Özpolat *et al.* (2015)
		Water game	Tsai *et al.* (2015)
		Climate game	Andrews *et al.* (2018)
		MANTRA	Mueller *et al.* (2020)
		DRRTHG	Sato *et al.* (2020)
		Treme-treme	Musacchio *et al.* (2016), Solarino *et al.* (2020b)
		Do it right: be safer!	Solarino *et al.* (2020a), (2020b)
		Battle of flooding protection	Tsai *et al.* (2020)
		Rules of disaster	Catedrilla *et al.* (2021)
		LEGO	Le Dé *et al.* (2021)
		Minecraft	Le Dé *et al.* (2021)
		Logistics to the rescue	Mullin & Milburn (2021)
		Common pool resource game	Conte (2022)
		Flood disaster management simulation	Rismayani *et al.* (2022)
		Moroca	Purnama Sari *et al.* (2023)
		Inundation	Solarino *et al.* (2024)
		GISscience	Feizizadeh *et al.* (2023)
		Local disaster knowledge game	Toyoda & Tanwattana (2023)
		Road to resettlement	Asgary *et al.* (2024)
		EGNARIA	Tzioutzios *et al.* (2024)
		Snakes and ladders game for landslides awareness building	Marahatta *et al.* (2024)
		Picture story game for fire safety	Marahatta *et al.* (2024)
		Relay game for earthquake awareness	Marahatta *et al.* (2024)
		Game name not mentioned (2 studies)	Pardede *et al.* (2017) Arakawa *et al.* (2024)

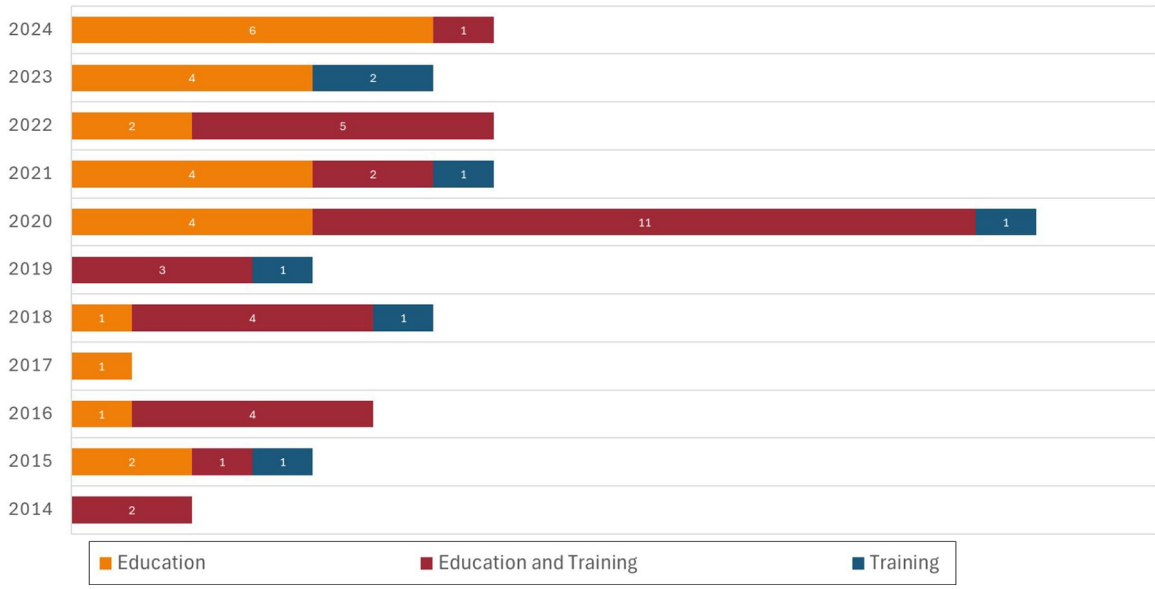
(***continued***)

Table 6

Application	Qty of games	Game	Studies
Training	7	Disaster in my backyard game	Radianti *et al.* (2015)
		Wargame-based simulation	Chen *et al.* (2018)
		Disaster management video game	Aldunate *et al.* (2019)
		TDSC	Achatz *et al.* (2020)
		SMARTriage	Chew *et al.* (2023)
		Flood safety training game	Mokhtar *et al.* (2021)
		Game name not mentioned (1 studies)	D'Amico *et al.* (2023)

Source(s): Authors' own work

Figure 5 Distribution of games by application between 2014 and 2024



Source: Authors' own work

that focus exclusively on this format, although still relevant within the field studied. The simulation and RPG category includes only three games, suggesting that this combination is currently underexplored. The integration of simulation and interactive narrative elements may represent a promising approach to foster collaborative skills and group decision-making, as indicated by the intended goals described in the reviewed studies.

Finally, the puzzle and adventure category had only one game, indicating a less explored approach within the study area. The evolution of the distribution of genres over the last ten years reveals a significant growth of simulation games, which have been consolidated as the main genre since 2015, which can be seen in Figure 7.

Until 2018, this genre was predominant, with moderate growth and fluctuations. In 2020, a sharp increase occurred, likely due to COVID-19, alongside the rise of simulation-strategy hybrids. From 2021–2024, numbers stabilized with slight genre diversification. Strategy games gained traction from 2022, while simulation-RPG hybrids appeared sporadically, suggesting experimentation.

Despite simulation's dominance, the trend points to more varied approaches, incorporating strategic and narrative elements to enhance complexity and engagement in humanitarian logistics games.

3.3.6 *Target audience addressed by games*

To identify the target audience, the extracted data was categorized into two classes: games for professionals and games for the community, as presented in Table 1. Table 9 shows the distribution of games according to this categorization.

Among the identified games, 34 were developed for professionals focusing on training in disaster management, emergency response and decision-making. These include wargame-based simulations, immersive virtual reality training and strategic management games, with specific sectors like health and public safety also targeted.

Community-driven games total 27, using playful mechanics to teach disaster awareness, risk management and preventive measures, with formats like interactive simulations and board games. Four games cater to both professionals and the community, offering hybrid approaches to engage diverse audiences in disaster management. Figure 8 illustrates the distribution of target audiences in humanitarian logistics games from 2014 to 2024, showing the evolution of these approaches.

Table 7 Distribution of games by player mode

Player mode	Qty of games	Game	Studies
Multiplayer	43	Ready!	Arrighi & Walker (2014)
		Disaster in my backyard game	Radianti *et al.* (2015)
		UpRiver	Suarez (2015)
		Second life	Dethridge & Quinn (2016)
		Hazagora	Mossoux *et al.* (2016)
		Climate game	Andrews *et al.* (2018)
		Wargame-based simulation	Chen *et al.* (2018)
		Nzoia WeShareIt	Onencan & Van de Walle (2018)
		ThinkLog	William *et al.* (2018)
		Disaster management video game	Aldunate *et al.* (2019)
		Epistemic video game	Caroca *et al.* (2019)
		HUG e QR HUG	Komori *et al.* (2019)
		PLAITRA	Lukosch & Comes (2019)
		TDSC	Achatz *et al.* (2020)
		Ramsete I, II, III	Booth *et al.* (2020)
		RAMSETE	Fleming *et al.* (2020)
		ESpresso	Kremer *et al.* (2020)
		DRRTHG	Sato *et al.* (2020)
		Multihazard tournament	Sermet *et al.* (2020)
		Do it right: be safer!	Solarino *et al.* (2020a), (2020b)
		Find the difference: be safer!	Solarino *et al.* (2020b)
		Hinanjo Unei	Toyoda (2020)
		Crossroad	Toyoda (2020)
		Evacuation simulation training	Toyoda (2020)
		Saske-Nable	Toyoda (2020)
		Breaking the Silos	De Ruiter *et al.* (2021)
		LEGO	Le Dé *et al.* (2021)
		Minecraft	Le Dé *et al.* (2021)
		SANYCaRE	Weyrich *et al.* (2021)
		Flood resilience challenge	Bogdan & Cottar (2022)
		Disaster response game	Klein *et al.* (2022)
		Costa resiliente	Olivares-Rodríguez *et al.* (2022)
		VR and role-playing	Xu & Dai (2022)
		Moroca	Purnama Sari *et al.* (2023)
		Inundation	Solarino *et al.* (2024)
		SMARTriage	Chew *et al.* (2023)
		Local disaster knowledge game	Toyoda & Tanwattana (2023)
		Road to resettlement	Asgary *et al.* (2024)
		EGNARIA	Tzioutzios *et al.* (2024)
		PRSG	Naeemi *et al.* (2024)
		Snakes and ladders game for landslides awareness building	Marahatta *et al.* (2024)
		Picture story game for fire safety	Marahatta *et al.* (2024)
		Relay game for earthquake awareness	Marahatta *et al.* (2024)
Singleplayer	16	Greatest good donation calculator	Özpolat *et al.* (2015)
		Water game	Tsai *et al.* (2015)
		AMP-management game	Rauner *et al.* (2016)
		Earth girl volcano	Kerlow *et al.* (2020)
		MANTRA	Mueller *et al.* (2020)
		Treme-treme	Solarino *et al.* (2020b), Musacchio *et al.* (2016)
		Battle of flooding protection	Tsai *et al.* (2020)
		Rules of disaster	Catedrilla *et al.* (2021)
		Logistics to the rescue	Mullin & Milburn (2021)
		Flood disaster management simulation	Rismayani *et al.* (2022)

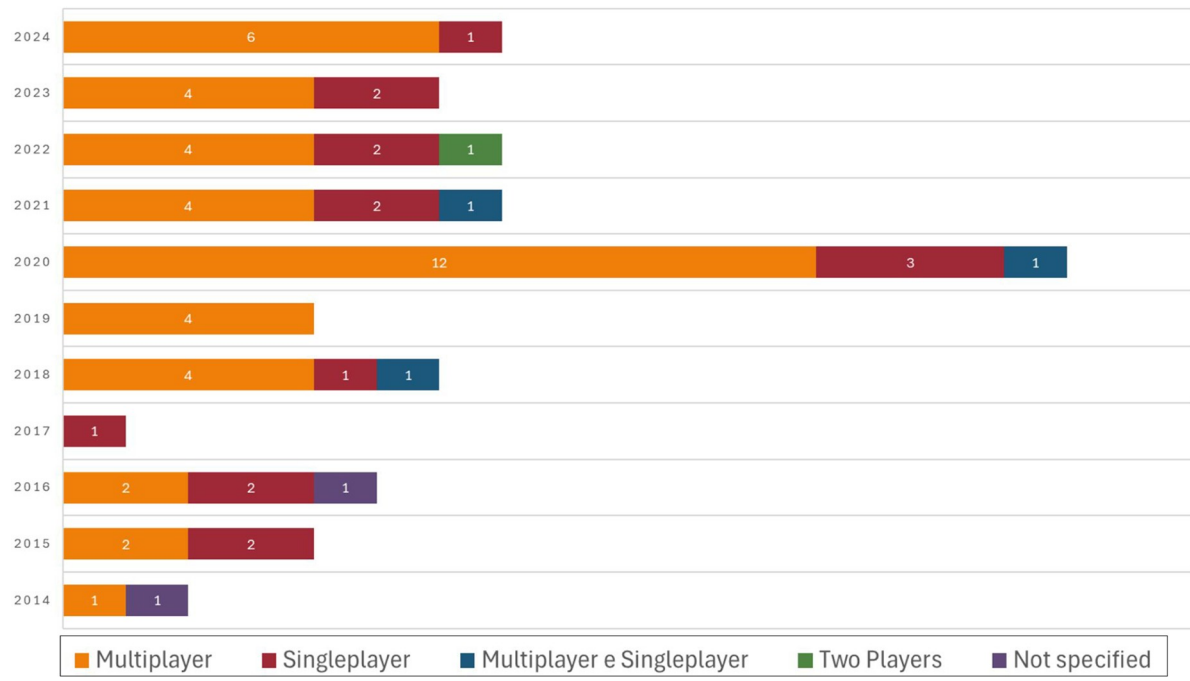
(***continued***)

Table 7

Player mode	Qty of games	Game	Studies
		GISscience	Feizizadeh *et al.* (2023)
		Game name not mentioned (5 studies)	Pardede *et al.* (2017) Pillai *et al.* (2019) Hosseini *et al.* (2022)
Multiplayer e Singleplayer	3	Project lily pad	Tomaszewski *et al.* (2020)
		Game name not mentioned (2 studies)	Bertazzo *et al.* (2018) Mokhtar *et al.* (2021)
Twoplayers	1	Common pool resource game	Conte (2022)
Not specified in the study	2	Rescue-D	Wolf-Fordham *et al.* (2014)
		Game name not mentioned (1 study)	Tena-Chollet *et al.* (2016)

Source(s): Authors' own work

Figure 6 Distribution of games by player mode between 2014 and 2024



Source: Authors' own work

Until 2019, games for professionals grew gradually, becoming dominant from that year onward. In 2020, their numbers peaked, likely due to the COVID-19 pandemic and increased demand for specialized training. Community-focused games, though fewer, gained relevance from 2020, showing a more balanced distribution in later years. Games targeting both groups appeared sporadically, suggesting design challenges or a preference for segmented audiences. While professional-focused games remain predominant, the trend points to greater community inclusion, emphasizing the need for public awareness and disaster preparedness.

3.3.7 Platform addressed by games

The games were classified into two main platforms: digital and board games, with one game spanning both. This categorization follows the platform descriptions in Table 1. Table 10 presents their distribution across platforms.

The analysis of the games found in the SLR demonstrates a varied distribution between the platforms. Of the identified games, the majority (39 games) are made up of digital games, while board games are represented in 25 games. In addition, one game combines both approaches, offering both a physical and a digital version. Figure 9 shows the frequency of platform adoption in humanitarian logistics games from 2014 to 2024, highlighting their evolution over the decade.

From 2018, digital games grew steadily, becoming dominant. In 2019, board games gained traction, peaking in 2020 with ten releases, likely driven by demand for interactive training. Their steady release (2021–2024) suggests sustained interest. While digital games remain prevalent, their growth slowed post-2020, indicating platform diversification. Hybrid games were rare, appearing only once. Overall, the rise of board games reflects a strategic shift, expanding training possibilities in humanitarian logistics.

Table 8 Distribution of games by game genre

Genre	Qty	Game	Studies
Simulation	40	Rescue-D	Wolf-Fordham *et al.* (2014)
		Greatest good donation calculator	Özpolat *et al.* (2015)
		Disaster in my backyard game	Radianti *et al.* (2015)
		UpRiver	Suarez (2015)
		Water game	Tsai *et al.* (2015)
		Second life	Dethridge & Quinn (2016)
		AMP-management game	Rauner *et al.* (2016)
		Nzoia WeShareIt	Onencan & Van de Walle (2018)
		Disaster management video game	Aldunate *et al.* (2019)
		Epistemic video game	Caroca *et al.* (2019)
		HUG e QR HUG	Komori *et al.* (2019)
		PLAITRA	Lukosch & Comes (2019)
		TDSC	Achatz *et al.* (2020)
		Ramsete I, II and III	Booth *et al.* (2020)
		ESpresso	Kremer *et al.* (2020)
		MANTRA	Mueller *et al.* (2020)
		Treme-treme	Solarino *et al.* (2020b), Musacchio *et al.* (2016)
		Do it right: be safer!	Solarino *et al.* (2020a), (2020b)
		Find the difference: be safer!.	Solarino *et al.* (2020b)
		Hinanjo unei	Toyoda (2020)
		Crossroad	Toyoda (2020)
		Evacuation simulation training	Toyoda (2020)
		Saske-nable	Toyoda (2020)
		Rules of disaster	Catedrilla *et al.* (2021)
		LEGO	Le Dé *et al.* (2021)
		Minecraft	Le Dé *et al.* (2021)
		Common pool resource game	Conte (2022)
		Disaster response game	Klein *et al.* (2022)
		Flood disaster management simulation	Rismayani *et al.* (2022)
		Moroca	Purnama Sari *et al.* (2023)
		GISscience	Feizizadeh *et al.* (2023)
		SMARTriage	Chew *et al.* (2023)
		EGNARIA	Tzioutzios *et al.* (2024)
		Flood safety training game	Mokhtar *et al.* (2021)
		Game name not mentioned (6 studies)	Pardede *et al.* (2017) Bertazzo *et al.* (2018) Pillai *et al.* (2019) Hosseini *et al.* (2022) D'Amico *et al.* (2023) Arakawa *et al.* (2024)
Simulation and strategy	13	Hazagora	Mossoux *et al.* (2016)
		PRSG	Naeemi *et al.* (2024)
		Climate game	Andrews *et al.* (2018)
		Wargame-based simulation	Chen *et al.* (2018)
		RAMSETE	Fleming *et al.* (2020)
		Earth girl volcano	Kerlow *et al.* (2020)
		Multihazard tournament	Sermet *et al.* (2020)
		Project lily pad	Tomaszewski *et al.* (2020)
		Battle of flooding protection	Tsai *et al.* (2020)
		Breaking the silos	De Ruiter *et al.* (2021)
		Logistics to the rescue	Mullin & Milburn (2021)
		Costa resiliente	Olivares-Rodríguez *et al.* (2022)
		Name of game not mentioned (1 study)	Tena-Chollet *et al.* (2016)
Strategy	8	Ready!	Arrighi & Walker (2014)
		ThinkLog	William *et al.* (2018)
		Inundation	Solarino *et al.* (2024)
		Local disaster knowledge game	Toyoda & Tanwattana (2023)
		Road to resettlement	Asgary *et al.* (2024) Marahatta *et al.* (2024)

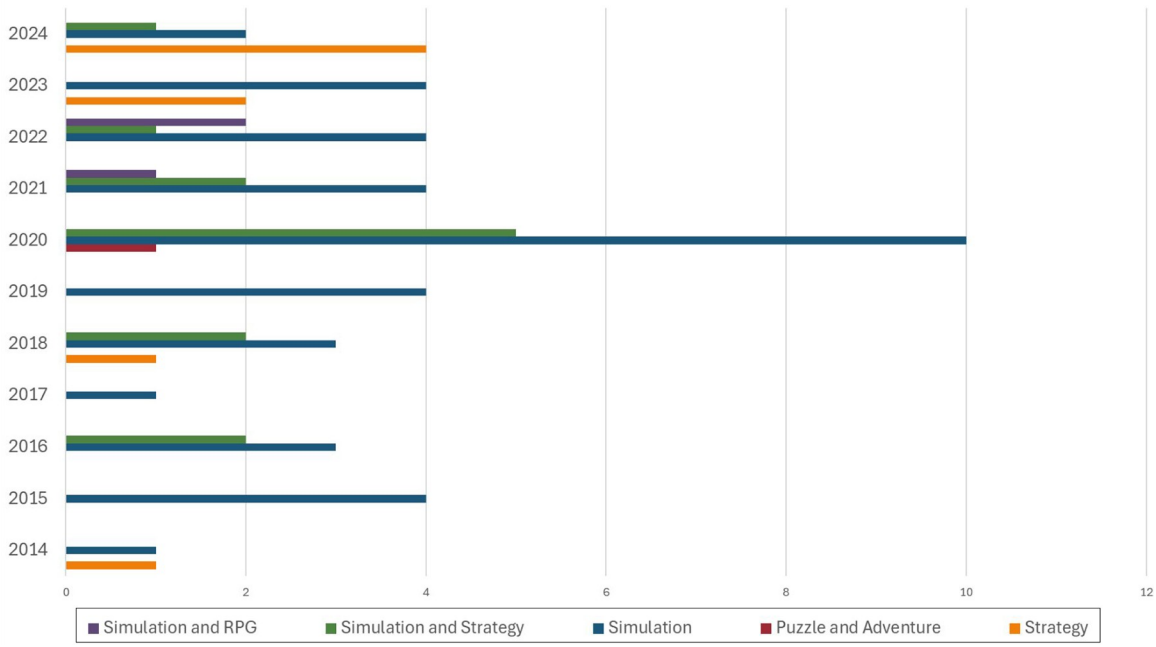
(***continued***)

Table 8

Genre	Qty	Game	Studies
		Snakes and ladders game for landslides awareness building	
		Picture story game for fire safety	Marahatta *et al.* (2024)
		Relay game for earthquake awareness	Marahatta *et al.* (2024)
Simulation and RPG	3	SANYCaRE	Weyrich *et al.* (2021)
		Flood resilience challenge	Bogdan & Cottar (2022)
		VR and role-playing	Xu & Dai (2022)
Puzzle and adventure	1	DRRTHG	Sato *et al.* (2020)

Source(s): Authors' own work

Figure 7 Distribution of games by genre between 2014 and 2024



Source: Authors' own work

3.3.8 Time interval covered by the games

The time range categories identified by SLR in the analyzed games follow the description set out in Table 1. The analysis revealed both games that combine different time models and others that do not specify a time range in the reviewed articles. Table 11 shows the distribution of the games according to their time interval.

The analysis of time intervals in the 65 games reveals a predominance of turn-based systems (30 games), emphasizing strategic decision-making crucial for disaster management training. Real-time games, though less common (26 games), play a significant role in simulating dynamic emergency responses. Limited-time games were rare (2 games), likely due to the challenge of imposing time constraints without hindering learning. Some games combined approaches (3 games), balancing planning and quick reactions, while 4, did not specify a time model.

Figure 10 illustrates the distribution of these approaches from 2014 to 2024, highlighting trends in disaster response game development.

The distribution of games by time interval highlights the predominance of turn-based and real-time approaches. Turn-based games are the most common, growing steadily until 2018 and peaking in 2020 with nine releases, reflecting a preference for structured strategic planning in disaster management simulations. Real-time games, the second most frequent (26 titles), saw peaks in 2016 and renewed growth from 2020 to 2022, emphasizing quick decision-making for emergency scenarios. Hybrid approaches were rare, with only one or two cases, while four games lacked time interval specifications, suggesting documentation gaps.

4. Discussion of the results of the systematic literature review

The SLR on humanitarian logistics and disaster management games (2014–2024) highlights a growing use of games for education and training, with a focus on disaster response,

Table 9 Distribution of games by target audience

Target audience	Qty	Game	Studies
Professionals	34	Rescue-D	Wolf-Fordham *et al.* (2014)
		Disaster in my backyard game	Radianti *et al.* (2015)
		UpRiver	Suarez (2015)
		AMP-management game	Rauner *et al.* (2016)
		Climate game	Andrews *et al.* (2018)
		Wargame-based simulation	Chen *et al.* (2018)
		Nzoia WeShareIt	Onencan & Van de Walle (2018)
		Disaster management video game	Aldunate *et al.* (2019)
		Epistemic video game	Caroca *et al.* (2019)
		HUG e QR HUG	Komori *et al.* (2019)
		PLAITRA	Lukosch & Comes (2019)
		TDSC	Achatz *et al.* (2020)
		Ramsete I, II and III	Booth *et al.* (2020)
		RAMSETE	Fleming *et al.* (2020)
		ESpresso	Kremer *et al.* (2020)
		Multihazard tournament	Sermet *et al.* (2020)
		Project lily pad	Tomaszewski *et al.* (2020)
		Hinanjo unei	Toyoda (2020)
		Crossroad	Toyoda (2020)
		Evacuation simulation training	Toyoda (2020)
		Saske-nable	Toyoda (2020)
		Breaking the silos	De Ruiter *et al.* (2021)
		SANYCaRE	Weyrich *et al.* (2021)
		Flood safety training game	Mokhtar *et al.* (2021)
		Flood resilience challenge	Bogdan & Cottar (2022)
		Disaster response game	Klein *et al.* (2022)
		VR and role-playing	Xu & Dai (2022)
		Moroca	Purnama Sari *et al.* (2023)
		SMARTriage	Chew *et al.* (2023)
		Road to resettlement	Asgary *et al.* (2024)
		PRSG	Naeemi *et al.* (2024)
		Game name not mentioned (3 studies)	Tena-Chollet *et al.* (2016) Bertazzo *et al.* (2018) Hosseini *et al.* (2022)
Community	27	Ready!	Arrighi & Walker (2014)
		Greatest good donation calculator	Özpolat *et al.* (2015)
		Water game	Tsai *et al.* (2015)
		Earth girl volcano	Kerlow *et al.* (2020)
		MANTRA	Mueller *et al.* (2020)
		DRRTHG	Sato *et al.* (2020)
		Treme-treme	Musacchio *et al.* (2016), Solarino *et al.* (2020a)
		Do it right: be safer!	Solarino *et al.* (2020a), (2020b)
		Find the difference: be safer!.	Solarino *et al.* (2020b)
		Battle of flooding protection	Tsai *et al.* (2020)
		Rules of disaster	Catedrilla *et al.* (2021)
		LEGO	Le Dé *et al.* (2021)
		Minecraft	Le Dé *et al.* (2021)
		Logistics to the rescue	Mullin & Milburn (2021)
		Common pool resource game	Conte (2022)
		Costa resiliente	Olivares-Rodríguez *et al.* (2022)
		Flood disaster management simulation	Rismayani *et al.* (2022)
		Inundation	Solarino *et al.* (2024)
		GISscience	Feizizadeh *et al.* (2023)
		Local disaster knowledge game	Toyoda & Tanwattana (2023)
		EGNARIA	Tzioutzios *et al.* (2024)
		Snakes and ladders game for landslides awareness building	Marahatta *et al.* (2024)

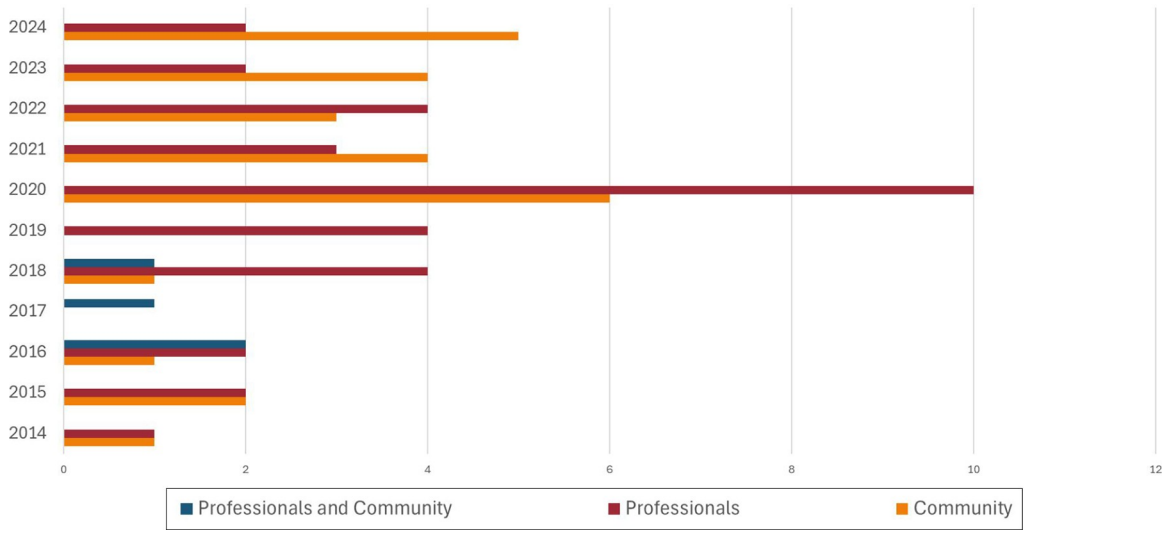
(***continued***)

Table 9

Target audience	Qty	Game	Studies
		Picture story game for fire safety	Marahatta *et al.* (2024)
		Relay game for earthquake awareness	Marahatta *et al.* (2024)
		Game name not mentioned (3 studies)	Pillai *et al.* (2019) D'Amico *et al.* (2023) Arakawa *et al.* (2024)
Professionals and community	4	Second life	Dethridge & Quinn (2016)
		Hazagora	Mossoux *et al.* (2016)
		ThinkLog	William *et al.* (2018)
		Name of game not mentioned (1 study)	Pardede *et al.* (2017)

Source(s): Authors' own work

Figure 8 Distribution of games according to target audience between 2014 and 2024



Source: Authors' own work

predominance of multiplayer formats and digital simulations for professionals.

The predominance of the response phase (25 occurrences) reflects a focus on emergency management, aligning with disaster management literature (Solinska-Nowak *et al.*, 2018). However, the lower representation of mitigation and reconstruction phases highlights a gap, despite their importance for long-term impact reduction. Games can drive behavior change, suggesting potential for more games focusing on these phases. Although some games integrate multiple phases, their limited presence shows a need for more comprehensive tools covering all stages of risk management (Sato *et al.*, 2020; Wouters *et al.*, 2013).

Hydrometeorological hazards, such as Floods are the most addressed events, while humanitarian crises and political instabilities appear less frequently. This bias may be related to the more tangible modeling of natural disasters, as pointed out by (Kankanamge *et al.*, 2020). However, global statistics indicate that socio-economic crises and climate change pose growing challenges in risk management (Solinska-Nowak *et al.*, 2018), reinforcing the need to expand the approach to games to contemplate more complex and multidimensional scenarios.

Studies like those in (Connolly *et al.*, 2012) show that digital and serious games can enhance motivation and learning outcomes, surpassing traditional methods like lectures. This aligns with the findings of this review, which identified 39 digital games. Moreover, the predominance of games focused on education and training (33 occurrences) further reinforces the trend highlighting the potential of serious games as effective training tools.

The focus on professionals (34 occurrences) suggests these games aim to inform and influence field practices, enhancing knowledge retention and decision-making in crises (Wouters *et al.*, 2013). However, fewer games target affected communities, highlighting an opportunity to foster resilience (Solinska-Nowak *et al.*, 2018). Expanding this approach could strengthen disaster preparedness and directly empower those facing these challenges.

A meta-analysis in Wouters *et al.* (2013) reinforces that serious games can be as effective, or more, than traditional methods when well-designed. This SLR identifies 40 simulation-based games, enhancing knowledge retention and disaster preparedness. The combination of strategy (13) and RPG (3) suggests a focus on strategic decisions and immersive narratives, supporting (Connolly *et al.*, 2012) on the value of

Table 10 Distribution of games by platform

Platform	Qty	Game	Studies
DG	39	Rescue-D	Wolf-Fordham *et al.* (2014)
		Greatest good donation calculator	Özpolat *et al.* (2015)
		Disaster in my backyard game	Radianti *et al.* (2015)
		UpRiver	Suarez (2015)
		Water game	Tsai *et al.* (2020)
		Second life	Dethridge & Quinn (2016)
		AMP-management game	Rauner *et al.* (2016)
		Climate game	Andrews *et al.* (2018)
		Wargame-based simulation	Chen *et al.* (2018)
		Nzoia WeShareIt	Onencan & Van de Walle (2018)
		ThinkLog	William *et al.* (2018)
		Disaster management video game	Aldunate *et al.* (2019)
		Epistemic video game	Caroca *et al.* (2019)
		HUG e QR HUG	Komori *et al.* (2019)
		Ramsete I, II and III	Booth *et al.* (2020)
		Earth girl volcano	Kerlow *et al.* (2020)
		MANTRA	Mueller *et al.* (2020)
		Multihazard tournament	Sermet *et al.* (2020)
		Treme-treme	Musacchio *et al.* (2016) Solarino *et al.* (2020a), (2020b)
		Project lily pad	Tomaszewski *et al.* (2020)
		Battle of flooding protection	Tsai *et al.* (2020)
		Rules of disaster	Catedrilla *et al.* (2021)
		Breaking the silos	De Ruiter *et al.* (2021)
		Minecraft	Le Dé *et al.* (2021)
		Flood safety training game	Mokhtar *et al.* (2021)
		Logistics to the rescue	Mullin & Milburn (2021)
		Flood resilience challenge	Bogdan & Cottar (2022)
		Disaster response game	Klein *et al.* (2022)
		Flood disaster management simulation	Arrighi & Walker (2014)
		VR and role-playing	Xu & Dai (2022)
		Inundation	Solarino *et al.* (2024)
		GISscience	Feizizadeh *et al.* (2023)
		Game name not mentioned (7 studies)	Tena-Chollet *et al.* (2016) Pardede *et al.* (2017) Bertazzo *et al.* (2018) Pillai *et al.* (2019) Hosseini *et al.* (2022)
BG	25	Ready!	Arrighi & Walker, 2014
		Hazagora	Mossoux *et al.* (2016)
		PLAITRA	Lukosch & Comes (2019)
		TDSC	Achatz *et al.* (2020)
		RAMSETE	Fleming *et al.* (2020)
		ESpresso	Kremer *et al.* (2020)
		DRRTHG	Sato *et al.* (2020)
		Do it right: be safer!	Solarino *et al.* (2020a), (2020b)
		Find the difference: be safer!	Solarino *et al.* (2020a), (2020b)
		Hinanjo unei	Toyoda (2020)
		Crossroad	Toyoda (2020)
		Evacuation simulation training	Toyoda (2020)
		Saske-nable	Toyoda (2020)
		LEGO	Le Dé *et al.* (2021)
		SANYCaRE	Weyrich *et al.* (2021)
		Common pool resource game	Conte (2022)
		Moroca	Purnama Sari *et al.* (2023)
		SMARTriage	Chew *et al.* (2023)
		Local disaster knowledge game	Toyoda & Tanwattana (2023)
		Road to resettlement	Asgary *et al.* (2024)
		EGNARIA	Tzioutzios *et al.* (2024)

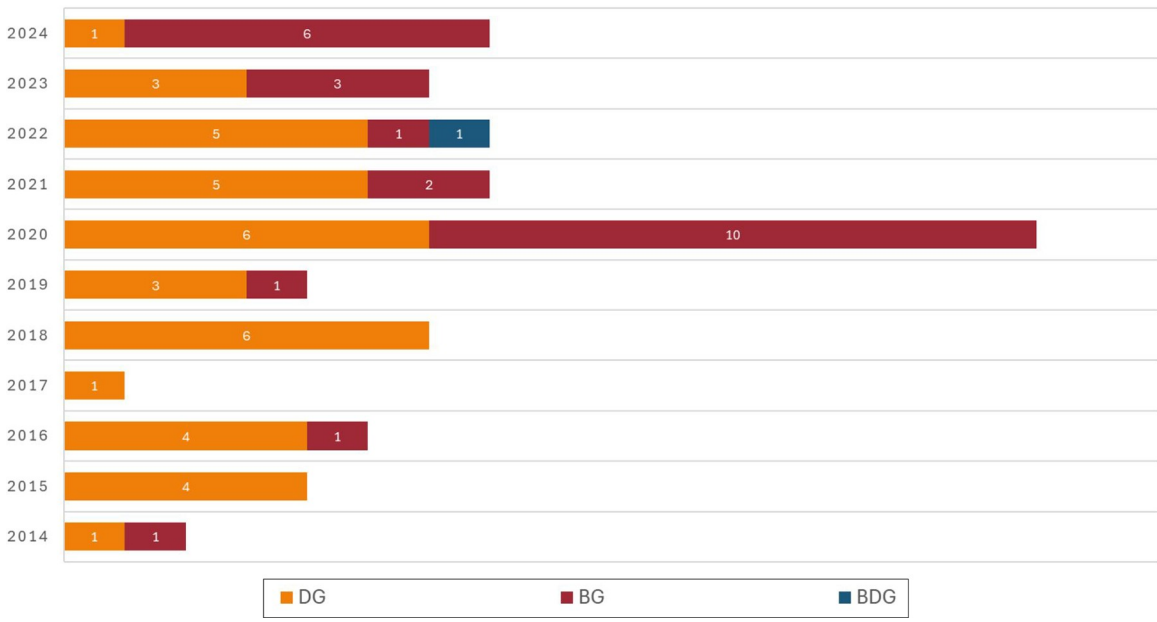
(***continued***)

Table 10

Platform	Qty	Game	Studies
		PRSG	Naeemi *et al.* (2024)
		Snakes and ladders game for landslides awareness building	Marahatta *et al.* (2024)
		Picture story game for fire safety	Marahatta *et al.* (2024)
		Relay game for earthquake awareness	Marahatta *et al.* (2024)
BDG	1	Costa Resiliente	Olivares-Rodríguez *et al.* (2022)

Note(s): DG = Digital Games; BG = Board Games; BDG = Board and Digital Games
Source(s): Authors' own work

Figure 9 Distribution of games by platform between 2014 and 2024



Note: DG: Digital Games; BG: Board Games; BDG: Board and Digital Games
Source: Authors' own work

interactive elements for engagement. Further research is needed on how different genres influence learning and crisis adaptation.

The prevalence of multiplayer games (43) highlights the focus on collaborative simulations, aligning with research on the importance of teamwork in crisis management (Solinska-Nowak *et al.*, 2018; Wouters *et al.*, 2013). The lower number of single-player games (16) suggests an opportunity to develop experiences that enhance individual learning and autonomous decision-making.

The dominance of digital games (39 titles) reflects advances in interactive technologies, ease of distribution and adaptability for various audiences (Klopfer, 2021). However, the notable presence of board games (25 titles) highlights the continued value of analog approaches for capacity building and awareness, offering accessibility and promoting social interaction. The existence of a hybrid game combining digital and physical versions suggests a promising direction for expanding learning experiences.

The categorization by time interval reveals distinct approaches. Turn-based games (30 titles) dominate, favoring reflection and planning – key for disaster response training (Solinska-Nowak *et al.*, 2018). Meanwhile, real-time games (26 titles) emphasize dynamic simulations, preparing players for rapid decision-making in crisis scenarios (Crookall, 2010).

The analysis of the predominance in each category reveals gaps that need attention: few community-driven games highlight the need for inclusivity, the scarcity of games covering all disaster phases limits impact and the lack of focus on social disasters calls for more research to balance these areas and enhance impact assessment.

A digital repository was created to organize and share the games identified in this SLR. The site https://jogoshumanitarios.unimar.br serves as a practical tool for researchers, educators, developers and professionals, offering easy access to game information. In addition to consolidating knowledge, it promotes the dissemination of these tools and encourages further research on games in disaster management.

Table 11 Distribution of games by time interval

Time interval	Qty	Game	Studies
TB	30	Hazagora	Mossoux *et al.* (2016)
		Climate game	Andrews *et al.* (2018)
		Wargame-based simulation	Chen *et al.* (2018)
		ThinkLog	William *et al.* (2018)
		PLAITRA	Lukosch & Comes (2019)
		TDSC	Achatz *et al.* (2020)
		RAMSETE	Fleming *et al.* (2020)
		ESpresso	Kremer *et al.* (2020)
		Do it right: be safer!	Musacchio *et al.* (2016) Solarino *et al.* (2020a)
		Hinanjo unei	Toyoda (2020)
		Crossroad	Toyoda (2020)
		Evacuation simulation training	Toyoda (2020)
		Saske-nable	Toyoda (2020)
		Battle of flooding protection	Tsai *et al.* (2020)
		Breaking the Silos	De Ruiter *et al.* (2021)
		SANYCaRE	Weyrich *et al.* (2021)
		Flood resilience challenge	Bogdan & Cottar (2022)
		Common pool resource game	Conte (2022)
		Moroca	Purnama Sari *et al.* (2023)
		Inundation	Solarino *et al.* (2024)
		SMARTriage	Chew *et al.* (2023)
		Local disaster knowledge game	Toyoda & Tanwattana (2023)
		Road to resettlement	Asgary *et al.* (2024)
		EGNARIA	Tzioutzios *et al.* (2024)
		PRSG	Naeemi *et al.* (2024)
		Snakes and ladders game for landslides awareness building	Marahatta *et al.* (2024)
		Picture story game for fire safety	Marahatta *et al.* (2024)
		Relay game for earthquake awareness	Marahatta *et al.* (2024)
		Game name not mentioned (2 studies)	Bertazzo *et al.* (2018) Arrighi & Walker (2014)
RT	26	Greatest good donation calculator	Özpolat *et al.* (2015)
		Disaster in my backyard game	Radianti *et al.* (2015)
		UpRiver	Suarez (2015)
		Water game	Tsai *et al.* (2015)
		Second life	Dethridge & Quinn (2016)
		AMP-management game	Rauner *et al.* (2016)
		Disaster management video game	Aldunate *et al.* (2019)
		Epistemic video game	Caroca *et al.* (2019)
		Earth girl volcano	Kerlow *et al.* (2020)
		MANTRA	Mueller *et al.* (2020)
		DRRTHG	Sato *et al.* (2020)
		Multihazard tournament	Sermet *et al.* (2020)
		Treme-treme	Musacchio *et al.* (2016) Solarino *et al.* (2020a)
		Rules of disaster	Catedrilla *et al.* (2021)
		LEGO	Le Dé *et al.* (2021)
		Minecraft	Le Dé *et al.* (2021)
		Flood safety training game	Mokhtar *et al.* (2021)
		Disaster response game	Klein *et al.* (2022)
		Costa resiliente	Olivares-Rodríguez *et al.* (2022)
		Flood disaster management simulation	Rismayani *et al.* (2022)
		VR and role-playing	Xu & Dai (2022)
		GISscience	Feizizadeh *et al.* (2023)
		Game name not mentioned (4 studies)	D'Amico *et al.* (2023) Pillai *et al.* (2019) Hosseini *et al.* (2022) Arakawa *et al.* (2024)
LT	2	Ready!	Arrighi & Walker (2014)
		HUG e QR HUG	Komori *et al.* (2019)

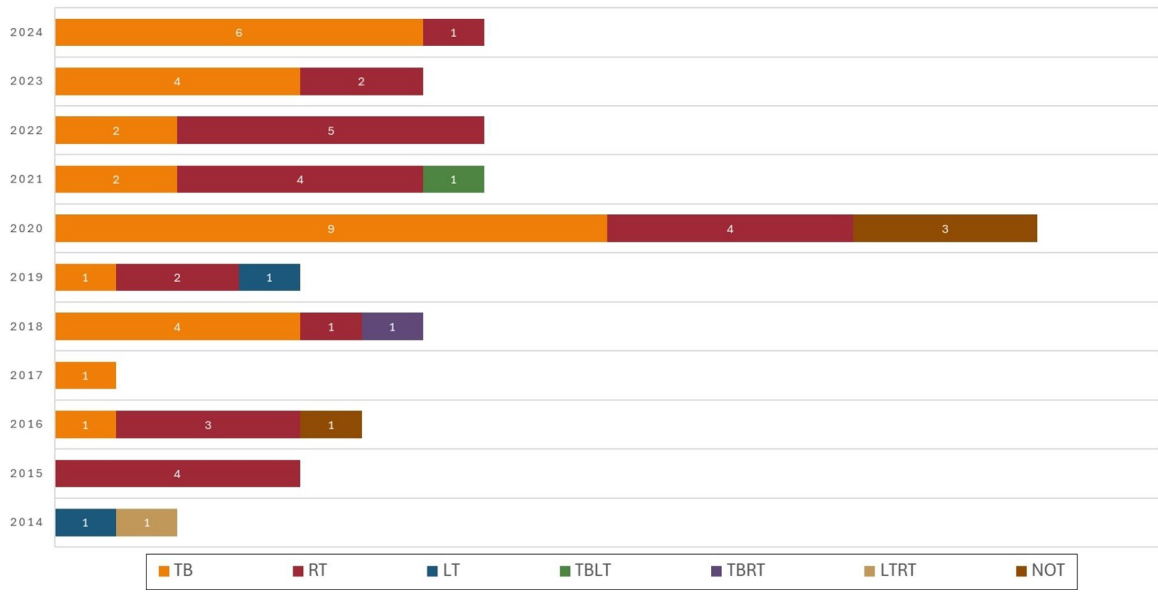
(***continued***)

Table 11

Time interval	Qty	Game	Studies
TBLT	1	Logistics to the rescue	Mullin & Milburn (2021)
TBRT	1	Nzoia WeShareIt	Onencan & Van de Walle (2018)
LTRT	1	Rescue-D	Wolf-Fordham *et al.* (2014)
NOT	4	Project lily pad	Tomaszewski *et al.* (2020)
		Ramsete I, II and III	Booth *et al.* (2020)
		Find the difference: be safer!	Solarino *et al.* (2020a), (2020b)
		Game name not mentioned (1 study)	Tena-Chollet *et al.* (2016)

Note(s) TB: Turn Based; RT: Real-Time; TBLT: Turn Based and Limited Time; TBRT: Turn Based and Real-Time; NOT: Not Specified; LT: Limited Time; LTRT: Limited Time and Real-Time
Source(s): Authors' own work

Figure 10 Distribution of games by time intervals between 2014 and 2024



Note: TB: Turn Based; RT: Real-Time; TBLT: Turn Based and Limited Time; TBRT: Turn Based and Real-Time; NOT: Not Specified; LT: Limited Time; LTRT: Limited Time and Real-Time
Source: Authors' own work

5. Final considerations

This SLR shows that while games in humanitarian logistics and disaster management vary, certain trends stand out. Most focus on the disaster response phase, prioritizing professional training and critical scenario simulation. The dominance of digital and multiplayer formats highlights the value of collaboration in crisis management, while the prevalence of simulation games underscores their effectiveness in creating immersive, realistic training environments.

Over the last decade, game development has grown significantly, especially after 2020, likely driven by digital advancements and the demand for interactive disaster response training. There is also a gradual expansion in focus, with more games addressing mitigation and preparedness, though response and reconstruction remain dominant.

Despite progress, gaps remain. Few studies empirically assess these games' effectiveness in skill development and real-world decision-making. In addition, most games do not integrate all disaster phases, limiting their use as comprehensive training tools. The lack of standardized impact assessment methods further hinders comparisons and best practice adoption.

This study consolidates existing knowledge and provides a structured overview of games in humanitarian logistics and disaster management across the repository. By mapping key features and trends, it serves as a reference for researchers, developers and decision-makers seeking to optimize their use in real-world challenges. Future research should focus on empirically validating their effectiveness and exploring more integrated approaches to increasing resilience and disaster response.

When interpreting the results of this SLR, it is necessary to discuss the limitations inherent to the included studies. Many studies presented small or non-representative samples, compromising the external validity of the results. In addition,

the lack of standardization in the measures made comparisons between studies difficult, ranging from subjective assessments to objective tests of knowledge and skills (Solinska-Nowak *et al.*, 2018; Wouters *et al.*, 2013).

Most studies focus on specific disasters like floods and earthquakes, limiting their applicability to diverse scenarios (Solinska-Nowak *et al.*, 2018). In addition, research is often confined to specific cultural and geographic contexts, hindering result generalization. A key limitation is the emphasis on short-term assessments, with little exploration of games' long-term effects on learning and disaster preparedness. The lack of longitudinal data weakens understanding of their sustained impact (Connolly *et al.*, 2012; Wouters *et al.*, 2013).

The inclusion and exclusion criteria of the studies in the review may have introduced bias, affecting the representativeness of the findings. Relevant studies may have been excluded due to language restrictions, accessibility or other factors.

When considering these limitations, it is relevant to interpret the results of this SLR with caution. Recognizing these limitations helps outline areas for future research, such as the need for more rigorous studies, the standardization of outcome measures and the exploration of a broader range of disaster scenarios and cultural contexts. In addition, developing serious games based on robust instructional design principles can maximize their positive impact on disaster management education and training.

This review has key practical and policy implications. Practically, games are effective tools for education and training in humanitarian logistics and disaster management, suggesting their integration into crisis preparedness programs. Policy-wise, continued investment in adaptable games for various contexts and disasters is crucial (Connolly *et al.*, 2012). Future research should focus on studying the long-term impact of these games and developing standardized assessment methodologies.

The analysis revealed an unbalanced distribution among the identified games with respect to the disaster phases addressed, the genres employed and the types of application. This asymmetry highlights important gaps in the field, which can guide future development initiatives. Specifically, there is a significant opportunity for the creation of new games and tools targeting underexplored contexts, such as the mitigation and reconstruction phases, as well as approaches that foster large-scale collaboration, impact assessment or integration with educational platforms. Thus, the findings of this study not only synthesize the existing knowledge but also provide practical insights for researchers, developers and institutions aiming to expand the use of games in the humanitarian logistics domain.

Furthermore, this review exclusively considered games documented in peer-reviewed academic literature indexed in Scopus and Web of Science, thereby excluding relevant games not associated with scholarly publications. This constitutes a methodological limitation that may overlook valuable tools developed and applied in practice. In addition, the long-term availability and playability of the games included in the review were not systematically assessed, as most source articles did not provide this information. Consequently, it remains unclear whether these games are still accessible, compatible with current platforms or obtainable in the case of physical formats. Future research is encouraged to address these gaps by exploring alternative sources (e.g. grey literature, institutional databases) and evaluating the current usability and accessibility of serious games in the field of humanitarian logistics and disaster management.

Another limitation is the lack of information in most studies regarding the dissemination and actual use of the games (e.g. number of players, reach or context of application). This gap hinders a comprehensive assessment of the real-world impact and adoption of the identified games. Future research should report such data to enhance the external validity and applicability of game-based interventions in humanitarian logistics.

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