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Supporting value sensitivity in the humanitarian use of drones through an ethics assessment framework

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Abstract

The current humanitarian use of drones is focused on two applications: disaster mapping and medical supply delivery. In response to the growing interest in drone deployment in the aid sector, we sought to develop a resource to support value sensitivity in humanitarian drone activities. Following a bottom-up approach encompassing a comprehensive literature review, two empirical studies, a review of guidance documents, and consultations with experts, this work illuminates the nature and scope of ethical challenges encountered by humanitarian organizations embarking upon innovation programmes. The Framework for the Ethics Assessment of Humanitarian Drones (FEAHD) identifies five values and five key questions related to ethical considerations along the decision chain of humanitarian drone activities. It fills a gap between high-level, principle-based guidance related to humanitarian innovation, and detailed operation-oriented checklists for projects involving the use of drones. In this way, the FEAHD contributes to support value sensitivity in the humanitarian use of drones.

Keywords: humanitarian drones, disaster mapping, medical supply delivery, value sensitive innovation, technology ethics.

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Introduction

Emerging technologies are widely used in humanitarian and development settings by aid agencies around the globe[1] – a development that has also been discussed critically in the humanitarian sector.[2] Nevertheless, as humanitarian needs and the complexity of aid programmes in challenging conditions continue to expand, populations affected by natural disasters or living in remote locations experience significant obstacles to recovery in post-disaster environments or to receive aid supplies. This situation potentially widens the gap of equitable access to assistance for people experiencing heightened vulnerability.

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1 United Nations Office for the Coordination of Humanitarian Affairs (OCHA), *From Digital Promise to Frontline Practice: New and Emerging Technologies in Humanitarian Action*, April 2021, available at: https://www.unocha.org/sites/unocha/files/OCHA%20Technology%20Report.pdf (all internet references were accessed in January 2022).

2 Kristin Sandvik, Maria Jumbert, John Karlsrud and Mareile Kaufmann, "Humanitarian Technology: A Critical Research Agenda", *International Review of the Red Cross*, Vol. 96, No. 893, 2014; Kristin Sandvik, Katja Jacobsen and Sean McDonald, "Do No Harm: A Taxonomy of the Challenges of Humanitarian Experimentation", *International Review of the Red Cross*, Vol. 99, No. 904, 2017.

As a prominent example of emerging technologies, drones[3] are increasingly being employed to address such barriers.[4] For example, they can be used to support humanitarian operations by collecting high-resolution aerial imagery from above, or to overcome the so-called "last mile challenge", whereby aid supplies cannot be easily delivered to end-users due to logistical obstacles.[5] According to van Wynsberghe and Comes,[6] the first drones deployed in the humanitarian sector were used for peacekeeping surveillance in the Democratic Republic of Congo in 2006.[7] The current practice of the humanitarian use of drones (HUD) revolves around two main applications: disaster mapping and medical supply delivery.[8] The "good drones", or, more specifically, the "humanitarian drones"[9] offer novel solutions that harness this technology to provide disaster relief or aid supplies to those in need.[10]

The rising use of the "good drones" has required sustained engagement among a diverse set of actors. These activities have brought together aircraft and drone manufacturers, insurance companies, airspace regulators, ministries of health, as well as development and humanitarian workers, to collaborate in new

3   Within the context of this article, the term "drones" refers to – and is used interchangeably with – "unmanned aerial vehicles" (UAVs), "unmanned aerial systems" (UASs), "remotely piloted aircrafts" (RPAs) or "remotely piloted aircraft systems" (RPASs). While different technical definitions of drones exist, according to Floreano and Wood (2015), they are electrically powered aircraft of small size, with limited flight range and duration, flying above the ground (semi-)autonomously, within or beyond a pilot's visual line of sight. Although there are various types of drones in terms of mechanical structure (such as fixed-wing, rotary-wing and multi-copters), according to Christen et al. (2018), most drones used in humanitarian contexts are fixed-wing or multi-copters below 30 kg. Dario Floreano and Robert J. Wood, "Science, Technology and the Future of Small Autonomous Drones", *Nature*, Vol. 521, No. 7553, 2015; Markus Christen, Michel Guillaume, Maxinilian Jablonowski, Peter Lenhart and Kurt Moll, "Zivile Drohnen – Herausforderungen und Perspektiven", *TA Swiss*, vdf Hochschulverlag AG, Zurich, 2018.
4   Ning Wang, Markus Christen and Matthew Hunt, "Ethical Considerations Associated with 'Humanitarian Drones': A Scoping Literature Review", *Science and Engineering Ethics*, Vol. 27. No. 51, 2021; Aimee van Wynsberghe, Denise Soesilo, Thomasen Kristen and Noel Sharkey, *Drones in the Service of Society*, Foundation of Responsible Robotics, 2018.
5   Jack C. Chow, *The Case for Humanitarian Drones*, Open Canada, 2012, available at: https://opencanada. org/the-case-for-humanitarian-drones/; Austin Choi-Fitzpatrick, "Drones for Good: Technological Innovations, Social Movements, and the State", *Journal of International Affairs*, Vol. 68, No. 1, 2014; Bart Custers, "Drones Here, There and Everywhere", in Bart Custers (ed.), *The Future of Drone Use: Opportunities and Threats from Ethical and Legal Perspectives*, Springer, Heidelberg, 2016.
6   Aimee van Wynsberghe and Tina Comes, "Drones in Humanitarian Contexts, Robot Ethics, and the Human–Robot Interaction", *Ethics and Information Technology*, Vol. 22, No. 2, 2020.
7   John Karlsrud and Frederik Rosén, "In the Eye of the Beholder? UN and the Use of Drones to Protect Civilians", *Stability: International Journal of Security and Development*, Vol. 2, No. 2, 2013.
8   It is worth emphasizing that the humanitarian use of drones is commonly understood as within the framework of the Humanitarian Action, Development and Peace Nexus, which includes a wide range of practices, including activities such as assessing water supply infrastructure or crop monitoring.
9   Within the context of this article, by "humanitarian drones", we refer to the deployment of drones by humanitarian actors in three situations: acute humanitarian crisis settings, including relief efforts during emergencies arising from events such as natural disasters, epidemic outbreaks or mass population displacement; immediate post-crisis settings, including post-disaster recovery and reconstruction efforts for populations affected by a humanitarian crisis; and long-term crisis-resilience or development projects, including activities related to medical commodity delivery or health supply chain management to strengthen resilience and mitigate risks.
10 A. van Wynsberghe and T. Comes, above note 6.

ways. This situation presents communication and operational challenges given the different areas of expertise, approaches, and vocabulary used in daily operations across these different actors.[11] The diversity of entities involved in HUD is illustrated by the following: many international organizations (IOs) active in the humanitarian field[12] have explored the use of drones for mapping and cargo delivery in their projects; multiple donors[13] have funded cargo drone projects; and a range of other organizations[14] are engaged in regulatory development or governance work related to HUD.

Another key actor is the drone industry. It is dynamic and changing quickly, and has been described as reinventing itself every eight years.[15] In contrast, the conventional aviation industry moves much more slowly. Civil aviation authorities are accustomed to adapting their guidelines at a pace that matches developments in the aviation industry. This pace is insufficient to keep up with the speed of change in the drone sector. Authorities thus find themselves under pressure to act quickly yet maintain rigorous and thorough processes, and to be focused on public safety and equity.[16] Aligning these goals can be particularly challenging if powerful companies with substantial economic interests seek to exploit this situation to influence the development of drone regulations for their own advantage.[17] Critics have identified risks that drones used in humanitarian contexts could disenfranchise communities and local efforts, leading to remote management, data collection, or processing dilemmas that many humanitarian organizations are ill-equipped to handle.[18]

In the past decade, innovation has become an area of focus in the humanitarian sector, appearing in institutional initiatives, donor speeches, policy documents and media coverage, and leading to new initiatives, partnerships and

11   Denise Soesilo, Patrick Meier, Audrey Lessard-Fontaine, Jessica Du Plessis and Christina Stuhlberger, *Drones in Humanitarian Action: A Guide to the Use of Airborne Systems in Humanitarian Crises*, Swiss Foundation for Mine Action, Geneva, 2016.

12   Examples include Medair, Médecins Sans Frontières (MSF), the United Nations Population Fund (UNFPA), the United Nations Children's Fund (UNICEF), the World Food Programme (WFP) and the World Health Organization (WHO).

13   Examples include the US Agency for International Development (USAID), the Gates Foundation and the Rockefeller Foundation.

14   Examples include the World Bank Group (WBG), the World Economic Forum (WEF) and the International Civil Aviation Organization (ICAO).

15   D. Soesilo *et al.*, above note 11.

16   *Ibid.*

17   *Ibid.*

18   Nathaniel Raymond, Brittany Card and Ziad Al Achkar, "The Case Against Humanitarian Drones", *OpenCanada Blog*, 12 December 2012, available at: https://opencanada.org/the-case-against-humanitarian-drones/; Antonio Donini and Daniel Maxwell, "From Face-to-Face to Face-to-Screen: Remote Management, Effectiveness and Accountability of Humanitarian Action in Insecure Environments", *International Review of the Red Cross*, Vol. 95, No. 890, 2013; Kristin Sandvik and Kerstin Lohne, "The Rise of the Humanitarian Drone: Giving Content to An Emerging Concept", *Millennium: Journal of International Studies*, Vol. 43, No. 1, 2014; Kristin Sandvik and Nathaniel Raymond, "Beyond the Protective Effect: Towards a Theory of Harm for Information Communication Technologies in Mass Atrocity Response", *Genocide Studies and Prevention: An International Journal*, Vol. 11, No. 1, 2017.

funding programmes. Alongside these developments, there has been discussion of ethical principles in humanitarian innovation,[19] and concern expressed for whether and how populations affected by crises are benefiting from innovations.[20] It is, thus, important to critically appraise how technological innovation intersects with values, norms, beliefs and moral commitments,[21] including the relationship between technological innovation and humanitarian principles.[22] If not, the relationship between innovation and experimentation may be obscured, participation and inclusion may be afforded limited attention, and risks and benefits may be unevenly distributed.[23] Hence, normative analysis of ethical challenges associated with humanitarian innovation is required for understanding what is at stake and how best to move forward regarding the use of emergent technology in the aid sector, including HUD.

This article aims to contribute to such an analysis by introducing an ethics assessment framework to support value sensitivity when humanitarian organizations are deciding whether and how to engage in a drone project in a particular setting. Here, value sensitivity entails close attention to how values are implicated in, and engaged by, decisions and actions. The framework has three levels: identifying values, key questions to support reflection across stages of the decision chain, and considerations for institutional preparedness related to ethics. The intent is to provide an accessible ethics support for reflection and deliberation among individuals and groups involved in HUD operations, and to encourage engagement with values in decisions about the initiation of drone-related programmes in the humanitarian sector. The framework seeks to address a gap between high-level, principled-based guidance for innovation more generally,[24] and detailed, operation-oriented checklists related to humanitarian drones.[25] On a broader scale, the framework may also serve to prompt further discussion and reflection about these issues among actors from humanitarian organizations, communities, government, industry, regulatory authorities and academia, as well as technology developers, designers and engineers.

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19 Alexander Betts and Louise Bloom, *Humanitarian Innovation: The State of the Art*, OCHA, November 2014, available at: https://www.unocha.org/sites/unocha/files/Humanitarian%20Innovation%20The%20State%20of%20the%20Art_0.pdf; Louise Bloom and Romily Faulkner, "Innovation Spaces: Lessons from the United Nations", *Third World Quarterly*, Vol. 37, No. 8, 2016; Humanitarian Innovation Fund (HIF)-ALNAP, *Humanitarian Innovation Guide*, Elrha, 2019, available at: https://higuide.elrha.org.
20 Kristin Sandvik, "African Drone Story", *BEHEMOTH: A Journal on Civilisation*, Vol. 8, No. 2, 2015.
21 K. Sandvik *et al.*, 2014, above note 2; K. Sandvik, K. Jacobsen and S. McDonald, 2017, above note 2; HIF-ALNAP, above note 19.
22 N. Wang, M. Christen and M. Hunt, above note 4; K. Sandvik, above note 20.
23 K. Sandvik *et al.*, 2014, above note 2; K. Sandvik, K. Jacobsen and S. McDonald, 2017, above note 2; K. Sandvik, above note 20.
24 A. Betts and L. Bloom, above note 19; HIF-ALNAP, above note 19.
25 WBG, *Guidance Note: Managing the Risks of Unmanned Aircraft Operations in Development Projects*, WBG, 2017; ICAO, *Unmanned Aircraft Systems (UAS) For Humanitarian Aid and Emergency*, ICAO, 2020; International Committee of the Red Cross (ICRC), *Handbook on Data Protection in Humanitarian Action*, 2nd ed., Geneva, 2020; Harvard Humanitarian Initiative (HHI), *Humanitarian UAV Code of Conduct & Guidelines (Fully Revised Version for 2020/2021)*, Uavcode, 2021; USAID, *UAV in Global Health: Defining A Collective Path Forward*, USAID, Washington, DC, 2019.

In the following sections, we present the steps undertaken to develop the framework and introduce the tool that resulted from this process. The next section presents an overview of the ethical landscape of HUD based on the findings of a scoping literature review and two empirical studies that we conducted. This step allowed us to identify areas of particular salience that an ethics assessment framework for HUD should be responsive to. We then offer a comparative review of six selected guidance documents that have relevance for ethics and HUD. Reviewing key documents allowed us to consider existing guidance and possible gaps, and to orient our development process in light of existing work in this area. The multi-step consultation process that we undertook as part of the framework development is presented in the penultimate section, which also introduces the proposed framework, providing details about its content and an illustration of its application with a short vignette. The final section concludes with a discussion about the strengths and limitations of the framework, as well as recommendations for future work on this topic.

State of knowledge about ethics and humanitarian use of drones

Scoping literature review

The development of the proposed framework was grounded by a comprehensive scoping literature review aimed to identify and assess how ethical considerations associated with HUD are discussed in the academic and grey literature.[26] We used a mixed approach of qualitative content analysis and quantitative landscape mapping of the selected articles to inductively develop a typology of ethical considerations associated with HUD. The analysis was complemented by two consultation meetings that took place in October 2020, whereby eight participants with expertise in related fields provided feedback on provisional findings and helped us refine our analysis, including identifying potentially missing or overlooked areas in the literature.

The review presents a portrait of the expanding literature from 2012 through to early 2020 related to HUD, and how ethical considerations are understood and conceptualized across academic and grey literature sources. It illuminates areas that have been the focus of attention (e.g. minimizing risks of harm and protecting privacy), sketches the evolution of this discussion over time (e.g. moving from a focus on mapping drones towards medical cargo drones) and points to areas that have received less consideration (e.g. potential tension between profit and humanitarian goals as new markets open up and as private sector engagement increases in the humanitarian space).[27] The findings broadly

26 N. Wang, M. Christen and M. Hunt, above note 4.
27 N. Wang, M. Christen and M. Hunt, above note 4.

overlap with the general ethical, legal and social implications (ELSI) agenda[28] that is widely used for technology assessment, while highlighting distinctive considerations for HUD.

The mapping of key areas of ethical concern for HUD resulting from the literature review was then used as an analytical reference to assess existing guidance documents (see Table 4). These insights can also be situated within the rise of the humanitarian innovation movement which emerged just prior to the time period of this review,[29] and which has led to a growing and diverse literature in its own right, including many papers critically examining ethical issues associated with innovative practices, processes and products, as well as efforts to develop ethics guidance for innovation projects.[30]

Empirical studies

A second source that allowed us to orient the early phase of framework development was empirical research that we conducted, which illuminates how ethical considerations were experienced by people involved in, and affected by, HUD in two contrasting settings. The first study took place in a landslide area of rural Nepal, where the livelihood of a local community was threatened by the 2015 Nepal earthquake, and a humanitarian organization sought to improve safety by using drones to map the area due to the unstable geological conditions of the terrain.[31] Based on qualitative interviews conducted in 2019, this study sheds light on a real-world example where different actors were brought together in a humanitarian innovation initiative. Based on an inductive analysis of the interviews, ethical considerations were identified related to community, technology, data, regulation and stakeholders as shown in Table 1.

At the centre of the analysis lie tensions between the hopes associated with technological innovation and the realities of what it could provide. The response to the earthquake in Nepal has been repeatedly portrayed by the advocates of

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28 The term "ELSI" first emerged in the context of the Human Genome Project (HGP) in the USA in 1990, where researchers, medical practitioners and lay advocates began to systematically explore the ethical, legal and social implications surrounding the HGP. Katie Cottingham, "'A Decade of ELSI Research': Embracing the Past and Gazing into the Future", *Science*, 26 January 2001, available at: https://www.science.org/content/article/decade-elsi-research-embracing-past-and-gazing-future.

29 HIF-ALNAP, above note 19.

30 L. Bloom and R. Faulkner, above note 19; Tom Scott-Smith, "Humanitarian Neophilia: The 'Innovation Turn' and its Implications", *Third World Quarterly*, Vol. 37, No. 12, 2016; Benjamin White, "Refuge and History: A Critical Reading of a Polemic", *Migration and Society: Advances in Research*, Vol. 2, 2019; Silke Roth and Markus Luczak-Roesch, "Deconstructing the Data Life-cycle in Digital Humanitarianism", *Information, Communication & Society*, Vol. 23, No. 4, 2020.

31 Ning Wang, "'A Successful Story that Can be Sold'? A Case Study of Humanitarian Use of Drones", *Proceedings of the 2019 IEEE International Symposium on Technology and Society (ISTAS)*, IEEE, 2019; Ning Wang, "'We Live on Hope…' Ethical Considerations of Humanitarian Use of Drones in Post-Disaster Nepal", *IEEE Technology and Society Magazine*, Vol. 39, No. 3, 2020.

Table 1. *Ethical considerations – Nepal case*[32]

Theme	Focus	Ethical consideration
Community	*Consent and care:* procedure of consent, sources of consent, consequences of consent	• *Trust*: already existing *v.* newly established • *Hope*: need for aid and dependence on external support • *Literacy*: what is expected to be understood *v.* what is actually understood • *Philanthropic misconception*: unrealistic expectations and neglected communication gap • *Duty of care*: being vulnerable *v.* being made vulnerable
Technology	*Risks and benefits:* technological limitations, societal implications, risk–benefit assessments	• *Tensions, compromises and trade-offs*: quality of information, types of technology, etc. • *Purposes, conditions and contexts*: why, how, at what cost, benefiting whom, whose responsibility, etc. • *Matters of concern*: "silver bullet" *v.* fundamental problems • *Priority of the agenda*: hasty technological advance *v.* sluggish social, economic and political growth

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technological innovation as "a success story that can be sold".[33] In such narratives, technology is often depicted as the "magic solution" to resolve social and structural problems.[34] However, the reality on the ground is more complicated, with high expectations but uncertain benefits being realized. Ultimately, the analysis can be distilled to two core aspects: (1) the role of emerging technologies in a precarious

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32   A more detailed version of this Table is presented in N. Wang, 2020, *ibid*.
33   N. Wang, 2019, above note 31.
34   *Ibid*.

Table 1. *Continued*		
Theme	**Focus**	**Ethical consideration**
Data	*Safety and security:* regulatory priority, operational guidelines	• *Data collection*: degree and level of data accuracy • *Data storage and usage*: compliance mechanism for data safety and security • *Data sharing*: digital data management system
Regulation	*Authority and procedure:* top-down force, regulatory authority, provisions and procedures	• *Lead agencies*: who and at what level • *Compliance and enforcement mechanisms*: content and process
Stakeholders	*Responsibility and accountability:* bottom-up force, moral hazard, ethical standards	• *Government*: priority-setting • *Humanitarian organization*: self-positioning • *Community*: needs-oriented • *Ethical standards*: action-guiding

context where diverse factors are at play, all of which may trigger vulnerabilities for affected populations; and (2) the role of the aid sector in an increasingly technologized ecosystem where new models of delivering humanitarian services present challenges of alignment with respect to the fundamental humanitarian principles.[35]

The second study took place in the lake area of Malawi, where drones were used to deliver medical supplies to two remote islands to help address the last-mile delivery challenges faced by the Government of Malawi.[36] In this context, in-depth

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35 N. Wang, 2020, above note 31.
36 Ning Wang, "'As it is Africa, it is OK'? Ethical Considerations of Development Use of Drones for Delivery in Malawi", *IEEE Transactions on Technology and Society*, Vol. 1, No. 2, 2021a; Ning Wang, "'Killing Two Birds with One Stone'? A Case Study of Development Use of Drones", *Proceedings of the 2020 IEEE International Symposium on Technology and Society (ISTAS)*, IEEE, 2021b.

interviews revealed a noticeable mentality of "killing two birds with one stone", whereby the use of drones enables the tech industry to associate their image with humanitarian causes and to trial products on a large scale in countries where needs are widespread and regulation is relaxed.[37] We identified ethical considerations related to safety, operationality and sustainability, as shown in Table 2.

Table 2. *Ethical considerations– Malawi case*[38]

Theme	Focus	Ethical consideration (cross-theme)
Safety	• *Human and environmental safety:* drone technology, connectivity solution, weather conditions, safety insurance • *Cargo safety:* sample packaging, dangerous goods, patient data	How does the context influence what is deemed acceptable? • *International development challenge:* donor-based, high beneficiary expectations, prone to shortcuts due to resource constraint
Operationality	• *Infrastructure gap:* health logistic system, laboratory sample processing, health facility capacity • *Operational costs:* investment, beneficiary, business model	• *Public acceptability of innovation:* donor confidence, government commitment, community engagement Is it a solution looking for a problem?
Sustainability	• *Local capacity:* locally based operation, project management, airspace management • *Donor dependence:* committed resources, structural roots, lack of knowledge	• *Technology experimentation:* "do not impose, but ask" approach, positive disruption, responsible innovation in the aid sector • *Drone industry expansion:* business motive, industry lobbying, supply chain bottlenecks, responsible private sector engagement

37 N. Wang, 2021b, *ibid.*
38 A more detailed version of this Table is presented in N. Wang, 2021a, above note 36.

The dual-purpose approach seen in this study is potentially problematic because introduction of new technologies to development programmes can have negative consequences for affected populations, both short-term risks related to the safety of the technology, and long-term consequences with respect to the experimentation approach, sustainability of benefits, and what might be displaced. Additionally, although the culture of taking risks and accepting failure is mainstream in innovation, such attitudes may not suit humanitarian contexts, where fundamental principles are derived from the humanitarian imperative of alleviating suffering and assisting people affected by crisis.[39] This study offers insights for critical reflection on the trend of the "African drone rise", whereby drones and Africa are being construed as solutions to each other's problems, opening up questions with respect to the ethical and societal implications of using drones in the aid sector in light of two key concerns: (1) the social implications of such practices across different settings; and (2) the normative role of technology in the aid sector, especially where it appears to be a solution looking for a problem.[40]

Overall, the two empirical studies complemented the scoping literature review by identifying areas of concern through investigations of experiences and perceptions of people involved in, and affected by, real-world situations of HUD, as well as ethical issues that emerged from these cases. A main insight gained through these studies is that the use case (mapping *v.* delivery) implicates both distinct and partially overlapping sets of ethical values, and that these concerns are perceived differently across different groups of people. Additionally, the relation between the technology industry and the humanitarian sector adds a new layer of complexity to the power dynamics among involved parties, especially communities affected by disasters or living in resource-constrained settings.

The ethics landscape and implications for humanitarian use of drones

Our literature review and empirical studies point to the following issues that are of particular relevance in developing a framework to support value sensitivity for HUD. First, as our empirical studies have shown, a key concern for HUD is the possibility that the humanitarian space has become a "testing zone" to advance drone technology that is intended to be implemented elsewhere. Likewise, commentators have suggested that the cost pressure from research and development (R&D) and regulatory compliance may encourage manufacturers to test new drones in countries where regulation is relatively flexible, while nations and localities with uncrowded skies may sense opportunity and seek to attract business by offering incentives for drone testing.[41] This arrangement, however, may create a dynamic in which companies and citizens of high-income countries benefit from the information learned from HUD in settings such as Nepal or

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39 N. Wang, 2021b, above note 36.
40 N. Wang, 2021a, above note 36.
41 J. C. Chow, above note 5; B. Custers, above note 5.

Malawi. Conflicts may also result between governments and companies over intellectual-property rights and the sharing of benefits derived from drone testing.[42] From this perspective, initiatives to test drones as part of humanitarian operations should assess how a wide range of short- and longer-term benefits and risks will be apportioned, and whether the conditions exist or can be created for the benefits of HUD programmes to be sustained for local communities.

Second, concerns have been raised that the drone industry may seek legitimacy through HUD and that it may facilitate expansion into new markets, driven by financial rather than humanitarian motives.[43] Similarly, O'Driscoll suggests that drone companies may associate themselves with humanitarian organizations as part of a public relations and marketing campaign to overcome lingering perceptions associating drones with military applications.[44] This pattern is somewhat seen in our two empirical studies, where drones are labelled by the industry as "life-saving machines" and are accepted by organizations and governments using them on that basis. A contrasting view is that a focus on drones may deflect the attention of humanitarian organizations away from underlying issues or alternative methods; if drones are envisioned as a panacea for all the problems that currently attend relief provision, various issues involved in aid delivery are likely to be ignored.[45] For instance, in our study in Malawi, concern was raised that efforts and resources devoted to drones could have been used on other approaches that might be more easily sustained, such as improving the laboratory equipment or training more health personnel. These aspects highlight the importance that, when assessing a potential drone project, consideration should be directed toward the possibility that enthusiasm for drones as a novel approach might displace potentially simpler and more effective solutions.

Third, there is a concern that the use of drones in humanitarian operations may create distance between humanitarian responders and the populations they seek to assist, turning humanitarian responses into a form of virtual reality and eventually diminishing empathy for affected populations.[46] In addition to the psychological aspect, as reported by the participants of our interviews during our empirical studies, responsibilities of humanitarian aid providers also have liability implications, with current regulatory frameworks lagging technological developments. Consequently, those wishing to use the technology face a range of hurdles with respect to legality, coordination and safety.[47] These concerns lead to

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42   J. C. Chow, above note 5; D. Soesilo et al., above note 11.
43   K. Sandvik et al., 2014, above note 2; K. Sandvik, K. Jacobsen and S. McDonald, 2017, above note 2; A. Donini and D. Maxwell, above note 18.
44   Dylan O'Driscoll, UAVs in Humanitarian Relief and Wider Development Contexts, K4D Helpdesk Report, UK Institute of Development Studies, 14 August 2017, available at: https://www.gov.uk/research-for-development-outputs/uavs-in-humanitarian-relief-and-wider-development-contexts.
45   K. Sandvik, above note 20; D. O'Driscoll, ibid.
46   K. Sandvik et al., 2014, above note 2; N. Raymond, B. Card and Z. Al Achkar, above note 18.
47   Bruno Martins, Chantal Lavallée and Andrea Silkoset, "Drones in Times of Pandemic: Caution Behind the Hype", Global Policy Blog, 11 April 2020, available at: https://www.globalpolicyjournal.com/blog/22/04/2020/drones-times-pandemic-caution-behind-hype.

questions related to best use of limited humanitarian resources, and whether humanitarian organizations are sufficiently well positioned to manage the development, operation and procurement of drones.[48]

Review of existing guidance documents

The next step of our framework development process involved the review of key guidance documents relevant to the range of ethical concerns that need to be addressed in relation to HUD. Guided by this rationale, we selected documents that were at the intersection of our three core concerns: (1) relating to drones; (2) applied to humanitarian and development uses; and (3) discussing ethical considerations. This review of existing guidance documents was not exhaustive in nature, but rather intended to provide a general sense of what was currently available on this topic. In what follows, six of the most recent and widely known guidance documents are presented as examples to illustrate the current state of guidance relevant to ethics and HUD. These documents were produced by leading IOs, as well as academics working on the topic. The review includes two documents produced by IOs, two documents jointly produced by IOs and academics, and two pieces of academic work. Table 3 offers an overview and comparison of the selected documents.

Existing frameworks, guidance and tools[49]

World Bank Group: Guidance Note: Managing the Risks of Unmanned Aircraft Operations in Development Projects (2017)[50]

The World Bank Group (WBG) Guidance Note provides an overview of the rapid emergence and possible uses of unmanned aircraft systems (UASs). It discusses potential risks, as well as operational and regulatory considerations, that need to be taken into account while planning and executing UAS operations. It also includes recommendations for how to apply UAS technologies within WBG operations and related client activities. The overall focus of the Note is on risk management. According to the WBG, its duty of care extends beyond operational safety and includes protection for people and the environment, data protection and cybersecurity, as well as to the reputation of the organization. It suggests that the risk-management process should cover all activities to reduce the possibility of both cultural and systemic failings resulting in a catastrophic event. Such a process includes three steps: hazard identification around key risk factors, risk

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48 K. Sandvik and K. Lohne, above note 18.
49 In this section, we kept the original terminologies referring to "drones" that are used in the respective guidance documents. The various terminologies used in these documents, as well as the technical definitions that may apply to them, is a reflection of the current state of un-unification of this technology, which is a challenge of its own.
50 WBG, above note 25.

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Table 3. *Overview of selected guidance documents relevant to humanitarian use of drones*

Nature of document	Date	Name of document	Author and affiliation	Focus of document	Principles introduced	Guidance proposed	Practical tools recommended
IO governance document	2017	WBG Guidance Note	WBG	Operational risk management	Not applicable	• Considerations for UAS operators	• WBG UAS Operational Checklist Form (Annex C)
	2020	ICAO U-AID Guidance	ICAO	Operational risks in emergency response	Not applicable	• Dangerous goods management • Safety risk management	• Examples of Dangerous Goods that May Be Necessary for Humanitarian Aid or Emergency Response (Appendix 2) • Elements that Should Be Included in a UA Operator's Policy and Procedures Manual for the Safe Transport of Dangerous Goods (Appendix 3) • Elements to Consider as Part of the UA Operator's Safety Risk Management Procedures (Appendix 4)

Continued

Table 3. Continued

Nature of document	Date	Name of document	Author and affiliation	Focus of document	Principles introduced	Guidance proposed	Practical tools recommended
IO and academia joint guidance document	2020	ICRC/BPH Data Protection Handbook	ICRC and BPH	Data protection	• Fairness and lawfulness • Purpose limitation • Proportionality • Data minimization • Data quality	• Basic data protection principles • Specific types of technologies and data processing situations	• Template Data Protection Impact Assessments Report (Appendix I)
	2021	UAViators/HHI Humanitarian UAV Code of Conduct and Guidelines	UAViators and HHI	Principles, obligations, and standards	• Humanitarian principles	• Operating principles • Humanitarian obligations	• Sixteen operating principles to support the safe, effective and ethical delivery of humanitarian assistance in emergencies (Code) • Four obligations for humanitarian teams to observe humanitarian principles in practice, as well as UAV-specific objectives and requirements that shape the engagement (Guidelines)

Table 3. *Continued*

Nature of document	Date	Name of document	Author and affiliation	Focus of document	Principles introduced	Guidance proposed	Practical tools recommended
Academic analyses	2019	Drones in Humanitarian Contexts, Robot Ethics, and the Human–Robot Interaction	TU Delft/van Wynsberghe and Comes	Analytical approach	• Humanitarian ethics principles (humanity, impartiality, neutrality, and independence) • Robot ethics principles	• Integrating robot ethics into the humanitarian ethics framework as an approach for nuanced and fine-grained ethical evaluations of HUD	Not applicable
	2020	An Ethical Framework for the Design, Development, Implementation, and Assessment of Drones Used in Public Healthcare	SDU and TU Delft/ Cawthorne and van Wynsberghe	Analytical approach and ethical framework	• Bioethics principles (beneficence, non-maleficence, autonomy, and justice) • Artificial intelligence ethics principle (explicability) • VSD principles	• Integrating contextually relevant values that can be operationalized in the design, development, implementation, and assessment of drones used in the public healthcare context	Not applicable

calculation with respect to probability and severity, and practical technical solutions to address the identified risks. It concludes by calling for a closer exploration of UAS uses for WBG operations, and of the risk factors and associated considerations.

International Civil Aviation Organization: Unmanned Aircraft Systems (UAS) for Humanitarian Aid and Emergency (2020)[51]

The International Civil Aviation Organization (ICAO) refers to humanitarian aid and emergency response operations collectively as "U-AID". The U-AID Guidance consists of four main sections: general regulatory framework, operational overview, risks and responsibilities about dangerous goods, as well as safety risk assessment, responsibility and mitigation. It is a resource for Member States to enable humanitarian aid and emergency response operations using UASs, and to enable an expedited review process for urgent operations. The Guidance supports civil aviation authorities in their review of requests for UAS operational authorizations in response to humanitarian emergencies, regardless of the status of their UAS regulations. Regarding the operational requirements, the ICAO distinguishes missions undertaken in response to a catastrophic event from missions for purposes of routine humanitarian cargo delivery, and makes recommendations for permissions and authorizations.

As regards dangerous goods, the ICAO developed international Standards and Recommended Practices that govern their safe transport on civil aircraft. The Guidance applies to circumstances when a State has determined that the use of UASs to transport dangerous goods for humanitarian aid and emergency response is appropriate. When granting an operator approval for carriage of such goods, the State of the operator must ensure that the operator establishes standard operating procedures for their safe transport on board or attached to the UAS. The Guidance recommends steps regarding the safety risk assessment process, and provides risk mitigation strategy examples, including several methods for operational risk assessment.

International Committee of the Red Cross and The Brussels Privacy Hub: Handbook on Data Protection in Humanitarian Action (2020)[52]

The Handbook on Data Protection in Humanitarian Action is a joint publication of the Data Protection Office of the ICRC and the Brussels Privacy Hub (BPH), an academic research centre of the Vrije Universiteit Brussel (Free University of Brussels). It aims to further the discussion launched by the Resolution on Privacy and International Humanitarian Action adopted by the International Conference of Data Protection and Privacy Commissioners in Amsterdam in 2015. The objectives are to explore the relationship between data protection laws and humanitarian action, understand the impact of new technologies on data

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51 ICAO, above note 25.
52 ICRC, above note 25.

protection in the humanitarian sector, and formulate appropriate guidance. The target audience includes humanitarian organizations involved in processing personal data for humanitarian operations, as well as other parties involved in humanitarian action or data protection.

The Handbook has two main parts: Part I applies generally to all types of personal data processing, including a detailed description of five basic data protection principles, namely, the principle of fineness and lawfulness of processing, the purpose limitation principle, the proportionality principle, the principle of data minimization and the principle of data quality, alongside the legal basis of personal data protection and sharing, as well as data protection impact assessments. Part II deals with specific types of technologies, including drones, as well as data processing situations, each with a discussion of data protection issues. It notes that information technologies embedded in drones or connected to them can perform various data processing activities and operations, e.g. data collection, recording, organization, storage and combination of collected data sets. Depending on the quality of the data, it may be possible to identify individuals directly or indirectly, either by a human operator or automatically. Even when identification of individuals is not possible via the use of drones, their use may still have substantial implications for the life, liberty and dignity of individuals and communities. Thus, the Handbook recommends humanitarian organizations to process personal data collected by drones using one or more of the following legal bases: the vital interest of the data subject or of another person, the public interest, in particular stemming from an organization's mandate under national or international law, consent, a legitimate interest of the organization, the performance of a contract and compliance with a legal obligation.

Humanitarian UAV Network and The Harvard Humanitarian Initiative: Humanitarian UAV Code of Conduct & Guidelines (2021)[53]

The Humanitarian UAV Network (UAViators)/Harvard Humanitarian Initiative (HHI) Code of Conduct and its supporting Guidelines presents a set of principles, obligations and standards to guide the use of unmanned aerial vehicles (UAVs) during humanitarian emergencies. The Code and the Guidelines are two related but separate documents. The former was created by the UAViators practitioner community, and is a standalone document and briefly describes sixteen operating principles, with the aim to guide all actors involved in the use of UAVs to support the safe, effective and ethical delivery of humanitarian assistance in emergencies; the latter outlines how humanitarian teams can respect these humanitarian principles *vis-à-vis* four obligations: engaging communities, upholding data protection standards, forming ethical partnerships, and engaging responsibly in conflict-affected environments. The latest revisions of the Guidelines were made by the Signal Program on Human Security and Technology at the HHI in late 2020. The Guidelines are recommended to be used

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53   HHI, above note 25.

either by governmental or private sector actors to support alignment of practices, legal obligations and partnership terms with those of humanitarian actors; or by humanitarian and development donors to help ensure that their data and practice requirements can utilize UAV-assisted remote sensing without compromising core principles and obligations.

Technical University of Delft: Drones in Humanitarian Contexts, Robot Ethics, and the Human–Robot Interaction (2019)[54]

The Technical University of Delft (TU Delft) paper aims to provide a nuanced analysis to the question of "should" we use drones in humanitarian contexts. The authors suggest that the strength of the humanitarian principles approach to answer questions of aid provision can be complemented by a technology-facing approach, namely that of robot ethics. In the paper, they review the principles of humanitarian ethics and robot ethics, and raise concerns about how they connect to HUD on two levels: (1) for humanitarian workers: the loss of contextual understanding culminating in the de-skilling of workers; and (2) for people living in communities affected by crisis: a threat to the principle of humanity by reducing human–human interactions, and a threat to dignity both through a lack of informational transparency and by failing to account for the physiological and behavioural impacts of drones. They then examine the ethical frameworks available for an evaluation of HUD, and point out that existing work in this area is missing a focus on the shift in how humanitarian care is provided as a result of the robot's introduction. The authors explore two opposing themes in the humanitarian space, namely, respect for the humanitarian principles, and the "technologizing" of care. They finally propose to integrate robot ethics, with a focus on the ethical issues stemming from human–robot interactions, into the humanitarian framework as an approach for the ethical evaluation of introducing new robots into the humanitarian space.

University of Southern Denmark and Technical University of Delft: An Ethical Framework for the Design, Development, Implementation, and Assessment of Drones Used in Public Healthcare (2020)[55]

The University of Southern Denmark (SDU)/TU Delft paper aims to bring the various ethical frameworks around care ethics and robot ethics into the design of public healthcare drones, in a way that supports the engineers and designers creating them, and that ensures the timely reflection of ethical issues prior to their use. The authors advocate for a proactive ethical approach to guide the R&D of drones used in public health. They propose a framework for ethical

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54   A. van Wynsberghe and T. Comes, above note 6.
55   Dylan Cawthorne and Aimee Robbins van Wynsberghe, "An Ethical Framework for the Design, Development, Implementation, and Assessment of Drones Used in Public Healthcare", *Science and Engineering Ethics*, Vol. 26, No. 3, 2020.

evaluations and guidance by: (1) using bioethics principles as the foundation, namely, beneficence, non-maleficence, autonomy and justice; and (2) adding a fifth ethical principle derived from artificial intelligence ethics, namely, explicability. Guided by the value sensitive design (VSD) approach,[56] the framework was built upon the notion of a values hierarchy consisting of four levels: ethical principle, values, norms and design requirements. The main discussion of the paper revolves around a detailed description of the upper two levels of the values hierarchy, followed by an illustrative deliberation on how practitioners can translate these into contextual norms and design requirements to construct an ethically informed design process. The authors note that although the framework is developed as an applied ethics tool to facilitate the consideration of ethics and human values in technology design, it is meant as a starting point for ethical reflection in technology development and should be used in conjunction with other bottom-up methods, such as gathering stakeholder input and conducting field studies.

Comparative analysis

As illustrated above, there has been activity by both IOs and the academic community to develop guidance for HUD on a range of topics related to ethics. Amongst these documents, we notice different approaches. The documents produced by academics mainly advance principle-based approaches, whereas the IO governance documents are typically based on detailed and checklist-type instructions for flight operations and the like. Joint guidance documents are more comprehensive with respect to their approach (from principle-based to concrete guidance), yet they tend to focus on particular domains of applications, such as data protection or airspace safety management.

　　　　A closer examination of the content of the selected documents through the lens of the areas of concern identified in our scoping literature review reveals the following: regulation and governance issues are well covered in the documents provided by IOs, but not addressed within the academic analyses. While ethical

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56　The VSD approach was first developed in the field of human–computer interaction in the early 1990s in the USA, and has since been used in information management, human–robotic interaction, computer security, civil engineering, applied philosophy, and land use and transportation. According to Friedman *et al.* (2002), VSD is a theoretically grounded approach to the design of technology that accounts for human values throughout the design process in a principled and comprehensive manner. The philosophical foundation of VSD holds that technology is the result of human imagination – humans envisioning alternatives to the status quo and acting upon the environment with the materials at hand to change the conditions of human and non-human life. At the same time, human values do not exist in isolation; rather, in the complexity of human relations, values sit in a delicate balance with each other (Friedman and Hendry, 2019). As a result of this human activity, technology to some degree reflects, and reciprocally affects, human values. And it is because of this deep-seated relationship that actively engaging with values in the design process not only is a responsible act, but also offers creative opportunities for technological innovation. Batya Friedman, Peter H. Kahn and Alan Borning, "Value Sensitive Design: Theory and Methods", *UW Technical Report*, University of Washington, Seattle, WA, 2002; Batya Friedman and David G. Hendry, *Value Sensitive Design: Shaping Technology with Moral Imagination*, MIT Press, Cambridge, MA, 2019.

issues are generally covered, there does not appear to be a tool that is comprehensive in its approach to these issues. None of the tools addressed more than twenty of the twenty-seven ethical concerns identified in our scoping literature review.[57] The most obvious gaps are with respect to broader societal issues concerning, in particular, the relationship between humanitarian organizations and private industry, or the impact of drones on questions of identity and purpose for those involved in the provision of humanitarian aid. Yet, notably, these are key issues for operational decisions, i.e. whether a humanitarian organization should involve drones as a means to address concrete problems in specific contexts. Table 4 provides a comparison between the ethical concerns identified through our scoping literature review[58] and the six selected guidance documents.

The proposed ethics assessment framework

In this section, we introduce the framework that we developed following the steps presented in the preceding sections. Frameworks addressing technology ethics can help appraise as well as shape the development and acceptability of a technology as it is unfolding, rather than having to attempt to foresee all the risks beforehand.[59] We stress that the integration of fundamental humanitarian principles of humanity, neutrality, impartiality and independence, along with other ethical values such as autonomy, justice, fairness, respect, responsibility and accountability, should also be a focus of attention for people involved in HUD.

Rationale of the framework

In the area of applied ethics, guidance tools may be formulated at the level of a general area of discourse (e.g. technology ethics), or they may be specific to a particular problem (e.g. humanitarian use of drones). With respect to ethics assessment frameworks, the intent is to guide decision making and the performance of actions by supporting normative deliberation, making relevant values explicit, and offering a justified account for the answers provided to the problems at hand.[60] The utility and effectiveness of frameworks depend on their comprehensiveness and clarity, and the potential for consistent operationalization of general principles to concrete ethical issues and for decision making by specific groups of actors. Our objective of developing an ethics assessment framework for HUD was to create a tool to aid decision making for the humanitarian drone community with respect to integrating ethical values for HUD, within the broader context of value sensitive innovation, and to support reflection and deliberation around these issues.

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57   N. Wang, M. Christen and M. Hunt, above note 4.
58   *Ibid.*
59   D. Cawthorne and A. R. van Wynsberghe, above note 55.
60   Caroline Clarinval and Nikola Biller-Andorno, "Challenging Operations: An Ethical Framework to Assist Humanitarian Aid Workers in their Decision-making Processes", *PLoS Currents*, Vol. 23, No. 6, 2014.

Table 4. *Comparative results regarding areas of ethical concern for humanitarian use of drones*

Primary level	Secondary level	Tertiary level	WBG Guidance Note	ICAO U-AID Guidance	ICRC/ BPH Data Protection Handbook	UAViators/ HHI Code of Conduct & Guidelines	TU Delft paper	SDU and TU Delft paper
Harm/benefit	Minimizing harm	Focus on physical safety and security of drone use	X	X	X	X	X	X
		Focus on environmental impacts of drone use		X			X	X
		Focus on compensating for harm		X			X	X
	Maximizing welfare	Focus on specific benefits		X	X			X
		Focus on general public welfare	X	X	X	X	X	X
Justice	Substantive justice	Focus on fair sharing of costs and benefits				X	X	X
		Focus on equitable access				X	X	X
		Focus on cost-effectiveness and/or opportunity costs	X			X		X
	Procedural justice	Focus on stakeholder accountability and compliance	X	X	X	X		
		Focus on general responsible use of drones	X	X	X	X	X	X
Respect for autonomy	Respect for individuals	Focus on technical aspects of information security	X	X	X	X		
		Focus on general considerations of privacy	X	X	X	X	X	X
	Respect for communities	Focus on active community engagement	X		X	X		X

Continued

Table 4. *Continued*

Primary level	Secondary level	Tertiary level	WBG Guidance Note	ICAO U-AID Guidance	ICRC/ BPH Data Protection Handbook	UAViators/ HHI Code of Conduct & Guidelines	TU Delft paper	SDU and TU Delft paper
		Focus on broader forms of stakeholder engagement	X	X		X		X
Regulation and governance	Content gaps in regulation	Focus on safety regulations	X	X	X	X		X
		Focus on airspace integration regulations	X	X		X		
		Focus on data protection regulations	X	X	X	X		
	Procedural dysfunction	Focus on inadequate or ambiguous regulatory process	X	X	X	X		
		Focus on undefined regulatory authorities	X			X		
Broader societal impacts	Public perception	Focus on effectiveness, accountability, transparency and trust of humanitarian aid	X	X	X	X	X	X
		Focus on reputational risks	X			X	X	X
		Focus on consistency of drone use with humanitarian principles	X			X	X	X

Continued

Table 4. *Continued*

Primary level	Secondary level	Tertiary level	WBG Guidance Note	ICAO U-AID Guidance	ICRC/ BPH Data Protection Handbook	UAViators/ HHI Code of Conduct & Guidelines	TU Delft paper	SDU and TU Delft paper
	Relations between humanitarian organizations and drone industry	Focus on the power (im) balance between humanitarian organizations and the drone industry						
		Focus on using drones through "in-house capacity" *v.* "external service providers"	X			X		
	Identity of humanitarian aid providers	Focus on "bunkerization" and the impacts of technology on aid providers and recipients					X	
		Focus on "solutionism" in aid provision						
		Focus on the "turn to innovation" in the aid sector						

Our target audience in developing the framework was primarily aid organizations and practitioners in both humanitarian and development sectors. The content of the framework, including the set of questions enclosed, may also help support reflection, discussion and deliberation among other involved actors, from industry to government and communities. Echoing the growing awareness of ethics among technologists and engineers – especially among those active in advocating the VSD approach – we also hope that the framework could provide an accessible resource for technology developers and designers to further engage with ethical issues.[61] In line with these goals, we sought to develop an ordered series of questions to prompt reflection and discussion at each stage of deliberation, along with clear guidance on when the framework is to be used and how it is to function.

Methodology of the framework development

Building on the previous steps, a crucial component of the framework development was consultation with a range of individuals involved in HUD, and with scholars working in areas relevant to this domain. Participants included researchers with expertise in humanitarian studies, sociology, ethics, anthropology and law, as well as practitioners from international humanitarian organizations, intergovernmental organizations and the drone industry. This consultation process involved the following five steps:

(1) An initial draft of the framework was circulated among nineteen individuals to obtain written comments at the beginning of 2021. Their feedback was used to make refinements for cohesion, clarity and scope.

(2) An online workshop was then held on 23–24 March 2021 with fourteen participants providing further input and discussing elements of the first draft. This feedback was taken into consideration in the next iteration of the framework development.

(3) A second draft was then developed and subsequently sent to the same group to solicit further feedback, which was incorporated into the next iteration.

(4) The third draft was shared with participants at a three-day hybrid-format workshop held on 1–3 June 2021. During the workshop, the framework was tested against realworld scenarios in small group simulation exercises (see the "Application of the FEAHD" section below for an example of a vignette; more details are available on the project website[62]). The small groups reported back to the larger group and a broader discussion of the fit and alignment of the framework to respond to HUD operations took place.

(5) Based on the feedback obtained at this workshop, including insights gained through the simulation exercises, the framework was finalized. The final version of the framework is presented in detail in the Annex, and its application to a hypothetical case study is discussed below.

61 D. Cawthorne and A. R. van Wynsberghe, above note 55.
62 Further resources about the FEAHD are presented on the project website, available at: www.ethics.dsi.uzh. ch/projects/FEAHD/.

The Framework for the Ethics Assessment of Humanitarian Drones (FEAHD) and its Application

Structure of the FEAHD

The FEAHD consists of three levels of considerations, asking different sets of questions to the potential users. Figure 1 provides a visual representation of the FEAHD, which aims to give an accessible overview of the structure of the FEAHD, and is used for illustration and dissemination purposes.[63] On an overarching level (i.e. "normative orientation", see Figure 1), an array of ethical values relevant to HUD are outlined to inform and orient deliberation, discussion and decision making regarding HUD. On a foundational level (i.e. "institutional foundation", see Figure 1), resources for ethics preparedness are suggested. These two sources of guidance together provide the context for a value-based decision chain (i.e. the decision chain, see centre bar of Figure 1), beginning with whether to embark upon a drone project, and continuing on to consider how to undertake drone operations in a responsible and sustainable manner.

In particular, we propose five values on the "normative orientation" level, based on the findings of the scoping literature review, and feedback received during the consultation process. These values include: optimizing benefit and minimizing harm, safeguarding justice, respecting autonomy, adhering to regulatory and governance standards, and promoting humanitarian principles. On the "institutional foundation" level, we draw on the concept of "ethics preparedness"[64] – a notion referring to an organization's capacity and state of readiness to support their staff, and to work collaboratively with partners and others, to respond to ethical issues. These supports may include common instruments such as statements of organizational values, codes of conduct, or policies and procedures. They could also take the form of internal organizational structures such as identifying someone with an advisory role for ethics questions or forming an ethics task force. External organizational structures may also be established, such as working with an arm's-length ethics advisory board. These sets of resources (core values, guidance documents and institutional support structures) are different in form and focus, reflecting some key areas identified through the literature review and consultation processes. They are functionally independent from each other, but can also be used in a coordinated fashion. For instance, "safeguarding justice" could be strengthened by ensuring that justice is appropriately reflected in

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63 The visual representation of the FEAHD was printed on an A6 "postcard" to support dissemination and distribution activities among humanitarian organizations and other entities involved in HUD. The "postcard" also contains a link to the project website, available at: www.ethics.dsi.uzh.ch/projects/FEAHD/.

64 Abha Saxena, Peter Horby, John Amuasi, Nic Aagaard, Johannes Köhler, Ehsan Gooshki, Emmanuelle Denis, Andreas Reis, the ALERRT-WHO Workshop and Raffaella Ravinetto, "Ethics Preparedness: Facilitating Ethics Review During Outbreaks – Recommendations from an Expert Panel", *BMC Medical Ethics*, Vol. 20, No. 29, 2019.
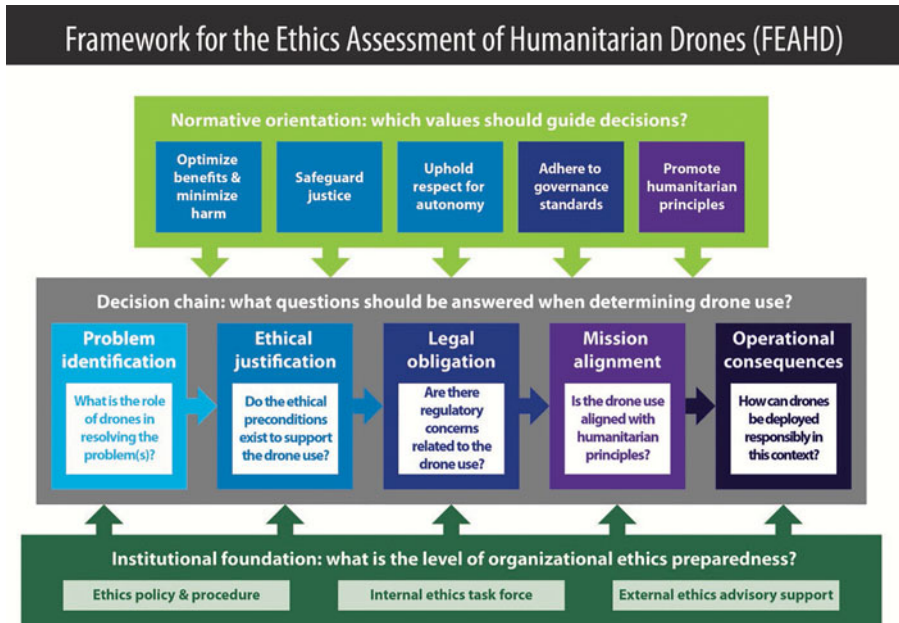
Figure 1. Overview of the Framework for the Ethics Assessment of Humanitarian Drones (FEAHD).

organizational guidance documents and emphasized by those individuals or groups holding internal or external ethics advisory roles.

Application of the FEAHD

To illustrate the application of the FEAHD, we present below the simulation exercise of one of the vignettes that was undertaken by participants at the final consultation workshop we held in June 2021.[65]

Vignette description

Following a destructive typhoon, organization Y intends to support disaster response activities in the particularly hard-hit city T, in cooperation with non-governmental organizations, including a search and rescue team and a country office of a humanitarian organization, and in collaboration with the United Nations Disaster Assessment and Coordination (UNDAC) teams.

A quad-copter drone is anticipated to be used. The drone has two cameras (one with high-definition colour and one with thermal bands) which would allow live, on-screen observation of the area captured by the camera. It can fly as far as

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65   In the development of the vignettes, we took inspiration from real-world humanitarian actions referenced by D. Soesilo *et al.*, above note 11.

2 km from its controller, and has a maximum flight time of 25 minutes. In particular, Y intends to conduct a number of missions in and around city T, and provide an aerial view of roadways, damaged buildings and to gather other real-time information about the typhoon's impacts.

One such mission includes flying over a hospital that has reportedly been damaged by the storm. Roadways to reach the hospital are blocked, and there is concern for the safety of team members if they were to travel by road to assess the state of the building. The deployment of the quad-copter drone will provide aerial imagery of the hospital, allow the team to assess the damage from the air, and provide accurate information on the needs for repairs and materials.

There is uncertainty about the authorization process for this operation. It is possible that by the time the drone flights are authorized by the national aviation and other regulatory authorities, the roads will have already been cleared and the major search and rescue work already completed.

Framework Application

1. With respect to "normative orientation", two values are particularly relevant to this case: optimizing benefits, and adhering to governance standards.
2. Regarding "institutional foundation", different approaches may apply. For instance, if relevant ethics policies and procedures are in place, then they should be complied with straightforwardly. It could also be possible that guidelines for use cases (such as infrastructure assessment through drones) with some similarities to the actual case are available that could serve as a template to facilitate the authorization process. Additionally, the team should have clarity about who they could contact (e.g. internal ethics advisor or external support) to request input if required.
3. In relation to the decision chain, the following steps may be applicable:

(1) Problem identification:
   - The primary use of drones is to guide the search and rescue teams
   - Secondary use of drone data for infrastructure repair could be possible

(2) Ethical justification:
   - The use of drones may affect aid supply allocation
   - The drones may detect other people in need (distress) during flight, possibly creating dilemmas of who (and how) to help first
   - The images captured by the drones may contain data about affected populations, touching upon the issue of data handling, especially regarding sensitive data
   - Limited scope for consultation or engagement with communities due to the emergency may create unexpected tension between humanitarian organizations and involved communities

(3) Legal obligation: identify potential challenges due to timing of approval procedures

(4) Mission alignment: clarify what to do with the information that is collected, including if people in distress are identified

(5) Operational consequences: define communication and plans for how to proceed when approval is received or if it is delayed, including contingency plans.

Additional guidance

Further details are provided in the Annex and on the project website,[66] including example questions linked to the different components of the framework. These additional questions are intended to provide further lines of reflection and discussion for users of the framework who wish to look more closely at particular dimensions of the framework (for example, when a team is considering the topic of regulation, they could pull up the linked questions in order to look at this element in greater detail). It is not intended that users of the framework respond to every question, but that they draw on the bank of questions as a resource to support value sensitivity for their respective HUD activities.

Conclusion

Given the growing interest in drone deployment in the humanitarian sector, and a more favourable regulatory environment in adopting drones in the civilian context in recent years, the ethical implications of HUD and governance guidance addressing them have received increasing attention. This trend indicates a heightened awareness of ethics among scholars and practitioners, echoing the debate about the rise of the "good drones" in the aid sector. Our research sits at the intersection of three domains: applied ethics, humanitarian studies, and science and technology studies. We drew on the findings of existing research to bring together insights from the theoretical and the experiential and to inform the development of an ethics assessment framework that is empirically informed and responsive to stakeholders' expressed interests. Those interests range from strengthening public health outcomes, to managing airspace regulations and promoting community wellbeing, as well as their real-world needs – encompassing economic, political, commercial and reputational concerns.[67]

Like many other contemporary frameworks,[68] the FEADH is a multi-level instrument, with components ranging from general values, to key questions guiding relevant ethical decisions, to resources for institutional preparedness. In its decision chain, it guides the user through a sequence of key questions in relation to problem identification, ethical justification, legal obligation, mission alignment and

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66 See above note 62.
67 N. Wang, 2019, 2020, above note 31; N. Wang, 2021a, 2021b, above note 36; N. Wang, M. Christen and M. Hunt, 2021, above note 4.
68 European Commission, *Ethics Guidelines for Trustworthy AI*, Brussels, 8 April 2019, available at: https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai.

operational consequences, and operationalizes the areas of inquiry with questions to guide reflection and deliberation. The empirically informed and consultative process of developing the framework enabled us to draw on a range of sources of insight and knowledge on this topic, and also to identify perceptions and key areas of concern for individuals involved in, or affected by, HUD.

By integrating considerations related to normative values, institutional preparedness, and key questions to ask across the decision chain related to the implementation of a drone project, the framework makes a distinctive contribution relative to other resources currently available in this area. One generic limitation of the framework is that it will likely become outdated with future technological and policy developments. Relatedly, its practical use with respect to variations across use cases might reveal some ambiguities or considerations of alignment that need to be remedied in future versions. The FEADH is, thus, conceived as a "living document" that needs ongoing revision to be responsive to additional challenges, refinements, and learning as HUD continues to evolve in humanitarian action and development programmes.

As feedback is received related to the use of the FEAHD, we believe that the development of additional explanatory or supporting material would be beneficial. Importantly, the document is primarily focused on humanitarian organizations and practitioners, and this is the group (along with academic researchers) who were most involved in consultations around the framework development. We sought to access other perspectives through the two empirical studies in Nepal and Malawi, but additional aspects of this topic are likely to be uncovered through engagement with additional stakeholder groups as HUD activities continue to emerge.

We hope that the FEAHD also provides a starting point for further reflection and discussion among stakeholders to engage with ethics and to support value sensitive innovation in humanitarian and development settings – for example, by providing insights for a methodological approach and structure to develop ethics resources for different domains of innovation. At the same time, our intention is that the FEAHD will continue to be refined through insights from additional perspectives and contexts, and be enriched through the experiences of teams or individuals engaged with HUD and beyond. Ultimately, our objective is to encourage reflection, discussion and deliberation about how values can be taken into account at all stages of considering and using drones in humanitarian settings, along with attention to structured approaches to ethics support.

Annex: Framework for the Ethics Assessment of Humanitarian Drones (FEAHD)[69]

In the sections that follow, we provide additional questions and components with the goal of supporting teams using the FEAHD to drill down and consider

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69 The framework presented herewith in the Annex is a condensed version of the FEAHD. Further resources about the FEAHD and its applications are presented on the project website, above note 62.

further aspects of a particular topic across the decision chain, or an aspect of ethics preparedness. It is not intended that users of the framework consider all of these questions, but rather that they use them as they dial in or dial out their attention between the broader structure of the FEAHD, and looking more closely at a particular aspect, all with the goal of supporting attention to values across the different stages of HUD activities. For an overview of the framework, see Figure 1.

I. Normative orientation: Which values should guide decisions?

Deciding whether and how to embark on a drone project in the aid sector will benefit from attention to how values can be linked to practices through a clear normative orientation. As a starting place for reflection about the humanitarian use of drones, the FEAHD proposes five value orientations based on a review of the literature on ethical issues related to humanitarian drone use, and a series of expert consultations.[70] These values include the following:

- Optimize benefits, minimize harm
- Safeguard justice
- Uphold respect for autonomy
- Adhere to governance standards
- Promote humanitarian principles

II. Decision chain: What questions should be answered when determining drone use?

The decision chain proposes a sequence of key questions that should be asked and answered in making the strategic decision regarding whether and how to use drones in a specified context, and in relation to the five principles noted above. Additional questions are presented below which are linked to each of the main steps of the decision chain. This bank of additional questions is intended to support further lines of reflection for those seeking to delve deeper into a specific component of the decision chain.

- Problem identification: What is the role of drones in resolving the problem(s)?
  - *What is the problem?*
  - *What is the context of the proposed drone use?*
  - *Who are the key stakeholders?*
- Ethical justification: Do the ethical preconditions exist to support drone use in this context?
  - *What are the potential harms and benefits?*
  - *How can justice be safeguarded?*
  - *How can respect be demonstrated?*

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70 Table 4 in the main text provides a detailed account of how these value orientations are contextualized with respect to HUD.

- Legal obligation: Are there regulatory concerns related to the drone use?
- Mission alignment: Is the drone use aligned with humanitarian principles?
- Operational consequences: How should drones be deployed responsibly in this context?
  - *What is the level of involvement and related responsibilities regarding the management of the proposed drone operations?*
  - *What are the technical conditions required to manage the proposed drone operation(s)?*
  - *Will pilot study be conducted prior to the operation(s)?*
  - *How will operation(s) be conducted?*
  - *Will a final evaluation be conducted after the operations?*

III. Institutional foundation: What is the level of organizational ethics preparedness?

Ethics preparedness concerns the structures and processes in place to support an organization's ability for handling ethical issues. A range of resources may contribute to ethics preparedness including policies or guidelines, internal organizational structures such as ethics task forces, or external organizational structures such as ethics advisory boards.

- Ethics policy and procedure: What policies and procedures exist or are needed in your organization to support ethics preparedness?
- Internal ethics task force: Is it feasible to establish a dedicated ethics support structure within your organization?
- External ethics advisory support: What are the possibilities for external ethics advisory support?