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RESEARCH ARTICLE

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Innovation in humanitarian assistance—a systematic literature review

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Abstract

The promise of innovation in humanitarian contexts has generated an expanding literature, from academics as well as practitioners. However, the field has become characterised by conceptual ambiguity and insular approaches, inhibiting the integration of findings and best practices. Therefore, this paper aims to identify the key concepts, definitions, and themes in humanitarian innovation (HI) research by applying a systematic literature review and content analysis. Based on data from 301 publications, we analyse scholarly and practitioner articles addressing the topic of humanitarian innovation. Our analysis suggests that efforts to reform the humanitarian system by leveraging innovation have been primarily ad hoc, fragmented, and serving miscellaneous separate objectives. This results in the implementation of incremental improvements, rather than transformative change throughout the sector. To bridge the gap between the various conceptualisations of HI, we propose a conceptual framework that provides a system perspective on HI, which includes the institutions, actors, contextual factors, and outputs of the system. The implications of our finding for further research and policy are discussed as well.

Points for practitioners

• Ensure active participation and inclusion of affected populations in innovation agendas and processes.

• Strengthen collaborative efforts among actors (donors, practitioners, private sector, intermediaries, NGOs) in humanitarian sector to increase coordination, knowledge exchange, and bundling of resources for innovation.

• Facilitate evidence-based approaches and data-driven decision-making, for the operationalisation of appropriate innovations.

• Increase the quality and quantity of funding going to innovation actors, and steer funding towards innovations explicitly catering to the needs of affected populations.

Keywords Humanitarian innovation, Innovation systems, Systematic literature review

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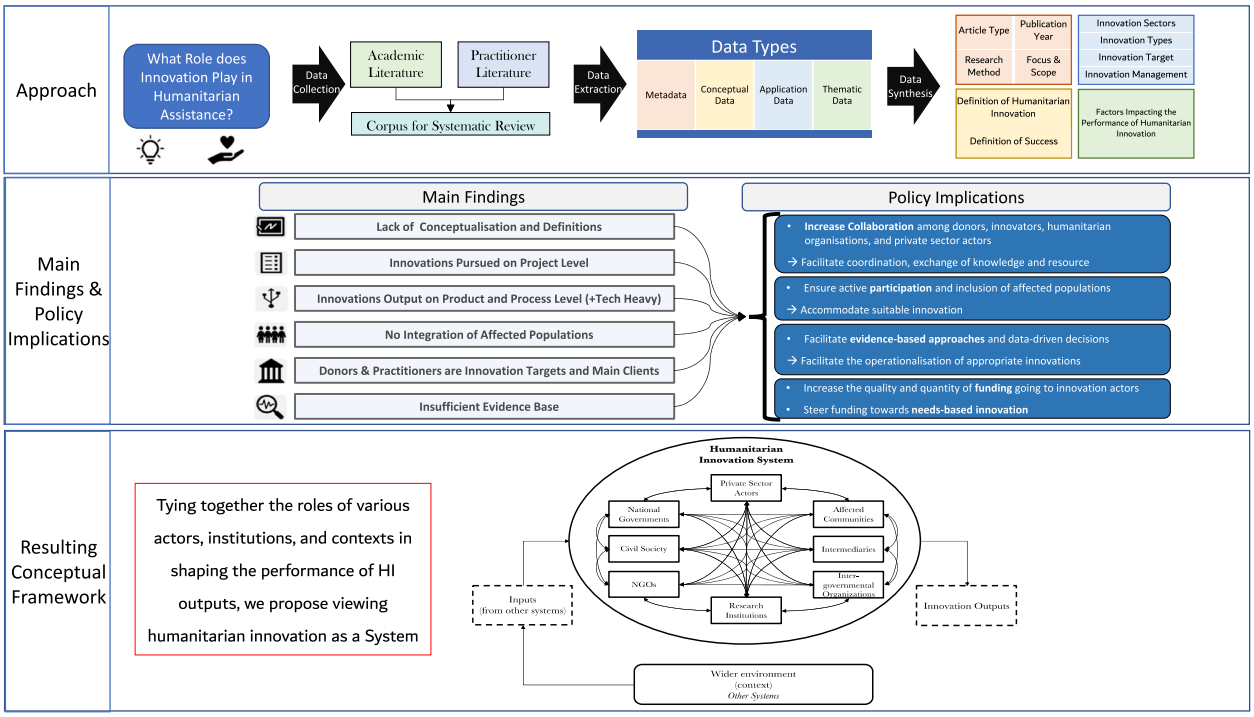
Graphical Abstract



Introduction

There is a rising operational and financial deficit in the capacity of governments and humanitarian organisations to respond to humanitarian needs, as challenges facing international humanitarian action are growing in scale, scope, and complexity. While absolute funding for humanitarian relief has been continuously increasing, it is not able to keep up with the growing requirements, as assessed by Humanitarian Response Plans (HRPs) for different regions and countries (OCHA 2022). This situation has been compounded by the global coronavirus pandemic, which created enormous demand and at the same time limited the availability and mobility of human, physical, and financial resources (Rush et al. 2021). Additionally, the war in Ukraine led to a grave humanitarian crisis in the country itself and its ripple effects are felt in the global food and energy markets (OCHA 2022). Overall, in 2022, 274 million people need humanitarian assistance and protection, a significant increase from 235 million people in 2021, which was already the highest figure in decades (OCHA 2022).

Given the increasing needs, and the pressure on the scarce resources available to address them, there has been a recognition within the humanitarian sector of the necessity for radical change to deliver better aid (Chandran 2015; Finnigan and Farkas 2019; Ramalingam 2013). Consequently, over the past decade, the humanitarian sector has begun investing more heavily in innovation, seeking new and more efficient solutions to address humanitarian crises and narrow the funding gap in the sector. Yet, while 'innovation' has become a prominent concept in the humanitarian sector, a counternarrative has formed that decries innovation's seeming inability to bring about transformational change in the sector. Fundamentally, it is unclear to what degree humanitarian innovation (HI) has had a positive impact on humanitarian practices and whether it can achieve transformative change. Furthermore, the discussion around the subject is presently fragmented, lacks conceptual clarity, and fails to coherently identify the most potent levers for impact. We therefore ask the research question:

What is the state of the art of humanitarian innovation?

This question is split into several sub-questions:

- How has the literature on humanitarian innovation evolved since 2015?

- How is (successful) innovation in different contexts of humanitarian assistance being defined by different actors?
- Which innovations are being introduced into humanitarian contexts?
    - Which sectors are most affected by humanitarian innovation?
    - Which types of innovations are introduced?
    - Who is the primary target of humanitarian innovation?
    - Which strategies are applied in managing humanitarian innovation?
- What are the primary themes/factors impacting innovation performance?

Hence, the purpose of this article is to review both the academic and practitioner literature to assess how the concept of humanitarian innovation has been applied and has evolved over time. This includes identifying definitions of key concepts, the characteristics of the innovations in humanitarian contexts, as well as their level of success. Furthermore, the study synthesises factors impacting the performance of humanitarian innovation, thereby outlining trends and leverage points that can be used to improve the innovation outputs in the humanitarian system.

We make several contributions in this article. First, we provide a systematic review of articles building on the humanitarian innovation concept, which allows us to comprehensively outline the state of the art on humanitarian innovation thinking. Second, the authors propose a framework portraying innovation in humanitarian contexts as an innovation system, describing the main components of the humanitarian innovation system, in order to structure the discussion of findings and identify underexplored areas and connections. This framework can provide a basis for the continuing scholarly exploration of innovation in humanitarian contexts. Third, based on the existing literature, the article outlines possibilities for policymakers to contribute to innovation in the humanitarian sector.

The remainder of the article is structured as follows: The background section briefly describes the current state of the humanitarian sector and the role of innovation. The third section describes the methodology applied in conducting this systematic review. Section four offers a meta-description of the broad characteristics of humanitarian innovation research that emerge from the review, including the chronology, outlets, methods, and focus areas of the articles. Section five outlines the conceptual findings from the literature, specifically key definitions of innovation concepts. Section six examines practical findings, meaning the characteristics of innovations introduced in the field. Section seven presents a synthesis of the main factors impacting humanitarian innovation performance. Section eight discusses the findings and presents a unified comprehensive framework focussing on humanitarian innovation from a systems perspective, which ties together our findings. Section nine concludes, discusses the limitations of the research, and proposes avenues for future research.

Background

Humanitarian needs continue to grow, and despite increasing levels of absolute funding, the gap between requirements and funding is more than $32.9 billion, which is greater than ever (OCHA 2022). Furthermore, it is recognised by humanitarian actors that humanitarian tools and services are in many cases ill-suited to modern emergencies, which are frequently prolonged and conflict-driven (Betts and Bloom 2014). As a result, pressure has built to fundamentally alter the way humanitarian aid is provided, and innovation is considered a vehicle for introducing such change. The systematic application, study, and implementation of innovation is a recent phenomenon in the humanitarian field (Warner 2017).

In 2008, the concept of humanitarian innovation was first introduced by the Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP). It began with an innovation fair at ALNAP's 25th annual meeting, showcasing 23 'real-world examples of innovations that have helped to change the way in which humanitarian action is delivered' (Scott-Smith 2016). Within a few years, the concept began to make waves at other institutions. For instance, the UK Department for International Development (DFID) announced a £3 million investment in innovation in the humanitarian system, the World Food Programme, and the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) set up their own innovation grants, and similar initiatives were established at the United Nations Refugee Agency (UNHCR) and the International Committee of the Red Cross (ICRC) (Betts and Bloom 2014). The concept became truly mainstream in 2016, when innovation was designated as one of the main themes for the World Humanitarian Summit (WHS). 'To innovate', the WHS (2016) declared, 'means to do things in new or better ways'. That same year, the UN Agenda for Humanity stated that to deliver collective outcomes, the humanitarian sector must focus strongly on innovation (UN 2016). This has been noted as a defining moment for HI, as it was followed by an increased interest in, and funding of, activities, publications and projects targeted at innovation (Scott-Smith 2016). Consequently, a range of humanitarian actors have engaged in the 'innovation

turn', adopting innovation processes to stimulate new thinking on the provision of humanitarian assistance (Ramalingam et al. 2009). With the increased diffusion of the concept, there has also been an increase in differing conceptualisations of how humanitarian innovation is defined and conceptualised.

The field's burgeoning growth is related to the sector's perceived need to 'do more with less', as innovation in the humanitarian context is often conceptualised with a strong link to cost-effectiveness and efficiency. Müller and Sou (2019) point out that because of this conceptualisation, the focus on innovation in relation to humanitarianism is heavily skewed towards technical fixes and new products. Technology has opened the doors for new practices in humanitarian action, with cutting-edge technologies such as big data, unmanned aerial vehicles (UAVs), 3D printing, digital currency, or the Blockchain initially had been ascribed the role of silver bullets. More recently, there has been an increasingly vocal dismissal of what is deemed humanitarian technophilia and a call for more holistic approaches. The tide of 'optimism, bordering on technological determinism' (Garman 2015: 440) regarding humanitarian innovation is considered by some as too restrictive a conceptualization and a call for more holistic approaches has materialised.

Furthermore, HI has been criticised for being too top-down and Northern biased, promoting externally developed solutions to perceived needs, rather than locally identified solutions rooted in end-users' needs and priorities (Fejerskov and Fetterer 2020; Sandvik 2017). This has been called the top-down world of HI (Betts and Bloom 2013), where actors from the Global North, are influencing funding and decision-making (Skeels 2020). In order for HI to reach its full potential of meeting the growing challenges and enhance the efficiency and effectiveness of the humanitarian system in a sustainable manner, some have raised the need to localise HI (Fejerskov and Fetterer 2020), stating that the innovation agenda 'should have as its guiding light the idea of a paradigmatic shift in attitude, enabled by the principles of disaster prevention, local ownership, and beneficiary engagement' (Ramalingam et al. 2009:81).

The introduction of humanitarian innovation was initially considered a turning point towards better delivery of timely, needs-based, effective, principled, and high-quality humanitarian assistance. However, over the years, debates have emerged, approaches and definitions have evolved, and the very idea that HI can deliver paradigmatic change is being questioned. Our review of the literature therefore aims to assess how the concept is currently applied and has evolved over time and review the key themes that have emerged in the concept.

Methodology

In this article, we combine the systematic literature review (an all-encompassing review of the available literature) with the inductive content analysis (an in-depth analysis of this literature's nature). A systematic literature review (SLR) was conducted to map existing evidence on innovation humanitarian assistance and its impact on achieving humanitarian objectives. The utilisation of a systematic review methodology prevents the selection of randomly gathered publications, which would not be representative of the scholarship and practitioner literature building on the humanitarian innovation concept. We selected the articles to be included in the review through a systematic multi- stage procedure, following the standard steps of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement[1]. This resulted in 301 articles published in academic and practitioner journals, as well as reports published by national governments. The analysis includes articles published between 2015 and 2021. Following article selection, the content of the articles was analysed and codified to identify relevant definitions, as well as practical and thematic insights.

The following subsection describes how the authors proceeded, providing the number of selected and discarded articles at each stage of the procedure, along with the selection criteria. A second subsection outlines the coding procedure used to standardise and cluster the information contained in the articles.

The article search and selection strategy

The authors selected the first set of potential articles by performing a keyword search for academic articles in SCOPUS, Web of Knowledge, and Google Scholar and a keyword search for practitioner literature in Reliefweb. SCOPUS, Web of Knowledge, and Google Scholar are the major databases for published academic articles, while Reliefweb is the most expansive database focusing on humanitarian practice, containing practitioner literature, government reports, and gray literature on humanitarian affairs. The keywords used were 'humanitarian innovation' for the academic databases and 'innovation' for Reliefweb, as all articles are concerned with humanitarian efforts. The time frame chosen is from 2015 to 2021, when the concept of humanitarian innovation entered the mainstream.

The first search step on these four databases using the key term 'humanitarian innovation' or 'humanitarian' and 'innovation', from the years 2015 to 2021, yielded the results in Table 1.

[1] As specified on www.prisma-statement.org.

Table 1 Databases for article selection

	SCOPUS	Web of Knowledge	Google Scholar	Reliefweb
URL	www.scopus.com	webofknowledge.com	https://scholar.google.com/scholar	reliefweb.int/updates
Search term/rule	TITLE-ABS-KEY (humanitarian AND innovation) AND (LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015))	TS = (humanitarian AND innovat*) Indexes = SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan = 2015–2021	'humanitarian innovation' FROM 2015	ANYWHERE: (innovation) 2016 TO PRESENT, ANY LANGUAGE, ANY FORM further filtered by FORMAT 'analysis' OR Assessment OR Data OR Evaluation and Lessons Learned OR Situation Report OR UN Document
Number of results	330	446	1070	481

The keyword-based search for 'humanitarian innovation' returned 330 results in SCOPUS, 446 in Web of Knowledge, and 1070 in Google Scholar. The different number of results between the databases may be explained by the different set of journals being available in each database and/or using a different search engine in each database. The search for 'innovation' in Reliefweb returned 481 results. We complemented our search of large-scale databases with purposeful sampling from smaller, high-impact, databases, e.g. government websites, UN websites, practitioner websites such as Elrha, which we searched using the same keywords. We thereby further increased our preliminary sample by 257 articles. Several articles considered as seminal in the field that were published before 2015 were also included.

From this initial corpus of 2584 articles, we removed all article duplicates, thereby excluding 981 articles. Hence, for the 1603 articles, we screened the titles and abstracts and excluded them if any of the following exclusion criteria were met:

- Non-valid formats (e.g. letters, master theses, entire books, lectures, course descriptions)
- False positive (humanitarian): Meaning of the word 'humanitarian' does not refer to 'the sector' (i.e. it describes a sentiment, or a subset of health care)
- False positive (innovation): 'innovate' or 'innovative' or 'innovation' is mentioned as a passing reference/use of an adjective/innovation, non-specific
- Concept mismatch: While the terms 'humanitarian' and; 'innovation' are both occurring in the article, they are not used in combination as 'humanitarian innovation'
- Method mismatch: Has no humanitarian application (e.g. biographical, or related research whose product is journalistic or historical)

The abstract screening eliminated a further 1097 articles, leaving us with 506 for full text review. In the final stage of the selection procedure, we fully read the remaining 506 articles identified. An additional 205 articles were removed upon reading because the content of the article was not directly related to humanitarian innovation. This reading led to a final set of 301 articles being selected for article coding (Fig. 1).

The coding procedure

From the final selection of articles, we analysed four different data types, described in Table 2.

1. *Metadata information* – meaning metadata about the articles
2. *Conceptual information* – meaning the key concepts and definitions applied for humanitarian innovation
3. *Practical information* – meaning the characteristics of innovations employed in the humanitarian contexts
4. *Thematic information* – meaning the concepts related to humanitarian innovation used in the articles and the conclusions drawn by the authors as to how to advance the HI agenda

We coded each article and incorporated the results into a database to standardise the information contained in the articles and to facilitate the identification of trends in the literature. Overall, we coded ten properties of the articles, in line with the categories described above. All authors and three research assistants were conducting the coding and the respective coding of articles was cross-checked for a sample of articles, in order to ensure alignment of the individual understanding of the meaning of each category's meaning.

For the article coding, we employed a content analysis approach, whereby we developed inductive

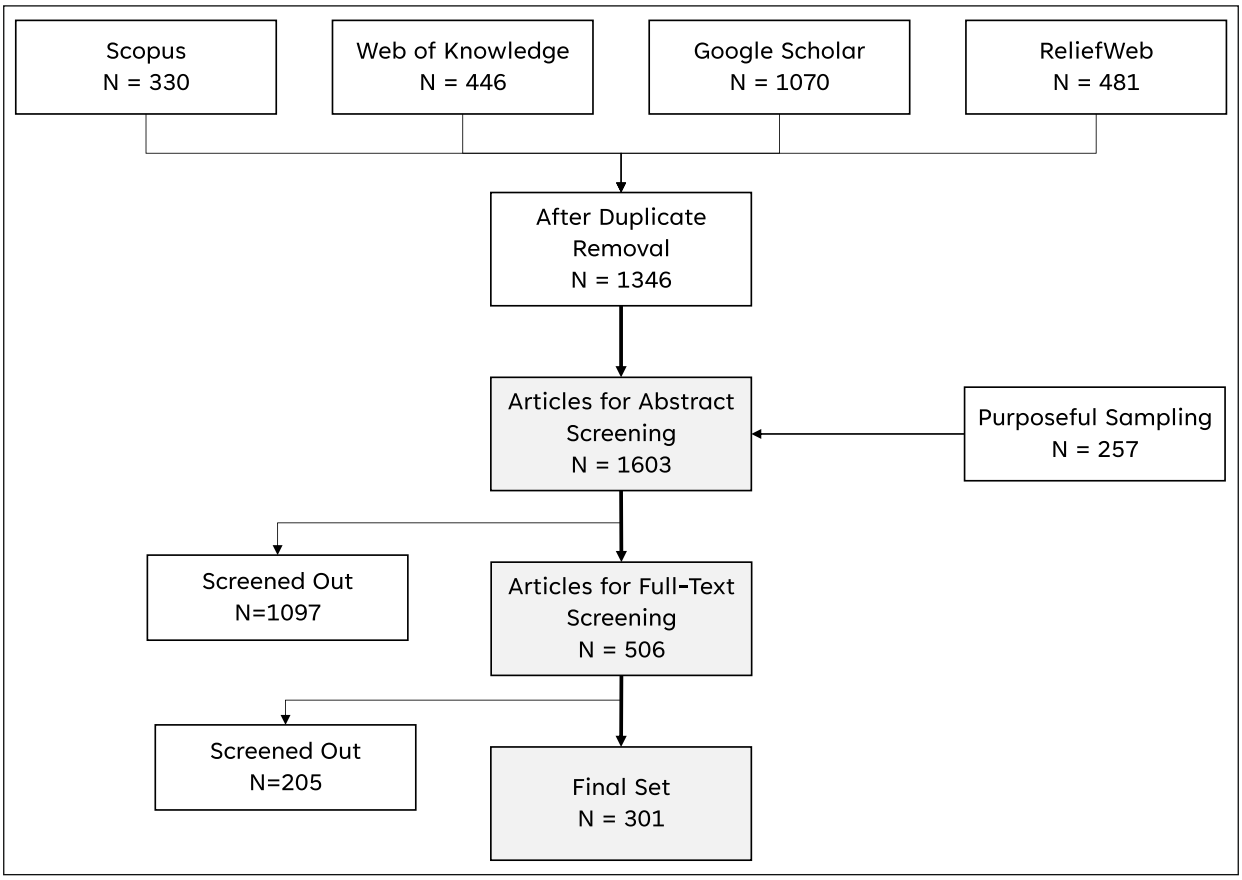


Fig. 1 The article selection process

Table 2 Data types and information obtained from the literature

#	Data type	Data type description	Information obtained
1	Metadata	Data providing information about the data itself	The type of article (academic or practitioner)
			The publication year
			The applied research method
			The focus and scope of the article, including subject and industry focus
2	Conceptual data	Concepts and definitions applied to humanitarian innovation	The definition of humanitarian innovation given in the texts
			The stated objective of humanitarian innovation (i.e. how success is defined)
3	Application data	The characteristics of innovations applied in the humanitarian contexts	Innovation sectors – the sector to which the humanitarian innovation belongs
			Innovation types—the typification of innovations
			Innovation target – the envisioned end-users of an innovation
			Innovation management strategy—the different approaches of how innovation development, coordination, and diffusion are managed within the sector
4	Thematic data	The key themes present in the research articles on the factors impacting humanitarian innovation performance	Drivers and obstacles of humanitarian innovation, meaning factors which enable or pose risks to the flourishing of humanitarian innovation

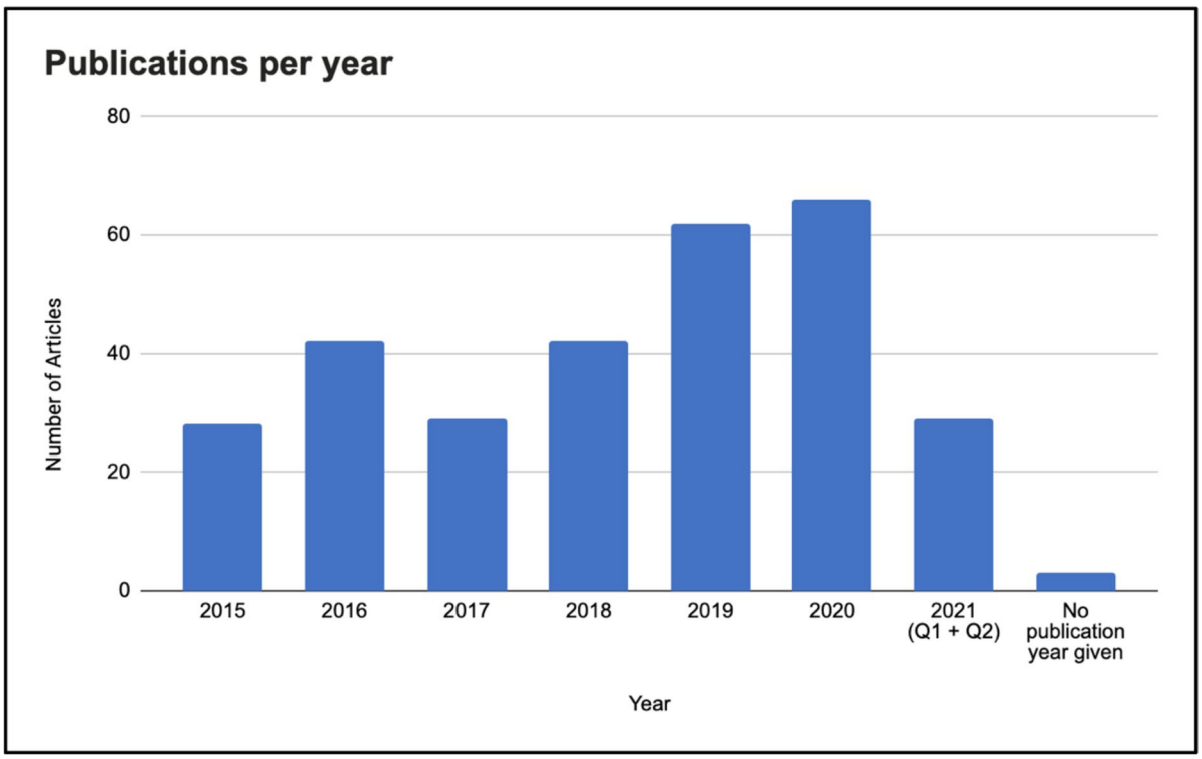


Fig. 2 Academic publications on humanitarian innovation

categorisations of the matters of concern, as opposed to applying preconceived notions (Hsieh and Shannon 2005). We organised the content analysis based on an inductive, bottom-up identification of topical categories. To generate the categories, we independently sketched and clustered into topics a list of descriptors taken from the text. Subsequently, we compared and merged the resulting classifications into typologies, which are described in the findings sections.

The Additional file 1: Appendix presents a complete list of the 301 articles identified in the review.

Data description

In the literature, we identified several different types of output. Many articles focus on offering conceptual advice on strategies for practitioners and policymakers to transform humanitarian practice and create the necessary prerequisites to make it 'innovation-ready'. Another group of articles reports on (individual) cases of humanitarian innovation initiatives and their outcomes, mainly to describe products and services considered to be suitable for the context by the authors. However, there is only a small number of articles that rigorously evaluates innovations' impact ex post, with most articles describing potential outcomes of innovations yet to be introduced in the field, or only so far having been piloted. On a smaller scale, some articles are devoted to the evaluation and critique of humanitarian innovation ideas and initiatives overall, offering critique or endorsement of the concept of innovation in humanitarian contexts.

The chronology of humanitarian innovation research

Bessant et al. note that the humanitarian sector is a relative newcomer to innovation, in terms of both practices and literature. 'There were no publications focused on the subject until 2009, making humanitarian innovation literature around a century younger than the overall innovation management field' (2014, 24). Although some articles on the concept of HI were published between 2009 (when the term humanitarian innovation was coined) and 2015, the concept did not take off until it was deemed a priority in the 2015 World Humanitarian Summit. Prior to the so-called innovation turn, the humanitarian sector attracted little attention from academic innovation studies researchers. Only more recently, practitioner and academic literature have begun displaying a growing number of studies on the potential of humanitarian innovation, describing new projects, processes, and approaches for improving humanitarian aid; addressing funding, budgeting, and institutional support; exploring the challenges of developing use cases and evidence-based practices; and the difficulty of bringing innovations to scale.

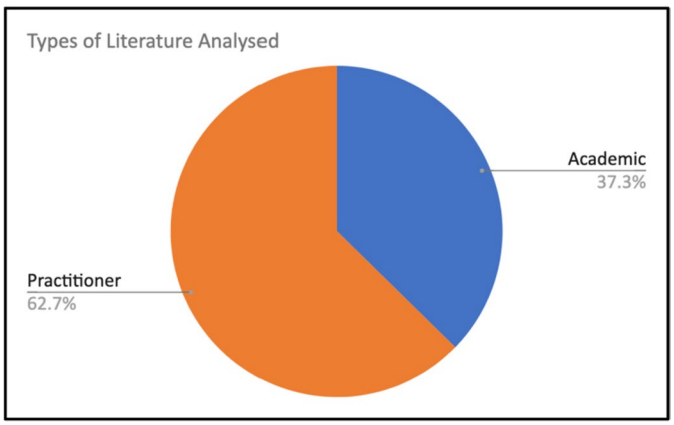


Fig. 3 Types of literature analysed

The chronology of the articles studying humanitarian innovation is presented in Fig. 2. The number of articles on humanitarian innovation has overall been increasing since 2015, indicating the concept's persistent and mounting relevance for the sector.

Types of research on humanitarian innovation

For the systematic literature review, we considered both academic and practitioner literature, to cover the entire spectrum of work on humanitarian innovation. We differentiate academic from practitioner literature by the type of review they undergo. Academic articles are those which undergo a process of peer review prior to publishing, whereas practitioner literature is generally self-published through an institution and no peer review is conducted.

A review of the outlets of the 301 humanitarian innovation articles finds that 188 are published in practitioner-oriented outlets and 113 in outlets targeting academics. The three outlets with the highest count of publications, totalling 51, are all aimed at practitioners (Elrha, OCHA, UNHCR). The academic outlets most represented are the journals 'Conflict and Health', the 'Journal of Humanitarian Logistics and Supply Chain Management', and the 'Journal of International Humanitarian Action', for a total of 15 publications (Fig. 3).

The asymmetry in the number of articles published in the two types may reflect a preference of humanitarian innovation researchers for articles with direct application among practitioners. It might also be due to the type of studies prevalent in humanitarian innovation articles, including case studies, narratives, or studies with limited theoretical contributions, which may prove more difficult to publish in academic journals.

Furthermore, in the literature, we observe an overwhelming majority of qualitative research. The lack of data driven analysis and quantitative research methods may further impede publications being placed in academic journals (Fig. 4).

Focus areas of the articles

The articles within the corpus of literature focus on different subject areas in relation to humanitarian innovation. Figure 5 presents the frequency of certain focus areas across the entire corpus.

The most frequently covered theme across the corpus is technology and telecommunications. This indicates the focus on the role technology plays in innovation. Access is the second most frequent focus area, relating to the ongoing challenge of humanitarian practitioners to access affected populations more efficiently and effectively and deliver necessary goods and services. Other frequently mentioned areas include capacity development, health, financing, and coordination. Besides such areas of application, considerable attention is also given as to how innovation should be conducted, referring to the innovation process itself, as it manifests from the frequency in which articles discuss issues such as collaboration, ethics, and evidence, partnerships, and private sector engagement. Certain topics are clearly more trend-related such as demonstrated by the recent focus on COVID-19 in humanitarian innovation literature since 2020.

Conceptual findings

Definitions of humanitarian innovation

Although there has been a considerable increase in literature in recent years, most articles we analysed do not define the terms 'innovation' or 'humanitarian innovation', with only 25% giving any kind of definition or stating the purpose of innovation in the humanitarian context. This is symptomatic of the sector, where a

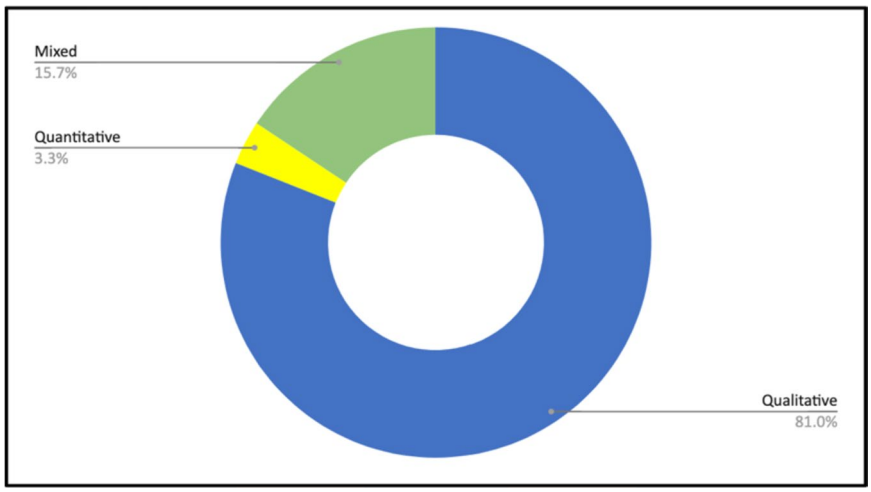


Fig. 4 Types of research in the analysed literature

common definition or a common language for humanitarian innovation more generally is still missing.

Some articles defining humanitarian innovation do not specifically tailor the definition to the humanitarian context. For instance, Scott-Smith defines it simply as a 'means to do things in new or better ways' (2016, 2). Bounie et al. label it 'incremental improvements' (2020, 370), and Krishnan (2020) indicates how innovative solutions encourage new ideas and products to tackle real-time problems. The Swedish Cooperation Agency, Sida, defines it as 'the use of knowledge – ideas, technologies, and processes – into products, procedures and services that bring added value and are new in a specific context' (2015, 5). The concept of innovation can be applied to almost all specialised areas and may include technology, but it is not reducible to technology. Furthermore, as OCHA notes, innovation should not be confused with invention: 'Innovation does not require the creation of something novel, it may also include the adaptation of something existing to a different context. Furthermore, there is no threshold for change to qualify as innovative, as it includes both disruptive as well as incremental innovations' (Betts and Bloom 2014, 5–6). These relatively broad and practical meanings contrast starkly with the definition used by the single largest donor, the United States Agency for International Development (USAID), which fuses humanitarian and development approaches, referring to innovation as 'novel business or organisational models, operational or production processes, or products or services that lead to substantial improvements (not incremental "next steps") in addressing [humanitarian] challenges' (2020, 4).

Some practitioners extend these notions by specifying the purpose of innovation and placing it in the humanitarian context. The Humanitarian Innovation Fund (HIF) defines humanitarian innovation both in terms of its foreseen outcome ('a creative solution, or novel idea, which helps address a problem or seize an opportunity') as well as a process ('an iterative process that identifies, adjusts, and diffuses ideas for improving humanitarian action') (Table 3) (Warner 2017, 6–7). ALNAP defines humanitarian innovation as an iterative process that identifies, adjusts, and diffuses ideas for improving humanitarian action (Obrecht et al., (2017). Bloom and Betts define it as 'a way of potentially transforming humanitarian practice' (2013, 3). Similarly, Betts and Bloom (2014) define it as a process for adaptation and improvement, which includes locating and scaling humanitarian solutions to problems in the form of products, processes, and wider business models.

Innovation in the context of humanitarian aid is framed overwhelmingly as outcome-based. The manner in which innovation is conceptualised in the humanitarian sector does typically not go into detail on the process of innovation, i.e. how innovation is created. Increasingly, the process has been considered more from a system's perspective (Ramalingam et al. 2015). The role of multiple actors in the innovation processes and their relationships and interactions has come into view, leading to the idea of a system of innovation. 'An innovation ecosystem is the evolving set of actors, activities, and artefacts, and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors' (Granstrand and Holgersson 2020, 3). Characteristic of this system view is the emphasis on the notion of innovation not being a single-actor effort, but rather as a dynamic and emergent process that is the product of multiple actors

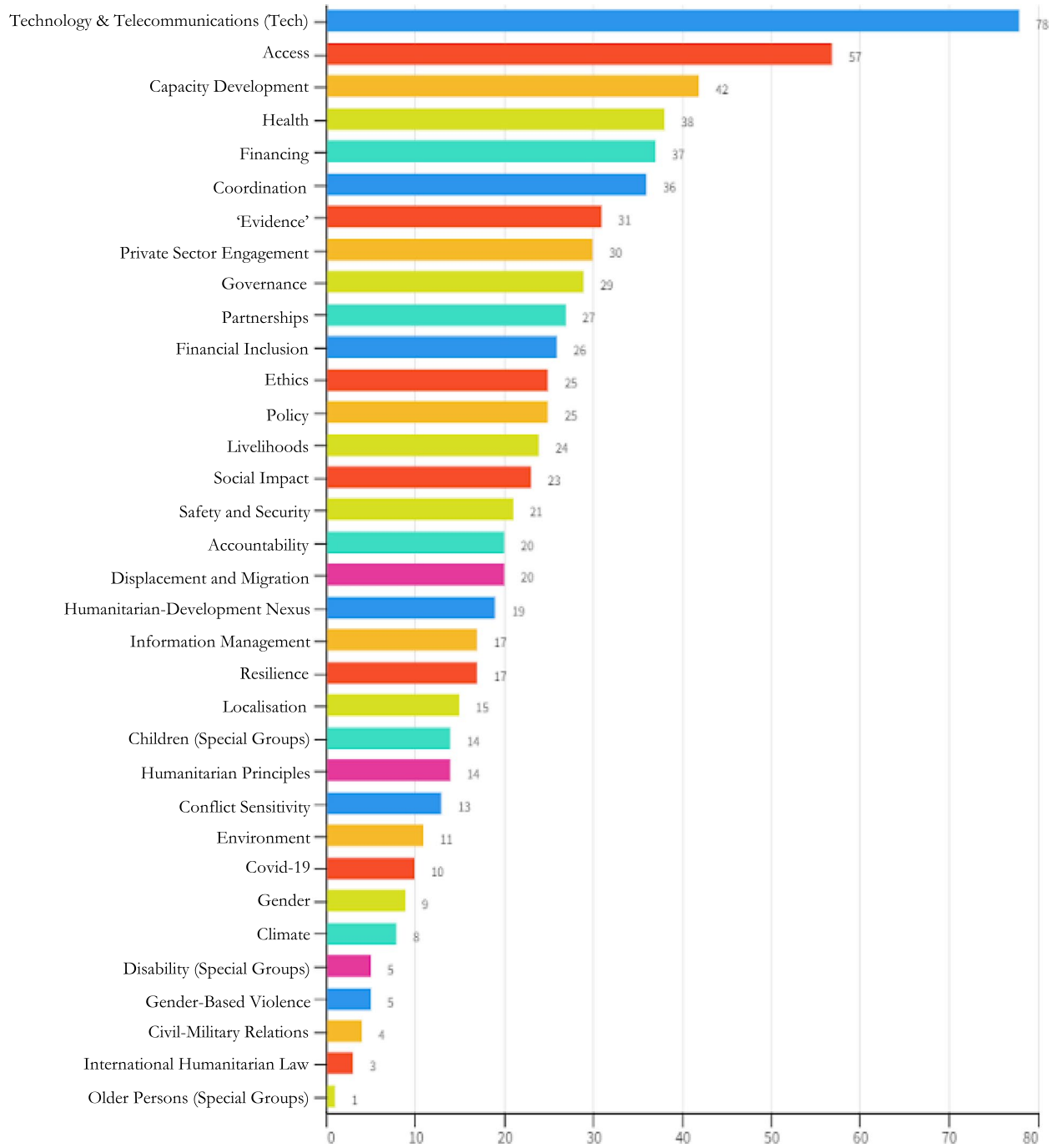


Fig. 5 Focus areas of humanitarian innovation literature (articles can relate to two or more topics)

and their relationships. This conceptualization, however, is still rare in the literature. Instead, the most widely adopted definition of innovation is provided by Bessant and Tidd, who define it as dynamic processes which focus on the creation and implementation of new or improved products and services, processes, positions, and paradigms (2007). These '4Ps' organise innovations into four types, depending on where the proposed improvement or change is occurring. They can be summarised as follows:

Table 3 Definitions of humanitarian innovation

	Frequency
Type of definition	
Outcome-based	34
Process-based	17
System-based	4
Type of innovation	
Products	19
Processes	18
Position	7
Paradigm	8
Business models	1

- Product—changes in the things (products/services) an organisation offers;
- Process—changes in the ways these offerings are created and delivered;
- Position—changes in the way services are presented to the user and how these are communicated and reframed by government and other actors;
- Paradigm—changes in the underlying mental models that shape what the organisation does.

The value added by each of the 4Ps in humanitarian settings 'implies improvements in efficiency, effectiveness, quality, or social outcomes/impacts' (HIF 2018, 1). Some articles discuss innovations that include multiple categories of the 4Ps model at the same time. For example, 3D printing (Tatham et al. 2015), which is a new manufacturing process, can also lead to a paradigm shift in the thinking about humanitarian supply chains concerning their supply chain configuration, the choice of suppliers, and the delivery mechanism. Despite blurry boundaries, the 4Ps model has become the principal reference point for what innovation is, according to Sandvik (2017).

Sandvik (2017) states that the 4Ps are accepted as true without reference to facts or proof. Indeed, critics have suggested that this engenders an analytical slipperiness, noting that 'the difficulty of picking apart the stakes of humanitarian innovation is largely a result of the scale of the '4Ps' (Scott-Smith 2016). Despite their tremendous scope, the 4Ps are being continuously amended, with additions such as policy innovation or business model innovation coming into the mix. As Finnigan and Farkas state, 'the promotion of the application of the 4Ps in the humanitarian sector failed to emphasise that the 4Ps act as one part of an overall business strategy. Without the strategy that articulates the intent, business structure, and plan, the 4Ps simply become another process activity to perform' (2019, 6). So, even the most used definition of innovation in the sector is fiercely debated, and no consensus thus far has been reached. Also, in practice, very few innovations appear to initiate a paradigm shift. For instance, most of the grants of Elhra's HIF have been for product and process innovations, rather than position and paradigm innovations (Lawday, Poulson and Foley, 2017). Currion (2019) states: 'Though new goods, methods and organisational forms can be seen in the humanitarian industry (particularly those enabled by networked technologies), very few seem to be able to gain significant traction'. Paradigm innovation is extremely hard to come by and extremely hard to see: 'It is an open question whether it is even possible to intentionally design paradigm innovations' (Currion 2019).

Definition of 'successful innovation'

Despite growing investments in humanitarian innovation, very little attention is given to defining the concept of 'successful innovations'. Research conducted by Obrecht and Warner (2016), which is commonly referenced in the literature, conceptualises success as either impact (improved solution or generating learning) or adoption (innovation diffused successfully). The success of an innovation is thus judged according to three success criteria:

- Adoption: The innovation is taken to scale and used by others to improve humanitarian performance;
- Improved solution: The innovation offers a measurable, comparative improvement in effectiveness, quality, or efficiency over current approaches to the problem addressed by the innovation;
- Consolidated learning and evidence: New knowledge generated or the evidence base enhanced around the area the innovation is intended to address or performance of the innovation itself.

The 'improved solution' criterion raises the following question: an improvement for whom? Problems and solutions in the humanitarian sector are multifaceted; what is a 'solution' for a donor or agency may not straightforwardly be considered a solution for field staff or affected people.

Consequently, a 'failed' innovation is one that is not widely adopted and achieves no impact (neither an improved solution nor consolidated learning). Notably, the humanitarian innovation literature distinguishes between 'good fail' and 'bad fail'. An innovation may fail to diffuse, but as long as consolidated learning and evidence is obtained (e.g. to use in future innovation endeavours), it is considered a 'good fail'.

Obrecht and Warner (2016) mention the following additional success criteria for humanitarian innovation:

- Involvement and respect of affected people: Be it directly or indirectly, demonstrating how their rights and interests are respected in an innovation process;
- Efficient development: Resources must be used efficiently in the development of innovation;
- Unique impact: When the humanitarian system largely ignores a particular issue, such as (formerly) cash-based assistance or menstrual hygiene, innovations that address such novel areas can have a high degree of risk, but also a unique impact on the system around them.

These factors can be seen as complementary to the abovementioned ones. However, it is notable that their inclusion already creates overlap with the success criteria defined above. For instance, an improved solution may entail a unique impact but inefficient development, so to what degree it would be a success or not remains questionable.

Even this broad conceptualisation of success is not uniformly employed in the literature. Instead, we see in the literature that an innovation's success is typically evaluated on a case-by-case basis. In most cases, some key performance indicators are chosen, and depending on the score or points achieved, the innovation is deemed a success. For example, a medical training given to refugees in a refugee camp was deemed a success based on the number of students enrolling in the course and the score obtained on the final exam (Lovey et al. 2021). These criteria for success are on the output and outcome level, but do not evaluate impact of the intervention, which would need to be evaluated by measuring the effect on health outcomes after the course was completed. Furthermore, if impact is indeed measured, the ultimate effects are often not taken into consideration, because measurement and evaluation of key performance indicators are not conducted on a long-term basis, due to a lack of funding. The sparsity of evidence, particularly regarding the 'impact' dimension, is also frequently noted in the literature.

There have, however, been efforts to evaluate innovations on the portfolio level. Portfolio-wide evaluations may aid in conceptualising success more comparatively and to judge innovations according to consistent criteria. However, such portfolio evaluations are still mostly being done based on case studies. For instance, the portfolio of Innovation Norway utilises self-evaluation using a preconceived framework to judge the success of a select few case studies (Hill 2018). Similarly, the UK's Humanitarian Innovation and Evidence Programme states that for its evaluation, case studies are being used to test and refine the HIEP theory of change and to provide an in-depth understanding of how best to support evidence generation and use in specific humanitarian contexts (Itad 2014). The use of case studies to evaluate an overall holistic innovation approach may prove disadvantageous, as survivorship bias and selection bias could lead to the chosen cases and their success drivers may not be representative. On the other hand, Elrha's portfolio evaluation analysed its innovation portfolio in its entirety, with pre-conceived success criteria related to outcomes, effectiveness, internal factors, funding, and relevance of the innovation (Lawday et al. 2017).

In the studied literature, we note that most sources make explicit reference to a specific innovation, framing it in a positive light, i.e. as successful, even when not explicitly calling it a success, despite the absence of any scientific evaluation of the innovation's impact. We do urge caution in taking these assessments literally, as the manner in how success is evaluated are typically self-assessments by the implementers. This once more showcases the need for more rigorous processes for obtaining evidence (ALNAP 2018).

Practical findings

In this section, we discuss findings with individual innovations as the unit of analysis, in order to gage common attributes of innovations that have been introduced into the humanitarian sector, with respect to several characteristics:

- The sectors into which innovations are introduced in the humanitarian context
- The types of innovations most frequently described in the literature
- The special role that is played by technological innovations
- The targeted end-users of the innovations

Innovation sectors (Table 4)

The results highlight that coordination and support services is the leading sector into which humanitarian innovations are introduced. These innovations are generally implemented in agencies and include the adoption of project management information systems and related digital data-gathering technologies, which has moved many humanitarian organisations over the past decade away from inefficient spreadsheets and paper-based systems. Secondly, innovations within the health sector are prominently featured. Other notable clusters include logistics, WASH, and food security. In addition to innovations being directed at specific clusters, we also noted innovations with either multi-sectoral possibility, meaning an innovation could be used in multiple sectors, for instance, drones being used both in logistics

Table 4 Sectors and clusters of humanitarian innovation activity

Sector	Frequency mentioned	%
Coordination & support services	33	10.31%
Health	24	7.50%
Water, sanitation, and hygiene (WASH)	19	5.94%
Emergency telecommunications	18	5.63%
Logistics	18	5.63%
Education	15	4.69%
Food security	13	4.06%
Protection	11	3.44%
Early recovery	7	2.19%
Camp management & coordination	4	1.25%
Shelter/NFI	4	1.25%
Child protection	3	0.94%
Mine action	3	0.94%
Nutrition	3	0.94%
Multi-sectoral possibility	82	25.63%
Sector not specified/NA/No further mention	63	19.69%
Total	**320**	**100.00%**

(transporting cargo) and early recovery (imaging). Furthermore, some innovations were not directed at any specific sector.

Innovation types

As pointed out in the previous section, the literature refers to different innovation types, along the lines of the 4Ps (Table 5). Additionally, we identify business model and policy innovations as frequently occurring in the literature. This section describes which type of innovation occurs most frequently in the literature.

- **Product/service innovation** refers to a change in what is offered. Product or service innovations are described most frequently (156). Examples of a product innovation include the development of affordable wheelchairs for use in emergency response contexts (ALNAP 2015), the development of portable media centres which provide educational resources and tools to refugees and displaced persons in camps in different camp settings (Iqbal 2017), or ready-to-use therapeutic foods for children with uncomplicated severe acute malnutrition (Kangas et al. 2019);
- **Process innovation** aims to change how a product/service is created or delivered. Within the literature, we found 148 instances of process innovations. Examples include the use of user-centric design to deliver sanitation services in emergencies by projects funded by Elrha's Humanitarian Innovation Fund (Bourne 2019) or human-centred design approaches by DEPP Labs with the aim of developing more responsive and locally led humanitarian and preparedness programming (Konda et al. 2019);
- **Position innovation** seeks to change the way in which a product or service is targeted and delivered. Among the 34 position innovations mentioned, examples included changes in the location of handwashing materials and facilities to promote and enhance child handwashing (Watson et al. 2020). This category of innovations mostly focuses on targeting previously non-accessible or marginalised communities;
- **Paradigm innovation** relates to a change in the underlying mental models that govern our approach. The relatively large amount (38) of innovations pertaining to this category relates to the focus on driving localisation through humanitarian innovation (Tatham et al. 2017), the introduction of innovative financing mechanisms (Spiegel et al. 2020), or the role of cash-based programming in replacing traditional forms of aid delivery (Heaslip et al. 2018);
- **Business model innovation** relates to the situation in which a reframing of the current product/service, process, and market context results in seeing new challenges and opportunities and letting go of others. Examples include the introduction of joint ventures or social enterprises (Vieille 2020), or innovative business strategies to bring humanitarian innovations to scale (Gray et. al., 2019).
- **Policy innovation** refers to an innovation that relates to a policy or policy process. The Australian government's priorities on gender equality and women's empowerment are an illustration of policy innovation. Through these priorities, the government aims to address gender issues, ensuring that women can make their voices heard amidst crisis (Australian Aid 2016);

Table 5 Types of innovation in literature

Type of innovation	Frequency	Percentage
Product innovation	156	54.55%
Process innovation	148	51.75%
Position innovation	34	11.89%
Paradigm innovation	38	13.29%
Business model innovation	4	1.40%
Policy innovation	39	13.64%
Multiple	96	33.57%

The majority of humanitarian innovations mentioned across literature constitute either product or process

innovation, which tend as a whole to offer more incremental change compared to 'position' and 'paradigm' innovations (Lawday et al. 2017). It is, however, important to note that the different types of innovation have fuzzy boundaries, nor are they exclusive. There can be considerable overlap as to which factors could be considered innovative (Francis and Bessant 2005). Innovations frequently take on multiple characteristics and can evolve over time. This was also clearly demonstrated by the various innovations which pertain to multiple types (96). For example, the mobile Vulnerability Analysis Mapping (mVAM) project of World Food Programme uses mobile technologies to collect food security information remotely (Robinson and Obrecht 2016a; Morrow et al. 2016). It brings together a wide range of tools to support practitioners in data collection (product innovation) which simultaneously change the ways in which data collection takes place by (process innovation) as well as brings along considerable shifts in the fundamental approach to humanitarian work by facilitating remote operations (paradigm innovation).

Technological innovations

According to UNOCHA (2017), the humanitarian sector has experienced more disruption due to technology in the past decade than in the past 50 years. Notable studies view technology as the prime enabler behind improved effectiveness and efficiency within the sector, focusing on mobile applications or the role of UAVs, 3D printing, and other cutting-edge technologies. Technological development, whether designed specifically for humanitarian contexts or adapted from other use cases, is seen as a fundamental contextual driver of humanitarian action and which types of innovations are ultimately implemented. From the literature we reviewed, roughly 80% of all product innovations were technological in nature. This translates to making up close to 50% of all innovations analysed. Table 6 displays the most frequently appearing technological innovations. Percentages are given with respect to all innovations identified in the corpus.

The technological innovations found in the corpus are ambitiously designed to simultaneously meet multiple objectives such as increasing reach, efficiency, and effectiveness. From the literature surveyed in this review, the three most frequently occurring types of technological innovations are crisis maps, mobile applications, and UAVs.

However, over recent years, also critical literature has emerged on these 'humanitarian technologies', questioning the humanitarian sector's 'neophilia' and to which extent excessive tech-optimism clouds the judgement on whether an innovation is genuinely game-changing or whether it merely 'fiddles around the edges' (Scott-Smith 2016). The risk is that due to tech fervour these solutions might take the place at the expense of more routine and less 'flashy' activities, which would, however, have a larger impact on affected populations (Scott-Smith 2016).

Table 6 Frequently occurring digital innovations

Digital technology innovations	Frequency	Percentage
Mobile applications	48	12%
Crisis maps & dashboards (incl. GIS)	30	8%
Unmanned aerial vehicles (drones)	29	7%
Digital cash transfer	28	7%
Internet access & connectivity	24	6%
Blockchain (distributed ledger technology)	18	5%
3D printing	17	4%
Biometrics & digital identity	17	4%
Toolset	8	2%
Internet of things	6	2%
Digital communication	5	1%
Industry 4.0	4	1%
Artificial intelligence	4	1%
Virtual reality	3	1%
Other	160	40%
Total	**398**	**100%**

The innovation target

Humanitarian innovation can broadly be divided into two categories, depending on whom the innovation is targeting (Table 7): Innovation that is directed at affected populations as end-users and innovation that focuses on practitioners as end-users. During the literature review, four more distinct subcategories emerged:

- The first direction sees **innovation that aims at the affected population to be the end-user**, giving a certain amount of ownership to them. This includes examples such as solar-powered saltwater pumps (Prasanna 2021) or soap with toys inside for this end-user emerging in the WASH sector (Watson et al. 2019);
- The second direction aims for **practitioners in the field to be end-users**, bringing indirect benefit to the affected communities. Examples of this type of innovation include web-based disease outbreak detection and response in emergency settings (Karo et al. 2018) or infrastructure innovation such as blockchain technology (Ko and Verity 2016; Zwitter and Boisse-Despiaux 2018);
- The third category sees innovation in which **donors and practitioners working at headquarters are the end-user of the innovation**. They have a lesser

Table 7 End-users targeted by humanitarian innovation

Use of innovation	Freq. mentioned	% per innovation
Use of innovation by affected communities	76	23.75%
Use by practitioners to direct benefit of communities (i.e. at field level)	69	21.56%
Use by practitioners/donors (i.e. at headquarter level)	99	30.94%
Concept/strategy only (no direct mention of end-users)	76	23.75%
Total	**320**	**100.00%**

amount of product innovation among them, instead focussing on process innovation. This category includes multi-year financing (Sida et al. 2019) or novel data-sharing practices such as the Humanitarian Data Exchange platform by the OCHA Centre for Humanitarian Data, which allows for the sharing of data between donors and practitioners in order to increase the amount of information available and share best practices for more efficient and informed decision-making (de Winter et al. 2019);

- The last category does not mention specific innovations and instead introduces new concepts, policies, or paradigms to the field of humanitarian innovation.

Of the 244 innovations that specifically mention targeting specific end-users, 168 (68.85%) are innovations targeting practitioners, either in the field or at headquarter level, while only 23.75% of innovations are to be used directly by affected communities.

Innovation management strategies

Innovation management strategies in the sector are primarily related to the process of creating innovation, managing innovation, and which facets must be specifically considered in the strategies (e.g. diffusion and scaling, design, ethical considerations). In line with Obrecht et al. (2017), we determine four engagement strategies for humanitarian innovation.

1. **Project-level strategy** refers to actors focussing on the implementation of a single project, product, or process. This type of management judges each innovation based on its own merits and shortcomings, without necessarily looking at trade-offs and synergies with other innovations or projects.
2. **Programme-level strategy** relates to programmes or organisational units encompassing several innovation processes, often pursued by. Such strategies are often pursued by 'hubs' or 'units' within organisations that work across different sectors or programme areas, overseeing or supporting multiple distinct innovation processes (e.g. UNHCR Innovation Unit, World Food Programme (WFP) Cooperating Partners Innovation Fund, Oxford's Humanitarian Innovation Project).
3. **Portfolio-level strategy** looks at multiple separate innovation projects and programmes. This enables funding of projects with a range of risk levels and assesses them at a collective rather than an individual level (Obrecht et al. 2017; Obrecht and Warner 2016). The positive impact from one or two big, transformational successes in a portfolio can thus suffice to justify the opportunity cost of many failures (Kasper and Marcoux 2014). Such portfolio approaches are oftentimes carried out by independent actors (e.g. Humanitarian Innovation Fund, Global Innovation Fund).
4. **Systems-level strategy** approaches innovation holistically and is concerned with how each part of an innovation process—knowledge transfer, development, adjustment, and diffusion—is affected by the involved actors, their relationships, and other systems. For example, the Center for Research in Innovation Management research on evaluating different systems for innovation would be an example of a system-level scope for assessing and understanding innovation practice (Ramalingam et al. 2015).

How to best manage innovation in humanitarian contexts has received considerable attention through the sharing of lessons learned and best practices in terms of innovation management as is evidenced by the creation and publication of increasing amounts of resources and toolkits, such as the Humanitarian Innovation Guide or the UN Innovation Toolkit. Best practices and lessons learned focus on different topics, such as human-centred design (Bourne 2019; Konda et al. 2019), participation and inclusion of local populations in innovation processes (Robinson and Obrecht 2016b), collaboration with different actors such as researchers or the private sector, ethical considerations in designing and conducting innovation in humanitarian contexts (Sandvik 2019), the role of evidence in guiding innovation processes and its role in driving adoption (Dodgson and Crowley 2021), or suggestions on how to overcome challenges to scaling humanitarian innovation (Elrha, 2018).

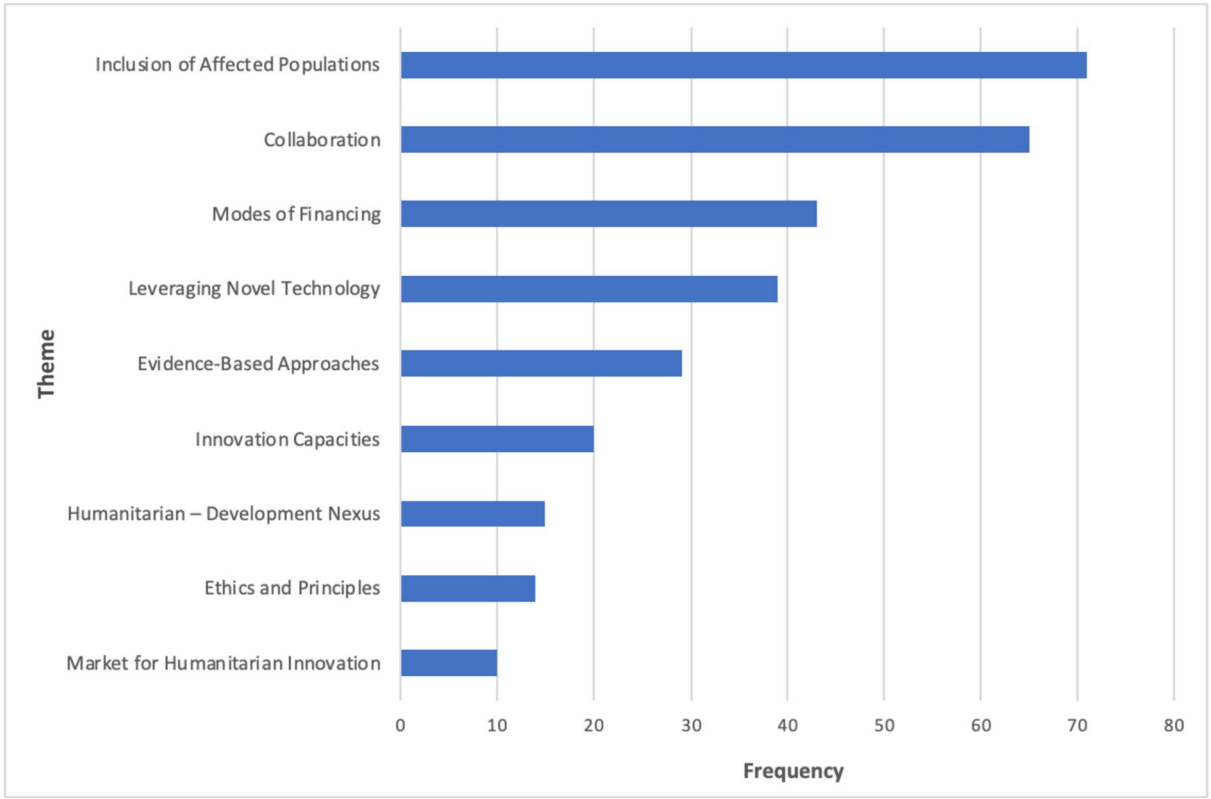


Fig. 6 Frequency of prevalent themes identified in the literature

Although the different level strategies are acknowledged, most of the literature describes humanitarian innovation strategies from a project-level perspective. Programme and portfolio-level analyses are rare and system-level reflections have only recently started to draw attention. This limits the opportunities to study humanitarian innovations from a comparative- or systems-level perspective and hence to develop a more holistic understanding for how innovation should be managed.

Thematic findings—factors impacting the performance of humanitarian innovation

In the literature, we identify multiple recurring thematic areas surrounding the concept of humanitarian innovation. These are typically portrayed as factors that either enable innovation's potential for humanitarian action (drivers) or hinder it (obstacles). While other themes were mentioned, we describe only themes with at least ten mentions throughout the literature we surveyed. Hence, in this section, we outline the nine most frequently appearing themes, ordered by frequency of appearance. Figure 6 displays the frequency of the nine most commonly appearing themes.

In Table 8, we briefly describe each theme, as well as how the literature portrays them as drivers or obstacles to humanitarian innovation.

Inclusion of the affected population

The collaboration with beneficiaries, meaning the affected populations, is considered the single most important ingredient for successful innovation, with many authors concurring that collaboration with beneficiaries and the community is an effective way to find suitable innovations to the context and the setting (Krishnan 2020; Turk 2020; Dodson and Bargach 2015; Sandvik 2017). Community involvement can also benefit the implementers. The benefits include input on innovation creation, feedback on the innovation operation, and innovation promotion in the field for the innovators. For the local population, the benefits include the engagement of locals in new projects, local training, talent development, and the creation of practical solutions (Obrecht and Warner 2016; Bertone et al. 2018; Heaslip et al. 2018). The literature also revealed a need to enable the active engagement of groups who may be socially marginalised, such as women, girls, and refugees. By triggering these

Table 8 Explanation of prevalent themes identified in the literature

No	Theme	Description	Frequency	Driver	Obstacle
1	Inclusion of affected populations	Inclusion of affected populations into the innovation process	71	Ensuring active participation and inclusion of affected populations in innovation agendas and processes	Top-down innovation driven by donors in the Global North
2	Collaboration	Collaboration among donors and practitioners, with the private sector, and with intermediaries	65	Collaboration and alignment between donors, innovators, humanitarian organisations, and private sector actors	Disregarding complementary sets of expertise, working in silos, not using synergy potential
3	Modes of Financing	The modes of financing humanitarian innovation	43	Increase the quality and quantity of funding going to innovation actors, and steer funding towards innovations explicitly catering to the needs of affected populations	Unilateral or bilateral financing, short time horizons
4	Leveraging novel technology	Leveraging technological development in humanitarian contexts	39	Utilising cutting-edge innovation when it is most suited for the respective contexts	Technophilia, over-reliance on gadgets
5	Evidence-based approaches	Basing funding decisions and agenda-setting on a robust evidence base	29	Facilitate evidence-based approaches and data-driven decision-making, for facilitating the operationalisation of appropriate innovations	Lack of Evidence and Data in decision-making
6	Innovation capacities	The role of innovation capacities and capabilities within donor and practitioner organisations	20	Providing a conducive environment for innovation inside donor organisations through fostering innovative cultures and strengthening innovation competencies	Lack of Institutional Support and a culture not embracing innovation
7	Humanitarian – Development nexus	Stronger linkage between humanitarian and development efforts	15	Link innovation with the humanitarian–development nexus	Silo-thinking between humanitarian and development practitioners
8	Ethics and principles	The potential conflict between commonplace innovation mantras (e.g. fail fast) and key humanitarian principles (do no harm)	14	Innovating without sacrificing humanitarian principles	Innovating while disregarding ethical principles
9	The market for humanitarian innovation	The market structure of the humanitarian sector, where donors, rather than affected populations, are the ones paying for innovations	10	Taking into account the affected populations' needs when financing innovation	Donors financing innovations based on own preferences only

groups' participation, it becomes easier to identify problems, design solutions, and implement feedback (Schmitt et al. 2021; Oxfam and WEDC 2018; Bessant et al. 2015; Sida et al. 2019). Increasingly, donors and practitioners provide platforms at different levels that are explicitly supporting and committing to initiatives around humanitarian innovation from affected communities through co-creation and bottom-up innovation (Betts et al. 2015; Scott-Smith 2016).

However, the literature laments the underdeveloped inclusion of the local population, i.e. those people actually affected by a humanitarian crisis. The affected population does not get adequately involved in any stage of the innovation process from design to production to giving feedback, with Elrha (2017b) suggesting that only 33% of humanitarian innovators consult with affected populations during their innovation processes. This is symptomatic of the lack of targeting of innovations at affected populations, as shown in the previous section. As a result, the design of the products and services that are sponsored by far-away donors are inappropriate for the context (Humanitarian Grand Challenge 2020). When the conditions are not well known or rapidly changing, better outcomes result when those affected are in control of, or at least involved in, the innovation processes (Bahadur and Doczi 2016; Honig 2019).

The need to recognise the specific culture, context, and social norms of the humanitarian setting is stressed by humanitarian practitioners and donors alike (European Parliament 2019). Nevertheless, there is a lack of humanitarian funding available to support such initiatives. Oftentimes, funding that is channelled to 'local' partners tends to go through NGOs that may have little representative relationship to crisis-affected communities. Funding requirements and accounting and auditing standards need to be adjusted to enable affected communities to access seed funding and encourage innovation by and for crisis-affected populations (Betts et al. 2015). IASC (2020) advocates for a wide form of local engagement, by recognising and supporting the role of mayors, village elders, faith leaders, camp, or community leaders in the innovation process.

Collaboration between (other) innovation actors

A primary theme that is present in the literature is collaboration. Collaboration between various types of stakeholders (donors, practitioners, and private sector are considered a primary driver for fostering more effective, efficient, and appropriate innovation in the humanitarian sector.

Practitioners

A primary driver for fostering more effective, efficient, and appropriate innovation in the humanitarian sector is collaboration between multiple stakeholders. This refers to increased cooperation among donors, for the purpose of agenda setting, among practitioners for the sharing of expertise, the inclusion of the affected populations in the innovation process, and the inclusion of private sector actors.

The humanitarian sector is considered to have 'a culture of isolation that creates barriers' (Betts and Bloom 2014), which infringes on the collaboration between multiple stakeholders. In the literature, increased integration of practitioners' operations is recognised as essential for supporting innovation in the humanitarian sector and can indeed be considered an innovation itself (Betts and Bloom 2014). Several initiatives have been started towards achieving this goal, such as the Grand Bargain or the Global Alliance of Humanitarian Innovation. These and other initiatives promote pooling and combining data, analysis, and information; improved joined-up planning and programming processes; effective leadership for collective outcomes; and pursuing financing modalities to support collective outcomes (World Bank 2018).

Donors

Collaboration between donors is typically portrayed on two levels. First, through the bundling of resources, several initiatives have been started towards achieving this goal, such as the 'Grand Bargain' or the 'Commitment to Action'. Such initiatives promote pooling and combining data, analysis, and information; improved joined-up planning and programming processes; effective leadership for collective outcomes; and pursuing financing modalities to support collective outcomes (World Bank 2018). Collaboration also serves as a coordination and accountability mechanism, where donors report on the progress they have made in regard to accomplishing their humanitarian innovation objectives. The collaboration between donors for the purpose of agenda-setting, sharing of best practices and data, therefore, can stimulate and encourage innovation.

The second level of collaboration is on the project-level. Multiple actors exist in the humanitarian innovation space, the capacities, and capabilities of which all differ. Partnerships within specific innovation projects can bring new capabilities into the development of a solution, such as creative expertise, technological expertise, access to users, access to funds, or a licence to operate. Taking full advantage of the capacities in the system requires incentives to encourage interaction, collaboration, and partnership. Creating such synergy effects can

be facilitated by donors through innovation consortia and multi-stakeholder projects.

Private sector

Besides collaboration among donors, partnerships with the private sector are also described as key requirements to facilitate humanitarian innovation in the literature (Council of the European Union 2017). Over the past decade, faced with growing resource constraints, humanitarian agencies have held high hopes for contributions from the private sector. Initially seen simply as an alternative source of funding, since about 2010, the private sector has been acknowledged as playing other roles, most notably in product and process innovation. It has also been increasingly recognised as operating at various scales, from multinational corporations to national companies to small businesses created by refugees and internally displaced persons. Furthermore, collaboration with the private sector, often in public–private partnerships (PPP), has become increasingly common. Collaborative private sector-NGO partnerships allow both organisations to combine their expertise and create contextual, innovative solutions for humanitarian and community-based response, something more essential than ever as new types of crises emerge globally. Donors, for their part, appreciate private sector involvement because it means lower overhead and less need for constant engagement and monitoring (Sandvik 2017), as well as the opportunity of leveraging private sector innovation expertise.

However, private sector actors' involvement in the humanitarian space is also seen as entailing potential downsides and risks. The silicon-valley style approach of innovating and 'failing fast' can violate the 'do no harm' principle and ultimately negatively affect the beneficiaries, who are most likely to bear the costs of the failure (Sandvik et al. 2017). Hence, there remains significant hesitance about whether businesses that seek profit can uphold humanitarian principles (Betts and Bloom 2014). Also, due to the perceived intention of private sector actors prioritising shareholder value maximisation, there is concern that the affected populations' needs will be neglected. The notion that aid money might be used to pay a return to investors is also sometimes seen as unethical. The increase in private sector activity has furthermore led to a debate on ethics and technical standards, responsible innovation, particularly regarding datafication of vulnerable populations (European Parliament 2019).

Hence, there exists a degree of concern about the practicality and underlying ideological issues associated with working with external partners, particularly from the private sector. The strong values (and ethics) underpinning the sector may be acting to constrain innovation and to limit the potential for resource sharing and amplification.

Intermediaries

Another mode of fostering cooperation described in the literature is through intermediaries. Intermediaries are brokers facilitating the open exchange of new information, knowledge, and technological invention between 'seekers' and 'solvers'. In response to identified gaps in the ability of international humanitarian action to innovate, such as lack of dedicated resources and spending and constraints in innovation management capacity, a number of intermediaries such as Elrha's Humanitarian Innovation Fund or the Global Innovation Fund have appeared in the humanitarian sector. Lawday et al. similarly state that their purpose is to 'support organisations and individuals to identify, nurture and share innovative and scalable solutions to the challenges facing effective humanitarian assistance' (2017, 1). The reasoning behind these intermediaries funding innovation projects is to leverage their expertise in innovative products and practices and thereby increase the quality of innovations sponsored. These types of funds largely follow a model of seed-funding, where they provide startup capital for piloting new solutions. Despite the acknowledged necessity for collaboration, however, there exist frequent challenges to collaborate due to the complex array of actors involved in the humanitarian innovation context (House 2020; Fekete et al. 2021).

Modes of financing

Adequate funding is one of the primary enablers of humanitarian innovation. The necessity of improving the effectiveness of the finances contributed by donors is a frequently recurring theme in the literature. However, even though there has been an increase of absolute funds for innovation in the last years, many authors state that the lack of financial resources is still an obstacle to humanitarian innovation (Watson et al. 2020; Caniato et al. 2017; Sandvik et al. 2017; Nelis et al. 2020; Lovey et al. 2021). Indeed, the funding gap between funds available and funds needed is continuing to grow, as is true for the entire humanitarian aid sector.

The financial resources that are available for humanitarian innovation are not specifically well designed for supporting the whole innovation process. Early stages of the innovation process usually receive more funding, whereas there is little financing for the adoption and diffusion stages, where programmes often stall (Rush and Marshall 2015; Sandvik 2017; European Parliament 2019). Therefore, innovations often get stuck at the pilot phase (Sahebi et al. 2020; Elrha 2018; Ko and Verity 2016; Obrecht and Warner 2016). 'Challenge funding' contributes

to this 'pilot and crash' phenomenon, by which new programmes keep being introduced but then cannot find long-term financial support (Benton and Glennie 2016). This insufficient support to 'follow-through' is also seen in the recovery phase and durable solutions phase, mainly due to donor fatigue and lack of resources (Fladvad Nielsen et al. 2016). Implementable and durable humanitarian innovations are said to be achievable only if sufficient financial support of stakeholders is provided (Scott-Smith 2016; Scott and Mars 2015; Heilbrunn and Iannone 2020), for instance from donors but also from host countries and countries nearby (Redvers 2017; Betts et al. 2015; Zwitter and Herman 2018). Stakeholders' support—both financial and political—must be maintained through the whole innovation process, especially in the last stages of implementation and scaling up/diffusion, where evidence collection and impact evaluations are carried out (Rush and Marshall 2015). Follow-up funding and incubation support can also help the most promising innovations reach scale (Benton and Glennie 2016).

New funding methods are being employed by donors to make the funds available more effective. Pooled funds collectively channel more funding (both in volume and percentage terms) to local and national actors than bilateral donors, particularly in conflict contexts (Metcalfe-Hough et al. 2021). Also, donors may achieve better results by donating in the form of multi-annual contributions to humanitarian agencies (IOB 2015). Shifting from annual to multi-year humanitarian funding can also aid by giving innovators access to more reliable, long-term funding streams. Such longer-term funding is called for by innovators, to increase reliability and predictability of contributions. This allows recipients to use this funding strategically across their respective mandates to ensure maximum impact with donor funds, scale up sustainable solutions, invest in innovative approaches, and adapt to changing situations in emergencies. However, while multi-year financing is extremely popular with recipient practitioners, clear causal effects on improved added value to the affected population are not clearly causally established (Sida et al. 2019).

Additionally, research by the Humanitarian Innovation Fund states that strict funding deadlines could stifle an innovation process, whereas more flexible approaches to funding sources supported a successful innovation (Betts et al. 2015). This is an unsurprising finding; nevertheless, grantees cite flexibility by donors as rare. Therefore, donor flexibility is often stressed as a key factor for innovation. Obrecht and Warner (2016), for example, explicitly state that their project succeeded only because the donor gave a no-cost extension on a deadline. Yet, flexible funding poses certain risks to donors: in some cases, delays on a timeline are necessary to get a prototype right; in other cases, these delays can be the result of mismanagement and poor planning.

Technology-driven innovation

Technological innovations are frequently framed as being 'game-changers' in the literature. Humanitarian innovators tend to overstate an innovation's potential, often claiming that technological objects can revolutionise the delivery of assistance (Pilloton 2009; Shall 2009; Johnson 2011). According to Sandvik et al. (2017), a game changer is a new constituent that notably alters an existing situation or activity: 'A game changing technology holds the promise of changing not only how things are done and by whom, but what is possible within (or despite) a given context'. However, they furthermore note that such innovations only give a competitive advantage within the existing rules, which are formed over extensive time periods and are rarely toppled by a single innovation. In the literature, technology is portrayed both as a driver and obstacle (Gaffey et al. 2020; Pascucci 2019; Zwitter and Herman 2018; Dandurand et al. 2020). The technological imperative is the idea that new technologies are essential and, hence, they must be developed and introduced in every context needed (Scott and Mars 2015).

The penetration rate of technology is also found to be an important factor for innovation. In a regional consultation report from the World Humanitarian Summit (2016), it is argued that the higher the penetration rate of technology, the higher the opportunity to innovate. Stakeholders recognise the potential that technological innovation has in humanitarian assistance, especially supporting the phases of prevention and preparedness of integrated disaster risk management (European Parliament 2019). There are different benefits and opportunities for humanitarian aid beneficiaries regarding technological and digital capabilities that authors have identified. There are educational and training improvements, as technology can be used, for instance, to face challenges related to multilingual classrooms (Benton and Glennie 2016). Mobile technology and internet penetration also bring opportunities for humanitarian innovation (Bolon et al. 2020). For example, mobile learning can be useful to displaced populations (Menashy and Zakharia 2020). Moreover, technological innovations are driven by needs, issues, or challenges surrounding the humanitarian context. Raftree (2020) calls for a digital transformation as users can be hesitant to engage with services that are useful for them mainly due to issues regarding data security. Seifert et al. (2018) argue that due to the lack of available data and forecast accuracy in disaster-affected areas, more efforts should be put into increasing the contributions of information and computer technologies (ICTs).

Technology can spread beyond the affected populations and benefit the humanitarian sector as a whole. For instance, digital infrastructure like the blockchain, which was originally developed as a mechanism used for financial transactions, is now used as a tool to improve the complex supply chain of the humanitarian sector (Rejeb and Rejeb 2020). Similarly, drones and satellites are cited as examples that ease the retention of imagery in areas that are difficult to access otherwise (Quinn et al. 2018).

Regarding the limitations or challenges of technological innovations in the humanitarian sector, some literature argues that there is an 'overblown tech optimism' (Menashy and Zakharia 2020) that makes innovators to narrowly focus on technological solutions instead of other approaches, leading to missed opportunities (Smith et al. 2020). The humanitarian neophilia concept relates to such overuse of technology. According to Scott-Smith (2016), the problem is 'They pursue gadgets at the expense of routine activities. They risk reducing complex humanitarian problems, which need political engagement and have a significant social angle, to the provision of material goods. At their worst they combine an excess of enthusiasm with a shortage of understanding'. According to Scott-Smith (2016), the tendency to 'overstate the object' is a recurrent characteristic of the humanitarian innovation movement. Such a scale of vision is characteristic of 'humanitarian neophilia, which prioritises novelty over suitability and applies this novelty on a severely restricted horizon'. Additionally, when humanitarian actors incorporate such over-stated technologies into their work, they may also incorporate unethical values embedded in them (Sandvik, 2017).

Furthermore, the processing of some types of data such as big data stemming from social media or biometric devices or satellite imagery, which often relies on machine learning algorithms, is oftentimes not yet reliable without human quality control. A more uniform data quality and standardisation must be reached, processing made reliable, and only then can more data-driven services be provided by donors reliably (de Winter et al. 2019). The emphasis on using data responsibly also occurs frequently, while also the need for extensive training of human resources for new data-driven methodologies is pointed out (Turk 2020; de Winter et al. 2019).

Further problems may be caused by the infrastructural requirements for technologies, which in crisis contexts are often not given for adequately operating high-tech equipment (European Parliament 2019). Furthermore, overly relying on technology may widen the so-called digital divide between those affected people who have access to technologies, thereby reaping their benefits, and those who cannot access them, who come away empty-handed (Raftree 2020; UNOCHA 2021).

Evidence-based approaches

In the literature, evidence-based approaches are described as key to making decisions that are realistic and based on the needs of the affected community. Hence, data and evidence play a crucial role in driving and finding opportunities to innovate (Fladvad Nielsen et al. 2016; Nelis et al. 2020; Obrecht and Warner 2016). It is important to tap into appropriate information streams to make suitable evidence-based decisions according to the humanitarian context (Comes et al. 2018; Nelis et al. 2020). The information provided by evaluation findings enables organisations to determine issues and opportunities for improvement in the humanitarian sector, especially when these evaluations involve the views of beneficiaries and affected populations (Obrecht et al. 2017; Bounie et al. 2020). Furthermore, there is increased recognition of the importance of evidence in guiding innovation processes as well as in driving and enabling adoption of humanitarian innovation (Dodgson and Crowley 2021). Due to the high uncertainty associated with innovation, monitoring and evaluation are considered of particular importance to demonstrate the accountability and effectiveness of innovations (Obrecht and Warner 2016; Warner 2017; Obrecht et al. 2017). The paucity of evidence and the need for innovation to identify and help overcome the methodological and operational barriers to delivering humanitarian interventions has led to the development of new programmes, such as the Humanitarian Innovation and Evidence Programme (Nelis et al. 2020), and specific resources for supporting evidence collection on humanitarian innovation (RIL 2021; Bryant et al. 2019).

The literature stresses evidence-based approaches as key to guiding decisions that are realistic and are directed at the right challenges. Without the proper base for information, it is impossible for donors to know whether their funding mechanisms achieve the desired policy objectives. Although there is increased knowledge sharing on how to develop evidence on humanitarian innovation and to use it to guide innovation processes, there are no commonly agreed upon procedures and criteria on how evidence should best be collected and analysed. The lack of data and evidence and their standardisation has led to challenges for humanitarian innovation. There exist under-researched topics, such as the potential of operations management to aid humanitarian processes, and little empirical evidence of certain innovations, like mobile clinics or innovations for durable solutions (Nelis et al. 2020; Burke et al. 2016; McGowan et al. 2020; Humanitarian Grand Challenge 2020). Besides, there is little evidence that can be used by humanitarian innovators to decide on the most suitable resourcing model and few use cases based on hard evidence that can help justify and

guarantee scaling (Obrecht and Warner 2016; European Parliament 2019). Thus, innovation information needs to be strengthened and more rigorous quality assurance techniques should be implemented to monitor accuracy (Rush et al. 2021; Turk 2020). A lack of evidence can lead to unintended consequences. For example, as a result of limited involvement and a 'hands-off approach', the Netherlands has failed to adopt a more critical attitude towards the functioning of the agencies receiving its support and the results they achieve (IOB 2015). Increased donor involvement may help make data and evidence more widely available in humanitarian action (IOB 2015).

Innovation skills and capacities

The literature repeatedly points out that in order to improve the effectiveness and efficiency of innovation in the humanitarian sector, the internal workings of donors and practitioners must become conducive to innovation themselves. The lack of 'walking the talk' by donors and practitioners proves an obstacle to innovation efforts. Indeed, while awareness around innovation is increasing throughout the sector, there remains a lack of understanding of the underlying processes, competencies, and time required for successful innovation to occur (Ramalingam et al. 2014). Furthermore, the dominance within the sector of large donors and agencies brings about a lack of R&D funding available to smaller actors in the sector and an inefficient interaction with the private sector. However, there are increased efforts to foster an innovative culture within organisations, with for example UNHCR stating that 'Our first agenda item is to expand our efforts to build a stronger culture and set of competencies around innovation' (Earney 2019). Donors are called upon to create innovative environments and a culture of innovation.

New skills and capabilities are needed to cope with the rapidly evolving humanitarian system. According to UNHCR, the staff of a donor government, NGO, or intergovernmental agency such as the UN must be supported explicitly in their effort to implement an innovation approach (Earney 2019). Many staff are in need of information on resources and support throughout the cycle, not solely in financial terms but also through mentorship, tools, and training, such as Elrha's 'Humanitarian Innovation Guide' or the 'UN Innovation toolkit'. Underlining the necessity for improving modes of working practices, the Global Alliance for Humanitarian Innovation (GAHI) argues that to effectively invest in innovation throughout the entire system, rather than investment in individual innovations, a different kind of investment from funding specific innovators is necessary, and donors must therefore develop the necessary capabilities to adequately perform this type of investment (McClure et al. 2018).

Many organisations, notably humanitarian agencies but also donors, face the challenge of building in-house acceptance of innovation activities. Even where innovation is encouraged, field workers often wish to keep their initiatives to themselves rather than sharing what they have learned, for fear of intervention from headquarters (Earney 2019). An innovation mindset can be fostered through changes in incentives and practices: opportunities to reflect creatively; dialogue that transcends bureaucratic hierarchies; connecting field and technical staff with headquarters and with one another; secondments within other organisations and sectors; greater human resource mobility across organisations; and encouraging rather than punishing early failure as a means of learning (Balestra 2019). In order to ensure that staff have required skills and capacities, a more concerted investment in staff and training would be necessary, to enable the best available knowledge leveraging and enhancing operations. UNHCR states that its employees need to 'know when, how, and who it takes for innovation to happen. And when they should embark upon an innovation process. They also need the knowledge and expertise to innovate' (Earney 2019).

Donor organisations are beginning to review structures and regulations that inhibit innovation, such as barriers to movement into and out of the system to acquire new experiences or skills or procurement rules that limit flexibility to pilot alternative products, processes, or partnerships, particularly with the private sector. For instance, USAID aims to enhance critical technical capabilities regarding innovation by improving its organisational structure and reorganising bureaus and shaping the workforce to create a more field-focused and functionally aligned headquarters that improves efficiency, programmatic coherence, and ultimately enables USAID to more effectively foster self-reliance (USAID 2019).

Ethics and principles

The literature frequently mentions the ethical implications of introducing innovations into novel contexts. On many occasions, innovations, mainly technological ones, are introduced and deployed in humanitarian contexts without first assessing the harms they may cause to human beings and how they comply with the humanitarian imperative of 'do no harm' (Sandvik et al. 2017). The increased collection and use of data and evidence in the humanitarian sector has also raised ethical concerns (Sandvik et al. 2017; Sandvik 2020). As innovation brings forth considerable uncertainty given the introduction of new processes and strategies, it poses considerable challenges to stakeholders engaged in the innovation process as to how to manage associated risks (either foreseen and unforeseen) and ensure their accountability.

Given the lack of common and implementable ethical guidelines and standards in the context of humanitarian innovation, the literature calls for an ethical framework to ensure that stakeholders clearly identify ethical issues, guarantee the innovation's respect for human dignity, clarify the level of involvement of end-users, assess harms and benefits guaranteeing no harm to non-beneficiaries, ensure the access to the innovation, and, lastly, implement and scale-up the innovation using evidence-based decision-making (Sheather et al. 2016; McClure et al. 2018; Taylor 2016; Sandvik 2020; Lovey et al. 2021). In order to effectively address such ethical challenges associated with innovation, an increasing number of guidelines and toolkits have been developed in recent years to share best practices and lessons learned (Sheather et al. 2016; Owen et al. 2013; Elrha 2017a; Principles for Digital Development 2021).

Furthermore, there are technical trade-offs when introducing new technologies in a setting as well as societal implications, resulting in a mismatch between technologies and humanitarian principles (Sahebi et al. 2020; Talhouk et al. 2020). New technologies could further introduce challenges due to, for instance, the lack of suitable infrastructure (Greenwood et al. 2020), and limited technological knowledge of stakeholders (Hossain and Thakur 2021). There are also specific risks of different technological innovations, due to their dual-use nature. Drones, for example, provide considerable benefits for among others transportation and logistics, but could simultaneously be used as weapons (Jeong et al. 2020). There are also uncertainties surrounding data use. Data risks can include, for instance, the selling of personal data of beneficiaries and affected communities, privacy and data ownership concerns, the collection of sensitive demographically identifiable information, and the misuse of data for military purposes, among others (Raftree 2020; Smith et al. 2020; European Parliament 2019). Biometrics, for instance, constitute a real danger for the affected community as they entail the collection of extremely identifiable personal data of beneficiaries which can be used ultimately for other purposes, posing cybersecurity and digital risks (Sandvik 2020). Hence, data risks exist during its collection, storage, and usage (Wang 2020).

Humanitarian-Development nexus approach

The literature furthermore stresses the necessity of increased collaboration between humanitarian practitioners and development workers. While the concept of creating a humanitarian-development nexus is repeatedly mentioned in the literature on humanitarian innovation, its link to innovation is not explicit. Predominantly, strengthening the ties of humanitarian and development action is portrayed as an innovation in and of itself. Also, the need for increased use of innovation across humanitarian and development spheres is mentioned, implying a shift of innovation's objectives away from quick-fixes of symptomatic problems and towards addressing underlying root causes and offer system-wide long-term solutions.

The humanitarian-development nexus suggests a paradigmatic shift for donors and practitioners from delivering 'only' aid as a direct response to crises and towards a more holistic approach. In the literature, the perception prevails that current modus operandi of the humanitarian system, consisting overwhelmingly of meeting needs immediately following a disaster, are insufficient and resulting in the biassed, inappropriate, and expensive management of crisis ex-post. Instead, donors and humanitarian practitioners are called upon to strengthen the transition from relief to development and improve coordination at the nexus of humanitarian action, development assistance, stabilisation, peacebuilding, and conflict prevention (European Parliament 2019; Bryant et al. 2019; IASC 2021; Dalrymple and Thomas 2021).

According to the literature, this can be accomplished particularly through programming that is premised on predictable, multi-year commitments that is willing to support programmes that include risk but enable innovation. Furthermore, strengthening operational links between the approaches of humanitarian assistance, development cooperation, and conflict prevention, both within individual organisations and across them, leads to greater programme impact. For instance, UN agencies and NGOs with mandates encompassing humanitarian and development work were better able to coordinate and adapt programming to address both immediate needs and longer term issues than those with a limited mandate (Dalrymple and Thomas 2021).

The humanitarian innovation market

The functioning of the humanitarian market system is a commonly occurring topic in the literature. The market constellation in the humanitarian sector differs in many ways from private sector markets, as the donors are the primary customers of innovation, not the affected populations. Hence, negative user experience is far less likely to result in the discontinuation of an innovation, as long as the donors remain willing to fund the innovation.

This can be, in part, explained by the incentive system in place in humanitarian contexts, i.e. the market structure of the sector. Concretely, the humanitarian markets' customers (in terms of who ends up spending money) are oftentimes not the affected populations or even the practitioners, but rather the donors. A pressing issue related to the meaning of innovation for the sector is therefore

to resolve the question of who the 'customer' of the innovation is. For most humanitarian agencies, the donor is the customer and the community where the innovation is applied is the beneficiary (Finnigan and Farkas 2019). As such, innovators provide the best value proposition as perceived by the customer, i.e. the donors. Donors' interests in certain innovations push innovators in that direction. For instance, donor push is among the main factors for the implementation of mobile clinics, which try to solve the lack of healthcare workers. Yet, evidence shows that mobile clinics may not have a better performance than traditional clinics in some humanitarian settings (McGowan et al 2020). Nevertheless, due to donors pushing this innovation, the chance of repeat business increases. Thus, policies that underpin the funding may inadvertently push and pull humanitarian practitioners and organisations towards practices that inhibit, restrict, or stifle effective innovation. Such donor push of innovation may result in less effective, efficient, and appropriate innovations. In contrast to traditional, efficient markets, negative user experience is far less likely to result in the discontinuation of an innovation, because the donors, who are unaware of potential negative aspects, remain willing to fund the innovation. The literature frequently notes that the innovations created are oftentimes 'pushed' by donors due to donor-preferences rather than their explicit qualities. Hence, donors need to be aware of this influence and maximise the likelihood of the innovations they fund to concretely benefit the affected population, by insisting on a clear evidence base.

To circumvent the issues arising from the setup of the complex market constellation to decrease focus on innovations catering to needs of donors instead of practitioners and affected populations by providing incentives for humanitarian innovation to cater more explicitly to benefit the affected population, rather than 'just' the donors, taking this further, Gray et al. (2019) describe that alternative revenue models should be considered to draw a distinction between the target end-users and buyers of humanitarian innovation. One example would be to focus on cash transfers to affected populations and let innovations enter and exit the system through supply and demand. The aim would be to alleviate need by financially capacitating 'humanitarian consumers' through quality financial services. Theoretically, this would redirect demand from institutional donors to end-users. Pushing this forward, humanitarian innovators suggest that aid agencies must be made independent through generation of financial returns: the relationship between donors and aid agencies must be terminated so that a regular market structure is established which directs demand to beneficiaries only.

Discussion

The humanitarian innovation sector is widely believed to have the potential to transform humanitarian practices; however, the surveyed literature suggests that the sector is not living up to this potential. Innovation outputs inconsistently add value to humanitarian practices, and the field is plagued with conceptual ambiguity.

One of the key issues identified in the literature is the lack of uniformity and consensus regarding the definition of humanitarian innovation. Without a generally accepted definition, it is challenging to differentiate between what constitutes innovation and what does not. Additionally, there is no holistic definition of success for innovation, making it difficult to assess the significance of innovation to the sector. Therefore, future research should focus on providing clear definitions and explicit analyses of the characteristics of humanitarian innovation.

In terms of practical innovations introduced into the humanitarian sector, the literature notes a clear dominance of innovations on the product and process level. The prevalence of incremental improvements, rather than transformative change throughout the sector, is a result of this. Moreover, relevant data on the performance of innovation is collected and processed inconsistently, and innovations' added value to the humanitarian sector is thus not verifiable.

To address these challenges, the literature suggests multiple approaches that can be adopted to improve the current state of humanitarian innovation. These include closer collaboration between actors involved in the sector, greater inclusivity of affected populations in the innovation process, and an increase in the capabilities of actors in the sector to become more conducive to innovation. To improve the operating principles of actors in the sector, there is a need to pool and prolong financing, more robustly utilise evidence-based decision-making, and apply clearer ethical guidelines, particularly when dealing with new technologies. Additionally, there is a need to evaluate technologies thoroughly for their appropriateness in the sector, as the humanitarian sector is becoming increasingly technophilic. Finally, to broaden the focus of humanitarian innovation, the sector needs to strengthen collaboration with actors outside of the humanitarian system, particularly in the development sector, to leverage complementarities and strengthen long-term resilience among affected populations.

The above suggestions identify potential avenues for improvement of individual facets of the humanitarian innovation sector. It is unclear how they can work in unison and lead to transformational change, as they do not necessarily resolve misalignments between actors, resources, and

Table 9 Components of the humanitarian innovation system

No	Component	Description of component	Elements of components (from the literature)
1	**Actors**	The various actors within the system, and the roles they play in driving innovation	Inclusion of the affected population Collaboration Innovation capacity
2	**Institutions**	The formal and informal habits and practices in actors' interactions, their relationships, networks. Shaping the way things are done within the system and how they inhibit or encourage innovation	Evidence-based approaches Modes of financing The humanitarian innovation market Ethics and principles
3	**Contextual factors**	Factors external to the system, That introduce innovation inputs into the system, have an effect on the humanitarian innovation system and may cause it to change and evolve	Technological development Humanitarian development nexus
4	**Output and performance**	The (types of) innovations resulting from the system, and the degree of 'success' they achieve (e.g. in terms of scale and impact)	Innovation conceptualization (lack of definitions) Innovation types introduced into the field (technophilia) Innovations approached on the project level, rather than holistically The innovation target

incentives. Instead, donors and practitioners must go beyond focussing on singular innovations or innovation processes and drive innovations throughout the entirety of the sector. Adopting a more deliberate and systematic approach can enhance innovation performance and facilitate better learning and cross-pollination of approaches within the sector.

Hence, the primary insight from our review of the literature is that a more comprehensive understanding of the innovation system within the humanitarian aid sector is necessary. The current operating modes, with managing innovations largely on project or portfolio levels, have led to the development of singular products and processes and do not have the desired transformational effect in the sector. Therefore, we suggest to more explicitly approach and manage humanitarian innovation as a system, to aid in understanding the complex and multifaceted factors that shape innovation processes.

An innovation system can be defined as 'the evolving set of actors, activities, and artefacts, and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors' (Granstrand and Holgersson 2020, p.3). The concept of innovation systems recognises the complex, interdependent, networked, and socially embedded nature of innovation (Rothwell 1994). Our findings from the literature confirm and extend the conceptualisation of innovation systems by Granstrand and Hogersson (2020). The following four components constitute the humanitarian innovation system:

1. Actors
2. Institutions
3. Contextual factors
4. Output and performance

Table 9 summarises each system component and shows how they are related to the findings from the literature.

Various actors are active in the space of humanitarian innovation, such as practitioners, policymakers, intermediaries, private sector actors, and the affected communities, who commission, create, diffuse, and use innovation. The importance of institutions, between these actors, referring for example to the use of evidence-based approaches, modes of financing, the structure of the market in the humanitarian sector, and the adherence to ethics and principles, is also highlighted frequently. Additionally, the humanitarian innovation system is influenced by contextual factors, which constitute inputs into the system stemming from the wider environment, i.e. other (innovation) systems. For instance, technologies developed in other innovation systems may enter the humanitarian innovation system and be used or altered by humanitarian actors. Contextual factors may also cause the system to change and evolve. The actors, institutions, and contextual factors dictate the performance of the humanitarian innovation system and therewith its ability to achieve the desired transformational change. The specific performance outputs are conceptual (definitions) or tangible (innovation outputs, strategies, targets) in nature. Those involved in humanitarian assistance need to more explicitly acknowledge the interrelationship between these components, knowing that attempting to improve only one aspect of the system while neglecting the others, may not lead to the desired outcomes. Figure 7 displays the humanitarian innovation system.

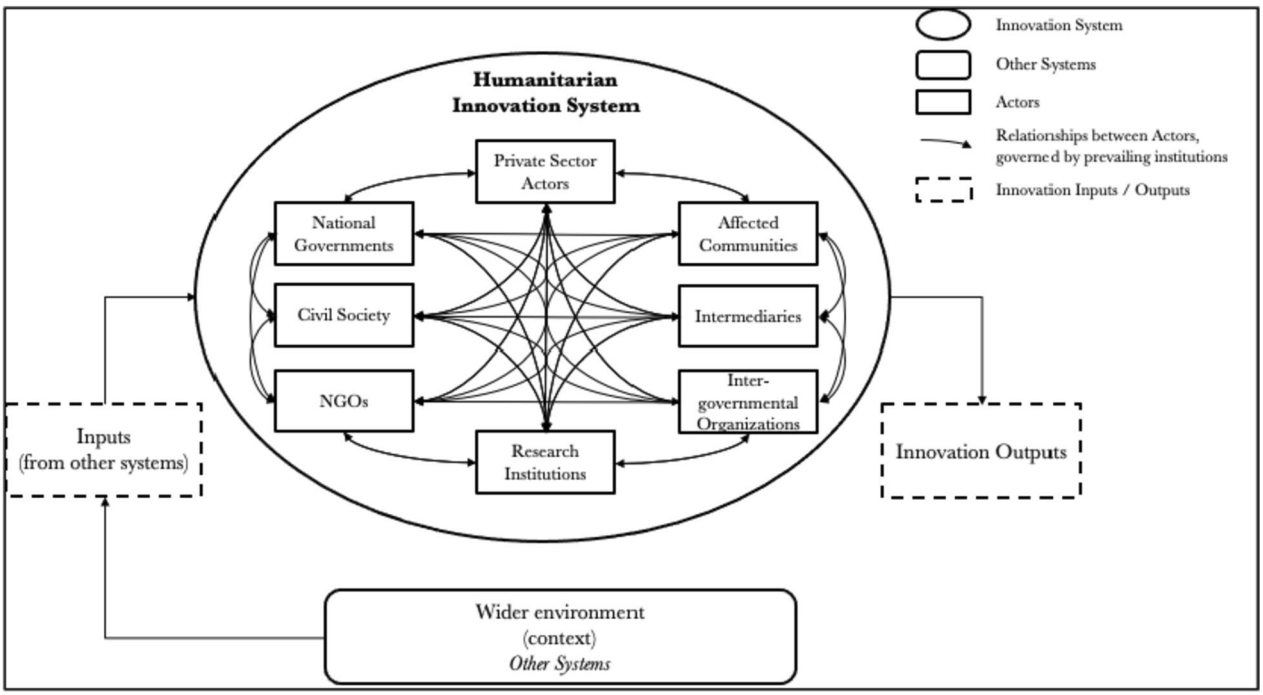


Fig. 7 The humanitarian innovation system

Conceptualising humanitarian innovation as a system is an important step in improving its performance as it allows for a more comprehensive understanding of the innovation process and the factors that contribute to its success or failure.

Additionally, for humanitarian innovation to achieve transformative impact, it is imperative that it remains true to its roots. The current trend towards prioritising innovation for its own sake over the humanitarian principles of 'doing no harm' and alleviating the suffering of those affected by crises undermines the potential for transformation and the development of effective and sustainable solutions. To address this, there is a need for the realignment of innovation within the humanitarian sector to focus on its fundamental mission of humanitarianism. This can be achieved through the explicit adoption of a mission-based innovation system, which provides a framework for the development of innovative solutions that are specifically tailored to the most pressing needs of a particular community or population (Mazzucato 2021), in this case, those affected by humanitarian crises. Such a system would ensure that innovation efforts are focused on meeting the needs of affected populations rather than simply creating new technologies or solutions for the sake of innovation.

This approach requires a shift from a technology-driven and project driven approach to a needs-driven approach, with a focus on co-creating solutions with local communities and prioritising long-term sustainable solutions that address the root causes of crises. By becoming a mission-based innovation system, humanitarian innovation can become a powerful tool for transforming the way we respond to crises and delivering more effective and efficient humanitarian aid.

It is important for policymakers to acknowledge the humanitarian innovation system in its entirety and adjust its alignment to become more mission-based for improving the efficiency and effectiveness of the sector. Adopting such a system's perspective can help in identifying possible levers and intervention points for successful innovation, but at the same time requires innovation actors to take a more holistic perspective as to how these are foreseen to drive desired transformational change within the sector. As stated by the UNHCR Innovation Service, systems thinking can aid in gaining 'perspective of a system from all the different stakeholders to see complexity, situational, perceived degree of order to or interconnections' (Neimand and Christiano 2020). Taking such a systems-based approach is not only beneficial for delivering more effective, efficient, and appropriate solutions to beneficiaries, but also for reforming the humanitarian sector itself by breaking perverse incentives and institutional blockages (Obrecht and Warner 2016).

Conclusion

Humanitarian innovation is not pursued for its own sake: it is meant to lead to substantial improvements in the provision of humanitarian assistance for the benefit of crises affected and crises vulnerable populations. Yet, there is little evidence on the relationship between innovation and humanitarian performance, resulting in ongoing questions as to whether innovation activity is leading to improvements in humanitarian action. The aim of the paper was to analyse the state of academic and practitioner literature on humanitarian innovation, identify themes in the field, and discuss them in the context of a system approach, which was subsequently used to derive policy implications.

The literature study explored several questions related to the concept of humanitarian innovation, to exhibit key concepts and themes. A key takeaway from the study is that many of the concepts frequently occurring in the humanitarian innovation literature are applied non-uniformly and need clearer definitions. Tellingly, the very definitions of humanitarian innovation are highly varied, applying different focus levels (outcome-based, process-based, system-based, etc.) and from being extremely general to very granular. Furthermore, we find that the innovations introduced or proposed in humanitarian contexts tend to be mostly concentrated on the product or process levels, with products often being technology-heavy gadgets that often do not target or correspond to the needs of the affected populations and are primarily managed on a project-level. We also identify the key themes from the literature that are described as drivers or obstacles of humanitarian innovation.

From the review of the literature, the primary insight is that a more holistic view on the sector is necessary, as themes are dispersed and oftentimes not considered concurrently. We therefore develop an innovation system approach, which brings together our findings. This conceptualisation can help policymakers better understand the complexities and interrelationships operating within the system—to see that piecemeal solutions and the introduction of some of the latest trends in the innovation management literature are unlikely to be as effective as hoped, outside of a systemic picture of how innovation works in practice. To enable this, future research should prioritise conducting a detailed analysis of humanitarian innovation systems in different contexts, to provide a better understanding of actors, roles, and relationships, identifying key actors and their roles, across different contexts as well as understanding their interdependencies and dependencies.

For policymakers, an understanding of the innovation system can help identify leverage points for enhancing innovative performance and overall competitiveness. It can assist in pinpointing mismatches within the system, both among institutions and in relation to government policies, which can thwart technology development and innovation. It is furthermore necessary for the sector to discontinue focusing on individual technologies or solution designs as silver bullets, and instead reinvent itself and develop and use the capacity to respond to challenges in the humanitarian sector. Instead, the innovation system must embrace its primary mission of humanitarianism.

We recognise that each component of the framework will require more research to obtain an in-depth and granular understanding of humanitarian innovation. However, there are important lessons that the research has identified, which provides confidence that an ecosystem approach can provide crucial pointers for both practitioners and policymakers in the sector. The findings strongly suggest that without a clear and shared understanding of what humanitarian innovation is and for what it is needed, the how and where of humanitarian innovation will likely remain vague, obscured, and difficult to formalise. Therefore, future research needs to endeavour further clarification regarding the key concepts around humanitarian innovation.

Lastly, while there appears to be strong evidence suggesting that local actors and communities are uniquely positioned to innovate in ways that are relevant, effective, and culturally and contextually appropriate, localised humanitarian innovation still appears to be under-researched and lacking practical guidelines. The role of innovation and localisation should therefore be researched in greater detail. This particularly relates to exploring more closely how knowledge transfer in local contexts is created and fostered, and more broadly how capacities can be built up in crisis contexts.

Abbreviations

ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
DFID	UK Department for International Development
GAHI	The Global Alliance of Humanitarian Innovation
HI	Humanitarian Innovation
HIF	Humanitarian Innovation Fund
HRP	Humanitarian Response Plans
ICRC	International Committee of the Red Cross
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
NGO	Non-governmental organisation
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
UAV	Unmanned aerial vehicle
UNHCR	United Nations Refugee Agency
USAID	United States Agency for International Development
WASH	Water, sanitation, and hygiene
WFP	World Food Programme
WHS	World Humanitarian Summit

Supplementary Information

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Additional file 1.

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Declarations

Competing interests
The authors declare no competing interests.

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