

Ethics and Unintended Harms of Humanitarian Innovation: Drones and Biometrics

Mutoni Uwase N.

Faculty of Business and Management Kampala International University Uganda

ABSTRACT

Humanitarian innovation has transformed the delivery of humanitarian assistance by introducing emerging technologies such as drones and biometric systems to improve operational efficiency, logistics, beneficiary identification, and emergency response. Despite their considerable potential, these technologies also create significant ethical challenges and unintended harms that may undermine the humanitarian principles they seek to advance. This paper examines the ethical implications of humanitarian innovation through a comparative analysis of drones and biometrics, focusing on their capabilities, benefits, governance frameworks, and associated risks. It reviews the operational applications of drones in disaster assessment, supply delivery, surveillance, and infrastructure monitoring, alongside the growing use of biometric technologies for identity verification, cash assistance, refugee registration, and family reunification. The study highlights the unintended harms associated with these technologies, including privacy violations, surveillance overreach, data misuse, discrimination, misidentification, unequal access to humanitarian assistance, safety risks, and power asymmetries between humanitarian organizations and affected communities. It further examines the legal, ethical, and governance frameworks that regulate their deployment, emphasizing the importance of international humanitarian law, human rights principles, institutional safeguards, informed consent, transparency, accountability, and community participation. The paper argues that while drones and biometrics can substantially improve humanitarian effectiveness, their deployment must be accompanied by comprehensive ethical risk assessments, privacy-preserving system design, continuous post-deployment monitoring, and robust governance mechanisms. Ultimately, responsible humanitarian innovation requires balancing technological advancement with the protection of human dignity, individual rights, and humanitarian principles to ensure that innovation contributes to humanitarian objectives without creating additional vulnerabilities for affected populations.

Keywords: Humanitarian innovation, Drones, Biometrics, Ethical governance and Unintended harms.

INTRODUCTION

Innovation offers the promise of enhanced effectiveness in humanitarian assistance but also generates the risk of unforeseen and potentially harmful consequences [1]. Drones and biometrics exemplify the tension between expanded capabilities and unanticipated harms. The ethical principles of humanitarian action, grounded in widely endorsed values and internationally recognized norms, establish a normative lens for understanding such dilemmas [2]. Humanitarian practice remains at risk from an evolving digital transformation that affects design and deployment decisions, necessitating fresh conceptual frameworks to mitigate unintentional harms without impeding innovation progress [3].

Conceptual Foundations of Humanitarian Innovation

The awareness of the ethical implications of humanitarian innovations has increased. Yet, such debates often overlook two critical facets: the occurrence of unintended harms and the humanitarian use of drones for supply delivery and biometric authentication of beneficiaries [1]. Most humanitarian and academic discourses analyze the ethical implications of deep learning, machine learning, and blockchain [2]. However, a larger portion of the humanitarian community continues to adopt drones and biometric technology despite their controversial nature. Given that humanitarian innovation has gained increasing attention within academia and among practitioners, it

merits further investigation [3]. Academia and research institutes recognize the social and ethical impacts of innovations accompanying humanitarian action, while the ethical discourse of humanitarian innovation is still in its infancy. Hence, analyzing the ethical, governance, and unintended harmer implications of drones and biometrics on humanitarian innovation is a critical endeavor [1].

Drones in Humanitarian Operations

Drones have been deployed in various humanitarian operations to facilitate logistics, assess infrastructure damage, and support supply delivery, among other applications [1]. Operational use is rapidly expanding in both the Global South and North, accompanied by rising investment, acceptance, and legal regulation. An international Code of Conduct for Drone Use in Humanitarian Action and the UN's Office for the Coordination of Humanitarian Affairs (OCHA) Guidance Note on Humanitarian Use of Drones provide ethical guidance for their deployment [2]. A growing number of humanitarian agencies publish reports and papers assessing the application of drones across many contexts and scenarios. NGOs like Médecins sans Frontières (MSF) also call for caution, advocating a moratorium on drone use until ethical governance frameworks are established [2]. Drones operate in different configurations fixed-wing, multi-rotor, or hybrid depending on mission requirements. All configurations typically share five common technical modalities: imagery capture (visible, infrared, thermal, multispectral), scanning and mapping, data transmission, flight planning, and autonomous operation [3]. Data collection platforms used by humanitarian agencies range from consumer-grade quadcopters, costing less than \$2,000, to high-end fixed-wing models priced over \$40,000. Aerial imagery constitutes the primary operational payload, used in damage and needs assessment or real-time situation monitoring [1]. Humanitarian pre- or post-disaster imagery is available from several online databases. Ground footage serves a complementary role, providing evidence of conditions in restricted access areas [3]. Drones enhance the survey of areas inaccessible or hazardous for human staff or vehicles. Missions are performed in hostile environments like endemic conflict zones, post-disaster situations with severe infrastructural collapse, or active conflict during systematic aerial bombardment [1]. Aerial imagery facilitates the rapid collection of critical time-sensitive information such as damage mapping and flood monitoring during the acute recovery phase after a disaster strikes [2]. Drones can rapidly generate maps and supply audits after sudden infrastructural failures. Governmental resources for damage assessments are frequently insufficient. Humanitarian assessments of situations before they are ready for formal reporting help to signal operations and expedite subsequent authorization [3]. The Code of Conduct emphasizes ethical principles such as observance of safety (avoiding harm to individuals), legality (conformance with legal frameworks), humanity (supporting life-saving efforts), and discretion (maintaining confidentiality)[2]. Drones raise ethical challenges across several dimensions, including safety (potential hazardous mid-air collisions, accidents, and injuries), legality (remaining within national laws and regulations), transparency (public awareness and agency accountability), accountability (attribution of responsibility for errors), and dependency (the risk of building dependence on complex machinery) [1].

Capabilities and Benefits

Drones enable a range of operational applications with relevant case studies including mapping, delivery, surveillance, and messaging, creating vast and varied data ecosystems [1]. One data flow, for example, originates with drone-mounted cameras and sensors, passes to cloud-processing facilities where machine-learning algorithms extract metrics for administrative and operational efficiency, and concludes with dissemination via websites, reports, and video archives [2]. Complementary examples include epidemiological modelling to track diseases and vector populations and photogrammetry for reconstructing building-damage assessments post-natural disaster. Other relevant drone applications encompass transporting medical supplies to remote locations and agricultural irrigation [3]. Biometrics facilitates numerous capabilities within humanitarian contexts including case studies on cash distributions and identity verification integrating with aid-delivery processes and connecting diverse data flows and data ecosystem components [4]. Various modalities, including voice, face, text, signature, fingerprint, and iris, enable assistance to affected populations [3]. Data-generation avenues encompass document and voice-recording activities at the onset of a programme, further commentaries from field operators during programme implementation, and source-material and client-interaction data linked to project proposals, reports, findings, and evaluations [1]. Common flows include biometric information leading to a unique token introduced to cash-distribution systems and a digital-identity token connecting individuals to cash-access records with supplemental transactions [5].

Ethical Considerations

Humanitarian innovation comprises new products, processes, and practices that enhance humanitarian activities [1]. It promotes the adoption and adaptation of technologies by humanitarian organizations, and attention must extend beyond intention and design to encompass actual effects on people and communities, especially unintended harms [2]. The current climate lends itself to normative inquiry due to the rapid proliferation of humanitarian drones and biometrics. Both technologies pose risks [3]. Drones can expose communities to surveillance overreach, data misuse, dangerous flight activities, a heightened expectation of drone use, and loss of equitable

access across affected populations [4]. Biometrics can cause misidentification of aid recipients, discrimination in access to and delivery of aid, unwanted data sharing, and regulatory capture of humanitarian operations [2].

Unintended Harms and Risk Pathways

Aerial drones can augment operations of humanitarian organizations by monitoring population movements, mapping disaster-struck locations, delivering supplies, and assessing the integrity of dams, bridges, and buildings after disasters [2]. The diverse possibilities and anticipated positive outcomes call for the adoption of drones by humanitarian sectors. Biometrics also offer humanitarian aid distinct opportunities: confirming the identities of disaster victims, enabling rapid delivery of first-tier emergency supplies, and preventing multiple appeals for assistance [1]. Despite their capability of collecting sensitive data, biometrics for aid delivery may foster a quicker, straightforward, and beneficial response within the humanitarian sector; thus, highlighting their double-edged capacity [2]. Nonetheless, the deployment of drones and biometrics presents an array of unintended harms. For drones, surveillance overreach, data misuse, safety failures, dependency, and inequitable access may occur [4]. Early unmanned aerial vehicle endeavors to collect aerial photography through private entities motivate accompanying, potentially negative impacts on humanitarian action, whereby these parties pose as aid delivery to gather surveillance and subsequently share information with defense organizations for military operations [5]. For biometrics, misidentification, discrimination, stringent data sharing, and governance gaps may happen. Projects across territories and stateless individuals can depend on oversights of identity misuse and aid duplication through incomplete access to humanitarian accessibility [6]. Concurrently, misplaced data handling concerning violations in locally established protocols under enforced regimes can additionally hinder humanitarian action [1].

Biometrics in Humanitarian Contexts

Humanitarian efforts, primarily aimed at protecting populations during armed conflicts, have increasingly turned to biometric technology, promising unprecedented accuracy in recipient identification and improved services for migrants and displaced populations [4]. Biometric data are defined by their link to the body, are collected once, are less prone to fraud, and can enhance security and affordability of aid by confirming identity without requiring digital devices [1]. Humanitarian actors hope that, through securing unifying identification of individuals, humanitarian and development actions can be effectively combined, a need emphasized by the flows of displaced populations produced by armed conflicts [5]. Biometric technology has gained traction in diverse international humanitarian efforts ranging from mass identity management following large-scale displacement to facilitating remittances across borders with the link to the financial sector broadened by biometric technologies, and in multilingual social media forums where asylum-seeking experiences can be shared across borders [5]. The International Red Cross has deployed biometric technology to facilitate family reunifications through the safe collection and sharing of biometric data between services, while international organizations have used it to support the dignity of refugees receiving assistance and to facilitate aid transfers in cash and voucher programs by guaranteeing identification [6]. The United Nations High Commissioner for Refugees operates in countries where persons of concern have no identity documentation and where the establishment of beneficiaries in cash and voucher assistance is based on multi-biometrical confirmations [4]. The governments of host countries benefit, too, because their own national systems are not compromised, the biometric records are held in one sector, and humanitarian operations do not interfere with national security after a large arrival of persons of concern [4]. Notably, biometrics do not always favor persons of concern but can also expose them to greater risks; during mass population movements, identity for some groups may be the immediate danger without which access to assistance becomes pointless. Biometrics may also widen barriers to the financial sector, where many institutions already automatically exclude groups in vulnerable situations [5].

Capabilities and Benefits

The technical modalities, data flows, and aid integration of biometric systems in humanitarian contexts reflect significant variation across the sector [1]. Humanitarian organizations employ biometrics to facilitate the delivery of assistance to affected populations, mitigate the use of counterfeit documents, and maintain the integrity of records for cash-based programming [2]. Such systems enable affected individuals to assert a claim on aid or allow humanitarian staff to verify identity, age, and other attributes before determining eligibility for services. Biometrics can also enhance the efficiency of multi-purpose cash assistance by securely verifying identity across multiple deliveries and support family tracing [3]. These situations invoke consideration of diverse ethical dimensions linked to the deployment of biometric technologies within humanitarian operations [4]. The ethical landscape associated with biometric systems comprises several consequential and deontological considerations. Potential infringements include the right to privacy, informed consent, human dignity, personal data protection, bias, and good governance [1]. The sensitive nature of biometric data and diverse intermediary uses raise widespread concerns about governmental oversight and the adequacy of international regulatory frameworks [3]. Likewise, risk of discrimination and security-induced exclusion solidifies the need to uphold anti-discrimination obligations and target marginalized groups affected by multi-dimensional discrimination. A range of unintended

harms can emerge through both informational and physical pathways that disrupt humanitarian principles and operational imperatives [4].

Ethical Considerations

Deployments of drones and biometric technologies in humanitarian contexts raise well-defined and urgent ethical questions about when, how, and under what conditions such innovations can be ethically justified and adopted [1]. The humanitarian sector is a complex web of diverse actors (civil society organizations, the private sector, public authorities, and multi-stakeholder platforms, bilateral and multilateral, local and international), which have the flexibility to adopt norms and principles defined through international deliberation [2]. Humanitarian assistance aims to alleviate human suffering and preserve human dignity, without adverse effects; humanitarian operations aim to promote the delivery of assistance and protection to those in desperate need [3]. A ground-level understanding of the new technologies of drones and biometrics, along with the alleged or observable unintended harms that accompany their deployment in humanitarian practices, is critical to any consideration of ethical risks or gains [3]. Drones equipped with optoelectronic sensors (thermal and optical cameras) can be piloted autonomously, flown within a visual line of sight and operated partly or totally remotely from the human operator; the most pertinent data captured from permissioned drone flights is video [4]. The choice of humanitarian drone technology determines the weight of the drone (catapult-launched, under 4 kg and therefore exempted from certificates in several jurisdictions or battery-operated, over 5 kg); the type of drone determines its location on the humanitarian supply chain but video is common across the spectrum [5]. Biometric technology enables the automatic identification and verification of individuals based on physiological characteristics (fingerprints, iris or palm variety, face, and voice) and behavioral characteristics (keystroke, gait, signature, and smile). Biometric and drone information are often subject to an ethical risk governance framework, providing an aspirational model for consideration which is properly illustrated in context [5]. An ethical perspective (the modesty perspective) dictates the relevancy of the information-based individual, the type of regulated agency holding information (non-profit or commercial), and the duality of destruction (termination and malfunction) [6]. Humanitarian innovation refers explicitly to new initiatives intended to better address human suffering and if individuals cannot capture the intended benefits for even a limited period of time humanitarian technology is unlikely to retain a neutral ethical profile [5]. One currently prominent characterization of humanitarian innovation focuses on technology-based initiatives but the notion of technology-neutral humanitarian innovation is much longer-standing [6]. The term “unintended harm” constrains the scope of potential harms to those which were not anticipated prior to launch, yet in humanitarian circles, there remain links to comparatively wider structures of dominant knowledge, with consequentialism and rights-based theories being two of the potential alternatives [1].

Unintended Harms and Risk Pathways

The core capabilities of biometric technology include its established basis for human rights, the availability of normative frameworks for their application, the highly sensitive and private nature of biometric data, the alarming prevalence of bias in biometric systems, and existing negative consequences of unintentional policy violations [6]. Biometric systems, first and foremost, fall under data privacy laws that establish the legal conditions for their deployment. They must also comply with widely-adopted principles that govern technical system design, such as the OECD’s Privacy Guidelines and the Council of Europe’s Convention 108 [5]. Many humanitarian organizations are signatories to or adherents of these frameworks, and some have even developed their own data management standards that govern the collection and utilization of human information including biometric data for specific processes [2]. Despite formalized laws and guidelines, humanitarian biometric systems are increasingly being either intentionally misrepresented as fully compliant yet still deployed or inadequately governed resulting in “backsliding” on organizations’ obligations without transparency and accountability safeguards [4]. Considerations recently raised by humanitarian actors include the usage of biometric data in biometric-based or biometric-associated systems of underserved populations, the unfulfilled expectation of a more complete view of the interaction of the physical-world concepts with their counterparts in the digital world, the wider bioeconomy and its confounding aspect when considering the characteristics of biometrics not found in other variables or collected data, and the social contracts governing these interactions [3].

Comparative Analysis of Drones and Biometrics

Drones and biometrics highlight overlapping ethical concerns, including privacy and power imbalances, alongside divergent risk profiles, with drones presenting physical hazards and biometrics mainly involving informational harms. The regulatory landscape is also more advanced for drones [4]. Deployment decisions reflect humanitarian needs, organizational capabilities, and public perception rather than ethical considerations or unintended harm assessments [1]. Erosion of privacy underpins both drone and biometric use. Drones enable mass and targeted surveillance; biometry facilitates identification through voice, facial, or fingerprint data [2]. Drones jeopardize accountable assistance by obscuring recipient identities; biometric systems can expose sensitive information about needs and activities. Stigmatization and discrimination, as well as unequal power relations, accompany both technologies [3]. The spectator effect diminishes community contributions when larger organizations deploy

drones; biometry exacerbates input inequities by sidelining vulnerable groups. Suboptimal or inadequate assistance can result from the concentration of power and information [4].

Shared Ethical Tensions

The prevalence of drones and biometric technologies within humanitarian operations raises common ethical tensions linked to privacy, power asymmetries, accountability, and equitable participation [1]. Yet, significant differences in unintended-harm profiles and governance trajectories emerge [2]. Drone operations pose direct risks of physical harm and safety failures exacerbated by opacity and lax governance; by contrast, biometric applications invoke predominantly informational harms, primarily misidentification, sharing of personally identifiable attributes, and discriminatory access, accompanied by broader concerns regarding data stewardship, cross-institutional governance, and protection against device and data theft [3]. Technological trajectories and regulatory frameworks for drones and biometrics have diverged markedly. Humanitarian biometrics, early adopted during the 2011 famine in the Horn of Africa, operated outside mainstream regulation [4]. In contrast, the humanitarian drone ecosystem is evolving alongside formalized governance frameworks, including the UN's 2021 development-focused Approach to the Use of Drones and the UN Institute for Disarmament Research's 2021 research dossier on drones and disruption [5]. Despite active regulatory development, interim drone projects rarely meet compliance thresholds; hence, the humanitarian sector pursues high-risk trials, often de facto exempt from oversight, safety, and operational constraints already required by neighbouring domains [6]. Finally, the feasibility of deployments at humanitarian site has influenced the urgency of technological uptake and the consequent administrative burdens [1]. Biometrics capable of residing solely on a user-provided device enable anonymous engagement without registering service beneficiaries with an agency; other systems increasingly necessitate agency linkages, threatening transparency, safety, and access. By contrast, the humanitarian drone ecosystem remains pre-deployment, though multiple technology firms already plan drone-related service delivery, necessitating attention to governance considerations [2].

Distinct Risk Profiles

In humanitarian operations, drones and biometric technologies raise distinct ethical concerns and unintended-harm profiles [3]. The deployment of drones is associated with safety risks as operational failures threaten lives, especially in fragile states and the technology permits overreaching surveillance of affected communities [4]. In contrast, biometric systems primarily generate informational harms, compromising privacy and dignity while enabling surveillance, discrimination, and tracking across multiple service providers [5]. The former technology is tied to uncertainty around regulatory use and accountability, whereas the latter is comparatively well-defined yet characterized by governance gaps [6]. Biometrics are easiest to incorporate in the immediate aftermath of crises, when other data-gathering techniques remain impractical [1]. Both cases underscore ongoing tensions between humanitarian principles and innovation objectives, as well as the need for rigorous safeguards and assessments that consider the specific circumstances, ethical implications, and possible consequences of each potential intervention [1, 2].

Governance, Accountability, and Legal Frameworks

International human rights law recognizes that the right to life, the prohibition of torture and other inhumane or degrading treatment, the prohibition of arbitrary deprivation of liberty, the right to privacy and family life, the right to protection of personal data and the prohibition of discrimination constitute inviolable rights that have to be safeguarded at all times, particularly during armed conflict [1]. When conducted outside a legal framework, drone strikes and biometric activities may violate those rights [2]. Central government involvement usually legitimizes drone warfare. Institutional mandates, established parameters and preconditions for data inputs, and well-defined policies limit data development and avoid excessive data collection [3]. Determining the extent of international law applicable to non-international armed conflicts is complex and varies between countries. Consequently, a comprehensive legal analysis on the potential conflict between international humanitarian law and biometric data collection in humanitarian crises remains an essential undertaking [3].

International Law and Human Rights

Humanitarian organizations have become increasingly dependent on digital technologies to respond to crises. Such reliance raises difficult ethical issues, given the potential for unintended harms resulting from these technologies, especially drones and biometric technologies [4]. The legal framework that constrains and enables these systems is therefore crucial to safeguard against their potentially harmful implications [5]. Drone systems are regulated in the security and privacy domains, whereas the biometric arena lies squarely within the privacy sphere. Unintended harms can arise directly from the use of data or indirectly through the system's operation [1]. The United Nations Office for the Coordination of Humanitarian Affairs highlights four principles that guide the humanitarian community worldwide: humanity, neutrality, impartiality, and independence. Compliance with these principles is essential to the legitimacy of humanitarian operations [1]. International law and underlying human rights treaties remain the primary sources of applicable global norms. Human Rights Watch notes that international humanitarian law governs the conduct of hostilities, including principles and obligations relevant to armed conflict

[4]. Human rights law prohibits discrimination, ensures the right to life, and emphasizes the importance of privacy. Public international law disallows arbitrary deprivation of life; unreasonable delay in the determination of rights; arbitrary interference with the home or correspondence; discrimination based on race, language, religion, or political beliefs; and cruel, inhuman, or degrading treatment or punishment [3]. The International Committee of the Red Cross speaks to the duty to assess the general environment of respect for the rule of law, governance, and security when providing assistance [2].

Institutional Policies and Safeguards

Humanitarian organizations are compelled to examine the ethical dimensions of their social missions and technical choices, especially in innovation [1]. Such ethical analysis must align with each organization's own values and mission. Unintended harms associated with humanitarian innovation, particularly the adoption of drones and biometrics pose specific moral challenges that merit critical examination [2]. Agencies engaged in such work require an understanding of unintended harms so that they can mitigate risks better and honor their institutional principles and associated commitments to individuals and communities [3]. The legal and policy frameworks covering the deployment of these two technologies, along with ethical guidelines delineating humanitarian organization practice, are dense and difficult to navigate [4]. Furthermore, the corresponding analysis is complicated by the multitude of supporting documents, oversight mechanisms, safeguard contingencies, and other foundational tenets that emerge. Nevertheless, existing institutional commitments and principles can provide firm foundations of clarity [1].

Community Participation and Informed Consent

Emerging humanitarian practices aim to secure community endorsement for abilities that span the 78 technology sectors surveyed [4]. Various models seek to obtain informed consent from communities prior to the application of data-intensive technologies, alongside commitments to benefit-sharing mechanisms [5]. The desire to encourage participation, improve contextual engagement, promote local legitimacy, and mitigate the risk of perceived or actual structural violence translates into a recommendation to deploy biometrics only after acquiring community consent wherever feasible [5]. In the absence of community consent, certain forms of humanitarian biometrics may still be deployed if upholding humanitarian principles while negotiating local agreements [6]. Nonetheless, humanitarian biometrics generally entail treatment of personally identifiable information that may pose significant privacy concerns, even when consent is secured [6]. The nature of deployment a matter largely outside a technology implementer's control renders the issue of community prior informed consent substantively more challenging for drones than for biometrics [1].

Mitigation Strategies and Responsible Innovation

Major humanitarian crises often inspire a surge in innovative technologies, but large-scale humanitarian technological innovation rarely occurs between acute crises [3]. Technological solutions are frequently promoted as fast, large-scale, or universal improvements to humanitarian relief despite chronic evidence to the contrary. A humanitarian innovation agenda extends an invitation for technological developments that important sectors may regard as unfit for humanitarian relief to be explored [4]. Drones and biometric technology both receive serious consideration. Drones amplify conventional air-drop logistics designed for post-earthquake resupply of collapsed structures [5]. Biometrics appears to counteract ineffective beneficiary registrations enabled by repeated aid inflows throughout long-standing political disturbances [6].

Risk Assessment and Scenario Planning

Humanitarian organizations increasingly seek to develop and deploy innovative technologies that promise to enhance the efficiency and effectiveness of their operations [2]. At the same time, they recognize the potential for unintended negative consequences, including unforeseen risks to affected populations, contributing to greater vulnerability and a loss of trust in the humanitarian community [3]. Such considerations have led to the establishment of several ethical frameworks designed to evaluate and guide the use of humanitarian innovations and the associated risks [4]. The risk assessment literature also provides a basis for analysis of potential pathways through which established technological innovations could contribute to additional risks that counter humanitarian aims. Two innovative technologies, drones and biometrics, have been increasingly adopted by humanitarian organizations; each offers considerable potential benefits, but also presents a range of technological, ethical, and regulatory challenges [5]. The review of the literature in these areas thus addresses the following questions: What capabilities do the respective technologies offer for humanitarian operations? What ethical considerations must be taken into account for their appropriate deployment? What potential unintended harms could be generated through their use, and via what pathways? [6].

Privacy-Preserving and Safe-by-Design Approaches

The UN High Commissioner for Refugees (UNHCR) and its NGO partners are increasing their use of biometric identification systems in support of humanitarian initiatives [1]. Biometric data is used to establish and verify the identity of individuals, prevent fraud, improve operational efficiency, and enable better-targeted assistance. Biometric identification approaches can use fingerprints, iris scans, gait analysis, facial recognition, and other

characteristics [2]. Significant investments are being made within the UN system to enhance the scope and capability of the biometric identification system employed by UNHCR and its partners to provide assistance to refugees, displaced persons, and stateless individuals [3]. Biometric identification involves a process of data acquisition, feature extraction, matching, and determination of a data subject's state [4]. The biometric identification process, therefore, follows the collection of data and this information can subsequently be shared with other agencies for action or further engagement. The inclusion of additional data sets to facilitate the biometric identification of a subject has also been initiated [2].

Post-Deployment Monitoring and Redress Mechanisms

Continuous monitoring of post-deployment usage, data flows and impacts and independent evaluations of unintended harms help strengthen accountability [2]. Record-keeping, auditing and regular reporting complements oversight processes, underpin transparency and facilitate numerous learning opportunities [3]. Biometric technologies and their associated data also require scrutiny after service launch. Safeguards for reportedly high-use assistance, registration and identity-verification applications mitigate the risk of data-sharing violations [3]. After-harm assessments of particular operational modalities, oversight systems and information-management standards inform humanitarian performance and reflect broader societal conditions [1]. Post-use reflections then analyse actual experiences, gains and challenges to ensure alignment with principles and promote further ethical humanitarian innovation [1].

Case Studies and Lessons Learned

The complex interplay between risk and responsibility in humanitarian innovation is further illustrated in drone and biometric applications [4]. Deployment of commercial drones by humanitarian agencies has expanded rapidly across the Global South in search and rescue operations, disaster response, and assessment of conflict-affected populations. Humanitarian agencies endorse drone use to enhance capacity, extend reach, improve operational security, expedite delivery, and meet essential humanitarian needs [2]. Yet corresponding ethical concerns accompany such initiatives [3]. They include the sufficiency of consent in operations, the adequacy of training and information provision, safeguarding beneficiary dignity during data capture, and balancing operational gains with proportional risk. Such issues resonate with humanitarian principles of humanity, neutrality, impartiality, and independence [1]. Biometric identification is increasingly integrated into humanitarian assistance to establish identity and deliver aid packages. Technical modalities encompass physical collection of biometric data (e.g., fingerprints, iris scans, voice) and creation of digital systems [3]. The stakes surrounding biometrics in humanitarian work are formidable. A detailed assessment of its humanitarian implications is critical given the limited capacity of the sector, the sensitivity of biometric data and technology, and widespread recognition of the need to monitor, document, and advocate against misuse of biometric systems and data [7]. Key ethical issues centre on the right to privacy, consent, dignity, bias, and governance. Leading international agencies have recently introduced a range of restrictions on the collection of biometric data, establishing that misuse could result in discrimination, denial of access to assistance, or surveillance [6].

Future Directions for Ethical Humanitarian Innovation

Humanitarian innovation occupies a pivotal role in the mission of humanitarian actors [1]. However, despite growing global interest in advancing ethical humanitarian innovation, the emergence of unmanned aerial vehicles (drones) and biometric systems has amplified the complexity and intensity of ethical discourse in the humanitarian sector. Awareness of the potential for unintended harms generated by humanitarian innovation, broadly defined, has thus deepened [5]. The literature identifies many contested ethical questions governing the use of drones and biometrics in humanitarian contexts [5]. Harms comprise dignity violations, data misappropriation, power asymmetries, privacy incursions, and violations of free and informed consent [6]. Existing scholarly efforts are often narrowly focused or based on limited evidence. Although humanitarian innovation is itself contested, considerable agreement surrounds the relevance of core humanitarian principles such as impartiality, neutrality, human dignity, humanity, and the responsibility to protect. Frameworks for understanding the emergence, diffusion, governance, and ethical scrutiny of new technologies such as drones and biometrics also confirm their significance relative to currently deployed humanitarian innovations [7]. In turn, key avenues for further inquiry are emerging, including the dimensions of humanitarian innovation beyond specific technologies, the full range of potential unintended harms and risk pathways, and the integration of additional ethical lenses [1, 2].

CONCLUSION

Humanitarian innovation has introduced transformative technologies that significantly improve the capacity of humanitarian organizations to respond to crises with greater speed, efficiency, and precision. Drones have enhanced disaster assessment, logistics, mapping, and emergency supply delivery, while biometric technologies have strengthened beneficiary identification, cash assistance, refugee registration, and family reunification processes. These technological developments have expanded the operational capabilities of humanitarian actors and created new opportunities for delivering life-saving assistance in complex emergencies. However, the review demonstrates that these benefits are accompanied by substantial ethical, legal, and governance challenges that

require careful consideration. The analysis reveals that drones and biometric systems generate distinct yet overlapping unintended harms. Drone deployments may expose affected populations to surveillance, safety risks, privacy violations, dependency on technology, and unequal access to humanitarian services. Conversely, biometric technologies present significant risks relating to privacy, informed consent, data security, misidentification, discrimination, exclusion, and unauthorized sharing of sensitive personal information. These risks are amplified in fragile contexts where vulnerable populations often possess limited bargaining power and where governance structures may be weak or absent. Consequently, technological effectiveness alone cannot justify deployment without comprehensive assessment of potential impacts on human rights and humanitarian principles. The study further emphasizes that ethical humanitarian innovation requires robust governance mechanisms supported by international humanitarian law, human rights standards, institutional policies, transparency, accountability, community participation, and informed consent. Humanitarian organizations should adopt privacy-by-design and safe-by-design approaches, undertake rigorous ethical impact assessments before deployment, implement continuous monitoring throughout technology use, and establish accessible redress mechanisms for individuals adversely affected by these technologies. Effective governance also requires collaboration among humanitarian agencies, governments, technology developers, regulators, and affected communities to develop clear standards and ensure responsible innovation. Looking ahead, humanitarian innovation should prioritize human dignity alongside technological advancement. Future research should focus on developing stronger ethical governance frameworks, improving transparency and explainability of technological systems, strengthening regulatory oversight, and evaluating the long-term social consequences of humanitarian technologies across diverse operational contexts. By integrating ethical principles into every stage of technological design, deployment, and evaluation, humanitarian organizations can maximize the benefits of innovation while minimizing unintended harms. Ultimately, drones and biometric technologies should serve as tools that reinforce rather than compromise the humanitarian principles of humanity, neutrality, impartiality, independence, and the protection of vulnerable populations.

REFERENCES

1. Jurko I. Humanitarian practice fit for the digital age. *Humanitarian Leader*. 2022;(26):1-16. Melbourne (Australia): Centre for Humanitarian Leadership, Deakin University. Available from: Centre for Humanitarian Leadership Working Paper Series.
2. Cawthorne D, Robbins-van Wynsberghe A. An ethical framework for the design, development, implementation, and assessment of drones used in public healthcare. *Sci Eng Ethics*. 2020;26(5):2867-2891. doi:10.1007/s11948-020-00233-1.
3. Greenwood F, Nelson EL, Greenough PG. Flying into the hurricane: a case study of UAV use in damage assessment during the 2017 hurricanes in Texas and Florida. *PLoS One*. 2020;15(2):e0227808. doi:10.1371/journal.pone.0227808.
4. Madianou M. The biometric assemblage: surveillance, experimentation, profit, and the measuring of refugee bodies. *Televis New Media*. 2019;20(6):581-599. doi:10.1177/1527476419857682.
5. Nyirenda D, Sariola S, Kingori P, Squire SB, Banda G, Mwangulu F, et al. Structural coercion in the context of community engagement in global health research conducted in a low-resource setting in Africa. *BMC Med Ethics*. 2020;21:90. doi:10.1186/s12910-020-00513-3.
6. Singh JA. Informed consent and community engagement in open field research: lessons for gene drive science. *BMC Med Ethics*. 2019;20:54. doi:10.1186/s12910-019-0396-x.
7. Perakslis ED. Using digital health to enable ethical health research in conflict and other humanitarian settings. *Conflict Health*. 2018;12:23. doi:10.1186/s13031-018-0154-8.

CITE AS: Mutoni Uwase N. (2026). Ethics and Unintended Harms of Humanitarian Innovation: Drones and Biometrics. IDOSR JOURNAL OF ARTS AND MANAGEMENT 11(2):82-89. <https://doi.org/10.59298/IDOSRJAM/2026/112.8289>