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# **Value-sensitive Innovation: Integrating Ethical Values in the Humanitarian Use of Drones**

## **Final Report**

**Official title of the research project:** Value Sensitive Humanitarian Innovation: Opportunities and Challenges to Integrate Ethical Values in the Humanitarian Use of Drones

**For the period from:** October 2018 **to:** August 2021

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**Host institute(s):** Institute of Biomedical Ethics and History of Medicine, University of Zurich; School of Physical and Occupational Therapy, McGill University; Institute of Biomedical Ethics and History of Medicine (IBME), University of Zurich

**Type of report:**  Interim report  Final report

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### ***1. Abstract of the Executive Summary***

Emerging technologies are widely used in humanitarian and development settings by international organizations globally. Drones represent the first wave of robotic technology applied in the humanitarian sector, demonstrating remarkable capacities to speed up humanitarian response and optimize development operations. Although the so-called “humanitarian drones” provide a unique solution to harness the power of innovation in assisting humanitarian and development work, technological innovation intersects with moral norms and beliefs. They also raise questions regarding impacts for vulnerable populations that the sector strives to serve as its mission commitment. This project provided in-depth investigations into the dynamics between human values and technological innovation in the aid sector. It followed a bottom-up approach encompassing a comprehensive literature review and two case studies in Nepal and Malawi (the case studies in Malawi involved two field trips). As a key outcome, a framework for the ethical assessment of humanitarian drones (FEAHD) was developed to help stakeholders enhance value sensitivity in humanitarian drone practices. In addition, six scientific publications, one project video and four webinar videos have been created. These outputs, freely available on a project website, contribute to the ongoing debate around “humanitarian drones”, and shed light on the nature, type and scope of ethical challenges that humanitarian organizations may confront when embarking upon innovation programs.

## ***2. Executive Summary***

### **2.1. Research Plan**

#### *2.1.1. Problem Statement*

The UN Office for the Coordination of Humanitarian Affairs (UNOCHA) anticipates an ever-growing number of populations in need of humanitarian assistance globally due to pandemics, natural disasters, armed conflicts, war, and population displacement. To respond to the needs of affected communities around the world, international organizations are increasingly implementing humanitarian innovation in. These solutions include the use of digital technology, geographic information system, robotics, spatial decision support system, and unmanned aerial vehicles (drones). The latter represent the first wave of robotics applied in the humanitarian sector.

Today, there is an increasing trend of drone use in humanitarian action for post-disaster relief missions, and for long-term development programs. Examples of successful drone use include the 2010 Haiti earthquake (damage inspection), Hurricane Sandy in 2012 (epidemic prevention), Typhoon Haiyan that hit the Philippines in 2013 (rescue logistics), the 2014 Ebola outbreak (medical supply delivery), the 2015 Nepal earthquake (disaster mapping), and the 2020 COVID pandemic (vaccine delivery). These initiatives demonstrate the capacity of drones to facilitate aid supply operations and make emergency responses more efficient. Contrary to the newsworthy reputation of military use, drones are now being portrayed as “life-saving technology for humanitarians to build legitimacy”.

Along with enthusiasm comes uncertainty. Technological innovation intersects with values, norms, beliefs and various moral commitments. In the humanitarian context, the use of novel technology may challenge the principle of “Do No Harm”, may raise questions related to sovereignty, may negatively affect equality and access for at-risk populations in disaster zones and remote areas lacking sufficient healthcare services. On a technical level, practical challenges include risks of data safety, privacy and security, and the potential mal- or dual-use of technology. On a normative level, innovation may disrupt relationships between various actors including introducing new players, may widen inequality between those with access and those without, and may cause unintended harmful consequences that disproportionately affect the vulnerable. To address these concerns, an in-depth investigation and a comprehensive analysis of the ethical issues associated with the humanitarian use of drones is needed.

#### *2.1.2. General Objective*

The objective of this research is to use the example of drones to explore how to integrate ethical values in the use of technology in the humanitarian and development sectors. The rationale is twofold: firstly, the nature of the humanitarian use of drones differs considerably from its civil or commercial use, e.g., precision agriculture, industrial inspection, recreational photography or high-tech film-making. This can give rise to confusions and misconceptions that exist in the on-going ethical debates about drones that must be elucidated. For instance, to date, considerable attention has been given to its military use as a weapon, rendering it a highly controversial topic. In consequence, ethical problems are more explicitly tackled in debates around their use as autonomous weapons, while when they are used for good causes and in the name of humanitarianism, ethical concerns are insufficiently addressed. This may lead to a dilemma whereby, on the one hand, the humanitarian principle of “Do No Harm” is being advocated, and on the other hand, unintended harms to the already vulnerable are being inadvertently evoked.

Secondly, the concept of the humanitarian drone is relatively new, despite having a high profile in discussions about humanitarian innovation, humanitarian ethics, and science and technology studies. Clarifications and examinations of its moral permissibility, and parameters that affect its responsible use, are of critical importance. For example, a growing number of UN agencies, NGOs and private

donors have launched research hubs to explore the impact of humanitarian innovation, demonstrating the political will to implement such initiatives in a safe, responsible and ethical manner. Nonetheless, the extent to which humanitarian drone use has brought positive societal impacts remains ambiguous and uncontested. While innovation solutions may have the potential to provide opportunities to the humanitarian sector to optimize scarce resources and deliver effective relief measures, it is vital to safeguard humanitarian imperatives, understand the dynamics and complexity of the technologically mediated human world, and ensure responsible deployment of technologies in humanitarian action.

### *2.1.3. Hypothesis*

Our preliminary research on this topic has shown that despite the widespread use of drones in military, civil and commercial settings, there is limited knowledge regarding ethical dimensions of its use in the humanitarian setting, as well as a dearth of normative analysis regarding values and principles underpinning technological innovation in humanitarian action more broadly. It should be noted that the technical capacity of drones varies widely between use cases, e.g., image collection *vs.* cargo delivery, which challenges different sets of ethical values. Moreover, the humanitarian use of drones in war zones or conflict scenarios is controversial. Due to considerations of security and protection, the humanitarian community is hesitant to use this high-potential technology in these settings. Further still, the speed, diversity and intensity of drone proliferation represents a structural democratization of technology, decreasing traditional information asymmetries. Hence, we ask whether the current humanitarian and development use of drones can actually add value to operations in the field, what sort of tangible benefits it can provide, at what cost, based on what values, and guided by what principles.

From an ethical perspective, there are two levels of concerns associated with the use of technology: the socioeconomic aspect on the macro level, and the technological aspect on the micro level. On the macro level, challenges such as the potential malicious use of technology, protection of privacy of the vulnerable, and security of sensitive data, touch on the appropriateness of using drones in humanitarian action. For example, drones have long been associated with military and autonomous weapons. A question arises as to whether the drone industry would gain moral capital by shifting perceptions from drones being a weaponized military technology to a powerful humanitarian innovation solution, thereby acquiring moral legitimacy. Even if lawfully used for non-military purposes, drones may still cause fear among populations previously subjected to weaponized drones. Cross-purposing applications for both military and humanitarian uses also risks undermining public trust. Similarly, compared with satellite images, drones provide much more precise and cost-effective imagery, especially when equipped with specialized cameras. Increased acuity heightens ethical concerns for monitoring, surveillance and protection of privacy. One may argue that confidentiality and consent are unlikely to be considered priorities for crisis-affected populations. This may be true to some extent; however, humanitarian crises do not justify ethical misconduct, nor do they permit privacy violations.

On the micro level, technical issues are associated with the cost-effectiveness and risk-benefit ratio of using drones in humanitarian settings. For example, unlike satellite imagery for which processing requires several days, aerial imagery takes only hours to produce, and it will inevitably intensify the Big Data challenge. As the robotics technology and its applications, such as drones, continue to mature, its use becomes ever cheaper, easier and more accessible, yet the challenge of safely and responsibly processing, analysing and storing the captured data persists. A number of ethical issues emerge here, e.g., whether crisis maps should be open source and shared freely to promote rapid and informed decision-making, or be encrypted and access-controlled to minimize security risks. Additionally, humanitarian data may be vulnerable to theft or subject to surveillance from state authorities, which potentially invoke risks to individuals and undermines humanitarian neutrality. This questions the legitimacy of the popular (mis)belief that social problems can be resolved by technological solutions,

and warrants prudent reflection about the balance between technical solutions and the legal, ethical and regulatory implications they may bring about.

#### *2.1.4. Research Methods*

Using drones as an exemplar case, this project seeks to answer three research questions:

1. What is known about the interplay between technological innovation and ethical values, norms and commitments in the humanitarian use of drones?
2. How should the shared or disparate values of humanitarian stakeholders be interpreted and addressed in the development and deployment of drones?
3. What policies and guidance tools can best direct the integration of ethical values in humanitarian drones?

To answer the first question, a scoping literature review of academic and grey literature was conducted to map and analyse the state of knowledge. The review identified scope, depth, key themes and gaps for the subsequent field research. To answer the second question, three field trips around two use cases of drones in the humanitarian and development settings were carried out in Nepal and Malawi. The studies include post-disaster mapping and medical supply delivery. They were supported by project partners from four leading international humanitarian organizations: World Health Organization (WHO), World Food Program (WFP), Médecins Sans Frontières (MSF), and Medair. To answer the last question, an ethical assessment framework was developed, drawing upon the notions of ethical preparedness of humanitarian organizations as well as responsible innovation. The research outputs produced by this project included both scientific publications in peer-reviewed international journals, as well as publicly accessible resources, such as the webinar series about the key research findings, as well as the ethical assessment framework and its associated dissemination video.

#### *2.1.5. Schedule*

The project was prolonged twice in the 2<sup>nd</sup> phase of the research due to the following reasons:

- 1) In August 2020, a cost-neutral prolongation of 3 months was granted, as the final workshop at the Brocher Foundation was rescheduled by the Foundation from January 2021 to June 2021 as a result of the COVID pandemic.
- 2) In June 2021, a cost-neutral prolongation of 2 months was granted to ensure that all financial transactions related to the Brocher Workshop could be processed within the official duration of the project.

The overall schedule including all workshops organized in the project as well as events where project results have been presented to the public are visible on the overview chart on the next page.

Time	2018			2019												2020												2021																																					
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun																																
Tasks	Task 1			Task 2												Task 3												Task 4						Task 5						Task 6						Task 7																			
	Workshops	WS1																											WS2						WS3						WS4																								
	Field Studies	Nepal			Australia												Malawi1												Malawi2																																				
	Research Visits	Canada															USA																																																
	Conf Presentation				CP1												CP2																		CP3																														
	Milestones				MS1												MS2												MS3						MS4						MS5						MS6						MS7						MS8						
	Other Events	E1 E2			E3												E4 E5												E6 E7						E8 E9						E10,E11						E12																		
Task Overview																																	Milestones Overview																																
Task 1: Development of scoping review protocol and case study strategy																																	Milestone 1: Manuscript of 1st publication (Case Study 1)																																
Task 2: Literature review through database search & systematic content analysis																																	Milestone 2: Manuscript of 2nd publication (Case Study 1)																																
Task 3: Time span of field studies																																	Milestone 3: Mid-term project report																																
Task 4: Case study analyses																																	Milestone 4: Manuscript of 3rd publication (Case Study 2)																																
Task 5: Development of the draft governance framework and toolkits																																	Milestone 5: Manuscript of 4th publication (Case Study 2)																																
Task 6: Refinement of the draft proposal																																	Milestone 6: Manuscript of 5th publication (Scoping Review)																																
Task 7: Dissemination of the research outcomes																																	Milestone 7: Draft of governance framework & toolkits (Case Study 3)																																
																																	Milestone 8: Finalisation of framework & toolkits (Framework & videos)																																
Workshop Overview																																	Event Overview																																
Workshop 1: Project pickoff-meeting with all project partners																																	Event 1: Project launch presentation at SNIS HQ (Geneva, Switzerland)																																
Workshop 2: Focus group consultation meeting 1																																	Event 2: Invited talk at Kathmandu University (Kathmandu, Nepal)																																
Workshop 3: Focus group consultation meeting 2																																	Event 3: Invited talk at Swisshes Boston (Boston, USA)																																
Workshop 4: Final dissemination workshop																																	Event 4: Invited talk at Medair HQ (Lausanne, Switzerland)																																
Field Study Overview																																	Event 5: Invited talk at University of Tokyo (Tokyo, Japan)																																
Nepal: One 3-week fieldwork in Nepal (1st field study)																																	Event 6: Invited talk at the Hastings Center (New York, USA)																																
Malawi: Two 2-week fieldwork in Malawi (2nd field study)																																	Event 7: Invited talk at the World Economic Forum (San Francisco, USA)																																
Research Visit Overview																																	Event 8: Invited talk at the Digital Society Initiatives, University of Zurich (Zurich, Switzerland)																																
Canada: One 3-week-visit at McGill University, Montréal. Focus: development of scoping review protocol & case study																																	Event 9: Invited talk at the June NanoTalk (Zurich, Switzerland)																																
Australia: One 6-month-visit at Monash University, Melbourne. Focus: pilot database search of the literature review, analysis of 1st case study, writing of 1st & 2nd papers. <External funding - SNSF>																																	Event 10: Invited talk at the ICRC DigitHarium - April Digital Delimmas Debate (Geneva, Switzerland)																																
USA: One 6-week-visit at the Hastings Center, New York. Focus: publication development of 1st & 2nd papers.																																	Event 11: Invited talk at the IEEE SSIT Distinguished Lecture Series (Dublin, Ireland)																																
Conference Presentation Overview																																	Event 12: Project conclusion presentation at University of Zurich (Zurich, Switzerland)																																
Conf 1: Presentation of 1st paper at the Autonomous Systems Conf (Zurich, Switzerland)																																																																	
Conf 2: Presentation of 2nd paper at the 2019 IEEE ISTAS Symposium (Boston, USA)																																																																	
Conf 3: Presentation of 3rd paper at the 2020 IEEE ISTAS Symposium (Tempe, USA)																																																																	

Table 1: Project timetable

## 2.2. Analysis of Research Results

This project comprises three work packages – a scoping literature review, two case studies (involving three field trips), and an ethical assessment framework. The objective of the scoping literature review was to map out the knowledge landscape about the research topic, which resulted in a journal article that was published by the *Journal of Science and Engineering Ethics*. The two case studies took place in Nepal and Malawi during 2019-2020, in settings where drones were used for post-disaster mapping and medical supply delivery purposes respectively. These studies yielded four publications, including two journal articles and two conference papers, all published by the *IEEE*. Finally, the work was concluded with the development of an ethical assessment framework to assist decision-making processes on the use of humanitarian drones for a wide range of stakeholders, which resulted in another journal article that has been submitted to the *International Review of the Red Cross*. The project, thus, resulted in six publications published or submitted to top-tier journals and conference proceedings in the fields of technology ethics and humanitarian studies, a webinar series (consisting of six video outputs), and an ethical assessment framework (disseminated to a number of international organizations). These outputs mark an impressive tally for a PhD project – not only do they collectively represent a novel contribution to knowledge on the research topic, but they also demonstrate the level of scientific originality and quality of the work.

From the *research design* perspective, the project focuses on a timely topic of technology ethics with high relevance to the humanitarian and development contexts. The topic is embedded in a plethora of ethical, social and legal implications (ELSI) related to the ongoing digital transformation faced by the aid sector, which is unfolding at the same time as the global community is confronted with humanitarian crises that threaten the survival and prospects of affected populations. The humanitarian use of drones has the great potential to benefit at-risk populations and help them cope with difficulties and distresses caused by war, conflict, disaster or epidemics. These applications have, therefore, generated lively debates among practitioners as well as in the academic literature on the ELSI of using drones in the global aid sector. Given that a growing number of UN agencies, NGOs, philanthropic foundations, and private donors are involved in the humanitarian drone community, yet there has been little rigorous

evaluation of the impacts and the socioeconomic determinants of these potentially disruptive technological interventions, the outcomes of the research bridges an important knowledge gap in the current discourse on drone ethics specifically, and on robot ethics more broadly.

With respect to *methodological approach*, it is worth highlighting that a particular strength of this work is the integrated research architecture – the way in which the research questions are being addressed is through the combination of literature review, qualitative fieldwork, and stakeholder consultation. This approach reflects a strong commitment to engage with lived experiences of people with direct interactions with humanitarian drones, as well as synthesizing existing knowledge on the topic, as a precursor to the development of the normative framework. More specifically, the literature study provides a strong foundation for this program of research. In a rigorous process, almost 1200 identified papers underwent screening and selection. The resulting classification scheme is the most comprehensive review of the knowledge gap on the ethics of humanitarian drones found in both academic and grey literature to date. Four case-study related papers then presented the results of the fieldwork, which relied on rich material obtained through interviews with diverse groups of stakeholders in Malawi and Nepal. The analyses extended beyond the main topics that have received most attention in the current debate (e.g., privacy, consent), and drew attention to less studied ethical concerns that tend to be downplayed or overlooked (e.g., expectations, community engagement). Finally, the ethical assessment framework of humanitarian use of drones provided an excellent example of how to turn empirical and theoretical research findings of a scholarly nature into practical guidance tools to support ethical deliberation in practice. The development of the framework was leveraged upon a robust consultation process, which generated huge interests in the immediate adoption and further implementation of it among the experts and stakeholders.

### **2.3. Evaluation of Research Outcomes**

This project was funded by the Swiss Network for International Studies (SNIS) for a period of two years in 2018. The project team comprises three researchers, including two Project Coordinators (Dr. Markus Christen, University of Zurich, Switzerland; and Dr. Matthew Hunt, McGill University, Canada) and one Principal Researcher (Dr. Ning Wang, University of Zurich, Switzerland). During the course of the research, the Principal Researcher received a personal grant from the Swiss National Science Foundation (SNSF) for six months, from March to June 2019, which was integrated in the project (approval by SNIS). Additionally, due to the COVID pandemic, the project was delayed for three months (without incurring financial costs). As such, the project was officially launched in October 2018 and ended in June 2021, running over nearly three years' time. A final prolongation of two months until 31 August 2021 was granted only for administrative reasons to ensure that all financial transactions related to the final dissemination event (as well as all research outputs including publications, videos and the framework) to be finalized and approved by the UZH Finance Office (see Section 4, Budgetary Report).

This project is highly *inter-disciplinary and collaborative* in nature. We have in total seven project partners across public, private and academic sectors. These include international organizations, such as WHO, WFP, MSF, and Medair; as well as academic institutions, such as McGill University (Canada), University of St. Gallen (Switzerland), and the Free University of Brussels (Belgium). In addition, we have an informal advisory committee composed of a number of international organizations, ranging from donor agencies in the humanitarian and development sectors to specialized industry associations to United Nations and NGOs, who are interested in our research findings, and are the target audience of our policy outcome. Throughout the entire project, we worked closely with these partners at different phases, from the project launch event, to the case studies, to framework development, and to the final dissemination event. Our collaboration also took place in various formats, including thematic meetings, site visits, written feedback, as well as focus group consultations.

In general, we deem the results obtained from the research in this project satisfactory. Our evaluation is based on three variables: *timeline*, *scope of activity*, and *quality of outcomes*. Across the 33 months' timespan of the project, various sets of activities have been carried out, the result of which led to the timely achievements of the eight project milestones (with minor delays due to the COVID pandemic). Specifically, in the 1<sup>st</sup> phase of the project, we organized one project kick-off workshop, followed by two case studies (involving three field trips) in Nepal and Malawi, three research visits in Canada, Australia and USA, two conference presentations in Switzerland and USA, and seven events including invited talks and panel discussions across the world. In the 2<sup>nd</sup> phase of the project, despite the ongoing pandemic and lockdowns, we organized three workshops (two online and one onsite, the latter co-funded by an external grant received from the Brocher Foundation) related to the policy outcomes of the research, followed by a remote conference presentation, and five more invited talks and panel discussions including the final dissemination event of the project.

Overall, the project is composed of diverse and dynamic activities encompassing both scholarly and public-facing ones, leading to fruitful and successful accomplishments of the intended project objectives. The research results obtained are collectively presented in the Principal Researcher's PhD thesis, entitled "Value Sensitive Innovation: Integrating Values in the Humanitarian Use of Drones", which was publication-based and was successfully defended on 22 June 2021 in Zurich, Switzerland. Details of all research activities are outlined in the Timeline table in Section 2.1.5. The table below provides a summary of the originally planned and finally achieved results.

Result item	Results achieved in first period (until June 2020)	Results achieved in second period / final results (as of August 2021)
Literature review	<ul style="list-style-type: none"> <li>- Scoping review protocol has been determined</li> <li>- Search protocol has been pretested and adapted</li> <li>- Preliminary search results have been screened to refine analysis scheme</li> <li>- Main search has been executed in April 2020</li> </ul>	Paper (5); see Section 2.6.
First case study	<ul style="list-style-type: none"> <li>- On site visit completed (3 weeks)</li> <li>- 10 interviews conducted</li> <li>- 10 interviews transcribed</li> <li>- 10 interviews analyzed for publications</li> <li>- Results presented at 2 conferences</li> <li>- Results published in 2 papers</li> </ul>	Paper (1) and (2); see Section 2.6.
Second case study	<ul style="list-style-type: none"> <li>- On site visit completed (2 weeks)</li> <li>- 12 interviews conducted (2 of them in US)</li> <li>- Transcription of interviews ongoing</li> </ul>	Paper (3) and (4); see Section 2.6.
Third case study	<ul style="list-style-type: none"> <li>- On site visit completed (2 weeks)</li> <li>- 7 interviews conducted (2 of them online)</li> <li>- Transcription of interviews ongoing</li> </ul>	
Dissemination and Toolset	<ul style="list-style-type: none"> <li>- Additional funding for focus group workshop (Brocher Foundation) achieved</li> <li>- Contacts to experts established</li> <li>- Dates for Focus group workshop determined</li> <li>- Plan for video discussed with SNIS (remark: an originally planned video in Guatemala has been replaced by a project overview video due to the pandemic).</li> </ul>	Final dissemination workshop June 1-3 2021 at the Brocher Foundation, Geneva. Toolset consisting of: <ul style="list-style-type: none"> <li>- Policy paper (6), including the FEAHd framework</li> <li>- Project overview video</li> <li>- Five webinar videos</li> <li>- A6 "Post card" summarizing FEAHd for marketing purposes</li> </ul>

**Table 2: Overview project results**

## 2.4. Practical and Policy Applications of the Research

Since its very conception, this project was conceived of as *an empirically-informed normative study*. We envisioned that empirical data collected from the literature review and the case studies would be critically appraised in order to develop policy outcomes to facilitate real-world decision-making about using drones in the humanitarian settings. This bottom-up approach manifests itself through not only the scientific publications, but especially the governance framework and the practical tools developed towards the end of the project. The practical applications include a series of webinars introducing the context in which drones are being deployed, the kind of ethical challenges emerged from these contexts, and the analysis of lessons learnt from these use cases. The webinar series consist of six stand-alone videos, which are of both dissemination and education nature, and are publicly available and can be accessed at the designated website of the project ([www.ethics.dsi.uzh.ch/projects/FEAHD](http://www.ethics.dsi.uzh.ch/projects/FEAHD)).

The key policy output of this project is the “*Framework for the Ethical Assessment of Humanitarian Drones (FEAHD)*”. It was developed by the research team in consultation with the project partners. The Working Paper attached to this report outlines how the Framework was developed and explains its content and how it can be used. Specifically, the framework is focused on a specific problem: how to identify, interpret and integrate ethical values in the humanitarian use of drones. It aims to create a pragmatic tool to aid decision-making for the humanitarian drone community, and to fill a gap between high-level, principle-based guidance related to humanitarian innovation on the one hand, and detailed process-oriented checklists for drone operations on the other hand. While the target audience is humanitarian organizations, the framework is relevant for a wider range of stakeholders including governments, industry members, regulatory authorities, scholars and thought leaders, as well as technology developers, designers and engineers. The framework and its associated checklist are publicly available and accessible and can be accessed at the designated website of the project.

To illustrate, on the next page is a visual presentation of the framework. It consists of three levels of deliberation – normative orientation, institutional foundation, and a decision chain – addressing different sets of considerations in a holistic manner. On the normative level, the ethical values important to stakeholders are outlined to inform the decision-making regarding drone use. On the foundational level, resources of ethical support are suggested to facilitate reflection within an organization. These two sources of guidance are interconnected and jointly provide a value-based decision chain regarding whether to deploy drones and how to manage drone operations responsibly. The merit of such a conceptual contribution as *an applied ethics guidance*, alongside practical tools devised and validated for operational applications, lies upon its provision of an immediately accessible approach for the involved stakeholders to engage with values and ethics that need our collective attentions.

As an instrument to enhance the use of the Framework, a visually appealing “Post Card” version in print (format A6) has been created, which summarizes the framework and points to the project website where additional resources can be found. This “FEAHD Post Card” is available both electronically and in physical copies, which will be distributed among the project partners and other targeted international organizations within the Geneva INGO community.



# Framework for the ethical assessment of humanitarian drones (FEAHD)

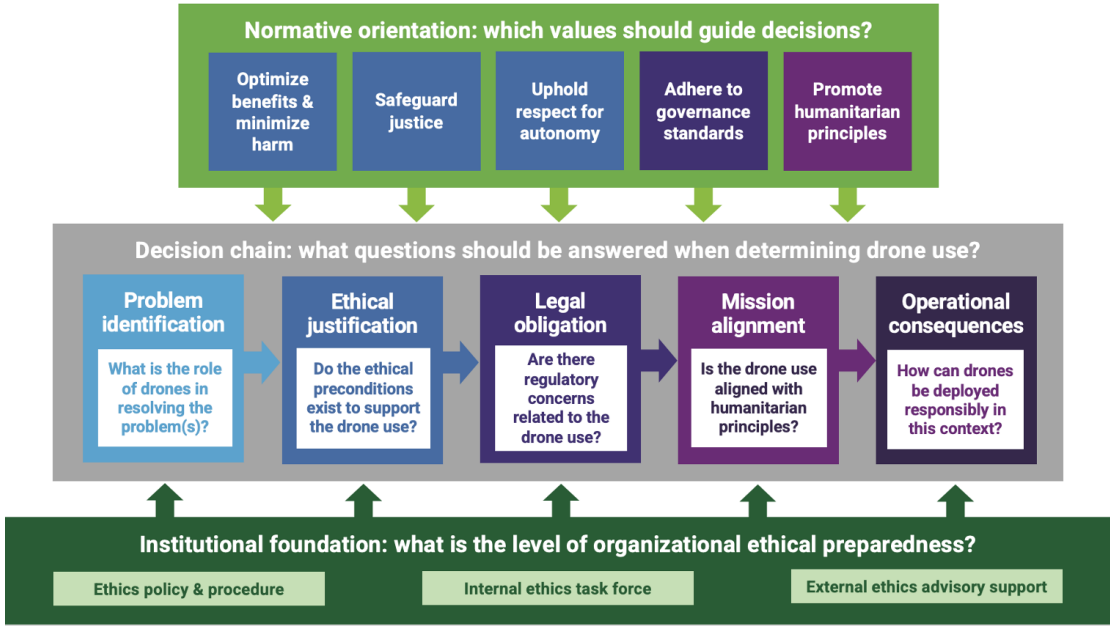


Figure 1: Overview of framework

## 2.5. Questions that Merit Further Exploration

Drones are a rapidly developing technology, and the humanitarian community has limited experience in their use. They are after all a tool, and not in themselves a solution to any of the vast problems that humanitarians are currently facing. The full impact of drones in the aid sector is not yet known or predictable. As the exploration of humanitarian applications for drones continues to grow, this uncertainty needs to be addressed from multiple dimensions within the larger context of humanitarian innovation, including especially the *focus on ethical, social and legal implications*. Humanitarians and their potential partners need to continue to assess the true impacts of employing the drone technology, with particular attention to the opportunity costs. Humanitarian aid requires efficient human-to-human interactions and a context-specific understanding of the situation on the ground. While drones can significantly contribute to the comprehension of the conditions in a crisis, or provide timely aid supplies to affected populations, they cannot replace humanitarians who work directly with the communities. Privacy, security and ethical concerns related to the use of data also arise in many scenarios, especially where the collection, aggregation and sharing of large amounts of data occurs. Humanitarian actors need to address these concerns on a case-by-case basis, and to tackle the issues as a matter of general interest within the community as a whole.

On the conceptual level, future research may also aim to explore more in-depth what *types of ethical guidance frameworks* can best serve the community in need, and how they may be developed in an agile and responsive manner to account for changing values. A key insight from philosophy of technology is that technological artifacts and sociotechnical systems are not value neutral, but support or inhibit certain values. Several philosophical accounts for understanding the embedding of values in technological artifacts have been proposed, and approaches such as Value Sensitive Design, Design for Values, and Responsible Innovation have been established for integrating values into technical design. Nonetheless, a blind spot that requires further attention is the possibility of value change after a sociotechnical system has been designed. Take this project as an example, when drones were first introduced into the humanitarian and development space, privacy, security or benefits sharing were

not necessarily central values recognized by the community, but soon enough stakeholders struggled to incorporate these values into the technical systems. As van de Poel and colleagues have pointed out, progress in the field is currently inhibited by the lack of a philosophical theory of value change in sociotechnical systems, where a dynamic rather than a static account of values is needed to better deal with value change. In this respect, there is a huge potential for researchers working on technology ethics to move into this space and contribute to fill the conceptual gap.

## 2.6. List of Publications and other Activities

The publications are ordered along publication date.

- (1) *“A Successful Story that Can Be Sold”? A Case Study of Humanitarian Use of Drones*  
Author: N. Wang  
Publication date: 20 December 2019  
Journal: Proceedings of 2019 IEEE International Symposium on Technology and Society (ISTAS), pp. 139-144  
DOI: <https://doi.org/10.1109/ISTAS48451.2019.8938015>
- (2) *“We Live on Hope...” Ethical Considerations of Humanitarian Use of Drones in Post-Disaster Nepal*  
Author: N. Wang  
Publication date: 2 September 2020  
Journal: IEEE Technology and Society Magazine, vol. 39, no. 3, pp. 76-85  
DOI: <https://doi.org/10.1109/MTS.2020.3012332>
- (3) *“As It Is Africa, It Is Ok”? Ethical Considerations of Development Use of Drones for Delivery in Malawi*  
Author: N. Wang  
Publication date: 11 February 2021  
Journal: IEEE Transactions of Technology and Society, vol. 2, no. 1, pp. 20-30  
DOI: <https://doi.org/10.1109/TTS.2021.3058669>
- (4) *“Killing Two Birds with One Stone”? A Case Study of Development Use of Drones*  
Author: N. Wang  
Publication date: 28 June 2021  
Journal: Proceedings of 2020 IEEE International Symposium on Technology and Society (ISTAS), pp. 339-345  
DOI: <https://doi.org/10.1109/ISTAS50296.2020.9462187>
- (5) *Ethical Considerations Associated with “Humanitarian Drones”: A Scoping Literature Review*  
Authors: N. Wang, M. Christen, M. Hunt  
Publication date: 3 August 2021  
Journal: Journal of Science and Engineering Ethics  
DOI: <https://doi.org/10.1007/s11948-021-00327-4>
- (6) *An Ethical Assessment Framework to Enhance Value Sensitivity in Innovation: Integrating Values in the Humanitarian Use of Drones*  
Authors: N. Wang, M. Christen, M. Hunt, N. Biller-Andorno  
Publication date: submitted (on 6 August 2021)  
Journal: International Review of the Red Cross

With respect to other activities, four **workshops** have been organized within the course of this project. The results of the project have been presented at **3 conferences and 12 additional events**. Details of

these activities can be found in Section 2.1.5. Finally, *dissemination activities* are currently ongoing, with specifically targeted communication channels and social media outlets, including but not restricted to, the following organizations (this process will continue through to September 2021, when the project website will be officially live):

1) *Project members' existing networks:*

- Digital Society Initiatives: <https://www.dsi.uzh.ch/de.html>
- Humanitarian Health Ethics Network: <https://humanitarianhealthethics.net>
- The IEEE Society on Social Implications and Society: <https://technologyandsociety.org/about-us/>

2) *Project partners' websites/working groups/task forces etc:*

- Global Network of WHO Collaborating Centers for Bioethics: [https://www.who.int/ethics/partnerships/global\\_network/en/](https://www.who.int/ethics/partnerships/global_network/en/)
- The WFP Task Force on Unmanned Aircraft Systems: <https://drones.wfp.org/about-us>
- Medair Innovation: <https://www.medair.org/what-we-do/>
- MSF Innovation: <https://msf-siu.org>

3) *Other interest groups & related resources:*

- International Telecommunication Union (ITU) / Focus Group on AI for Natural Disaster Management: <https://www.itu.int/en/ITU-T/focusgroups/ai4ndm/Pages/default.aspx>
- World Economic Forum (WEF) / Aerospace and Drones at the Center for the Fourth Industrial Revolution: <https://www.weforum.org/communities/drones-and-tomorrow-s-airspace>
- International Committee of the Red Cross (ICRC) / Inspired: <https://blogs.icrc.org/inspired/icrc-innovation/>
- UNICEF / The African Drone and Data Academy: <https://www.unicef.org/innovation/AfricanDroneAcademy>
- World Bank / African Drone Forum: <https://www.africandroneforum.org>
- Gates Foundation Innovation: <https://www.gatesfoundation.org/What-We-Do/Global-Health/Innovative-Technology-Solutions>
- GAVI the Vaccine Alliance / INFUSE: <https://www.gavi.org/investing-gavi/infuse>
- Harvard Humanitarian Initiative: <https://hhi.harvard.edu>
- UAV for Payload Delivery Working Group: <https://www.updwg.org/md3/>

The **project website** will be included in the new website of the UZH DSI Ethics Community, allowing for a long-term hosting of the project results. The Community website is currently under construction and will go online by end of September 2021. Intermediately, for the review, the project videos are available here:

Video about the ethical assessment framework we developed:  
<https://www.youtube.com/watch?v=Ju23FPdWoZ4>

Webinar series about the individual work packages of this project for dissemination purposes:  
<https://www.youtube.com/watch?v=nkn2skGWPfA&list=PL3ETYHRMe4hi84gayfi7aZTess-bHZpb4f>

## ***5. The Working Paper: A Framework to Enhance Value Sensitivity in the Humanitarian Use of Drones***

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### **Abstract**

*The current humanitarian use of drones is focused on two applications: disaster mapping and medical delivery. In response to the growing interest in drone deployment in the aid sector, we propose the Framework for the Ethical Assessment of Humanitarian Drones (FEAHD) to help enhance value sensitivity in humanitarian innovation activities. Following a bottom-up approach encompassing a comprehensive literature review and two empirical studies, this work illuminates the nature, type and scope of challenges humanitarian organizations confront when embarking upon innovation programs. The framework fills a gap between high-level, principle-based guidance related to humanitarian innovation, and detailed operation-oriented checklists for drone projects. It is, thus, interdisciplinary, empirically-informed, and responsive to stakeholders' expressed interests.*

### **1 Introduction**

Emerging technologies are widely used in humanitarian and development settings by aid agencies around the globe (Wang, Christen et Hunt 2021, van Wynsberghe, Soesilo, et al. 2018). As humanitarian needs and the complexity of aid programs in challenging conditions continue to expand, populations affected by natural disasters or who live in remote locations experience significant obstacles to restore safety in post-disaster environments or to receive aid supplies. This situation potentially widens the gap of equitable access to aid assistance and supplies for the most vulnerable. Addressing these barriers gives drones new purposes beyond their military origins. 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 (Chow 2012, Choi-Fitzpatrick 2014, Custers 2016). According to van Wynsberghe and Comes (2019), the first drones deployed in the humanitarian sector were used for peacekeeping surveillance in the Democratic Republic of Congo in 2006 (Karlsrud et Rosén 2013). The current practice of the humanitarian use of drones (HUDs) revolves around two main applications: disaster mapping and medical supply delivery. The “good drones”, or more specifically, the “humanitarian drones” offer novel solutions that harness this technology to provide disaster relief or aid supplies to those in need (van Wynsberghe et Comes 2020).

The rising use of the “good drones” has required the engagement of a range of actors. Aircraft and drone manufacturers, airspace regulators, insurance companies as well as public health, development and humanitarian workers had not had to work together so closely in the past. Ministries of Health and national aviation authorities typically do not interact with each other either. This situation presents communication and operational challenges given the different areas of expertise and vocabulary used

in daily operations (Soesilo, et al. 2016). Organizations active in the humanitarian field, such as Medair, Médecins Sans Frontières (MSF), the United Nations Population Fund (UNFPA), the United Nations Children’s Fund (UNICEF), the World Food Program (WFP), and the World Health Organization (WHO), have explored the use of drones for cargo delivery. Donors, including the US Agency for International Development (USAID), the Gates Foundation, and the Rockefeller Foundation, have funded cargo drone projects. Other organizations, such as the World Bank Group (WBG), the World Economic Forum (WEF), and the International Civil Aviation Organization (ICAO), are engaged in regulatory development or governance work related to HUDs.

Another key actor is the drone industry. It is dynamic and changing quickly, and has been described as reinventing itself every eight years (Soesilo, et al. 2016). 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 innovations and demands of 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 (Soesilo, et al. 2016). 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 (Soesilo, et al. 2016). 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 humanitarian organizations are ill-equipped to handle (Raymond, Card, & Al Achkar, 2012; Donini & Maxwell, 2013; Sandvik & Lohne, 2014; Lichtman & Nair, 2015; Sandvik & Raymond, 2017; van Wynsberghe & Comes, 2020).

This complex interplay of diverse stakeholders in the case of HUDs points to a more fundamental issue: increasingly, innovation has become a buzzword in the humanitarian field, appearing in institutional initiatives, donor speeches, policy documents, and media coverage (Sandvik 2015). It is important to note that technological innovation intersects with values, norms, beliefs and moral commitments (Wang, 2020; Wang, 2021a; Wang, Christen, & Hunt, 2021). However, there has been limited scholarly assessment that critically analyses the relationship between innovation and humanitarian principles (Sandvik, 2015; Wang, Christen, & Hunt, 2021). As a result, the relationship between innovation and experimentation may be obscured, with more tangible, but less understood and addressed, impacts on affected populations and humanitarian work with uncertain or unevenly shared benefits (Sandvik 2015). 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 HUDs.

This article aims to contribute to such an analysis by introducing an ethical assessment framework that aims to help involved stakeholders to enhance value sensitivity when embarking upon innovation programs related to HUDs. Here, value sensitivity entails close attention on the part of all stakeholders to how values are implicated and engaged by innovation activities. The framework seeks to fill a gap between high-level, principled-based guidance related to humanitarian innovation on the one hand (Betts et Bloom 2014, HIF-ALANAP 2019), and detailed, operation-oriented checklists for drone users on the other hand (WBG 2017, USAID 2019, ICAO 2020, HHI 2021). In what follows, first our methodological approach used in the development of the framework is sketched in Section 2. Section 3 provides an ethics landscape of HUDs, which is based on the findings of our research program, to identify areas of concern that should be addressed in an ethical assessment framework. Section 4 offers a comparative review of six selected guidance documents related to the ethics of HUDs to contextualize our framework in light of existing work. Section 5 features the proposed framework, providing more details about specific ethical guidance and its application. Section 6 concludes with a discussion about the strengths and limitations of the framework, as well as future work on this topic.

## 2 Methodological Approach

The ethical assessment framework proposed in this paper is focused on a specific problem – how to identify, interpret and integrate ethical values in the humanitarian use of drones. It aims to create a pragmatic device to aid decision-making for the humanitarian drone community. It consists of three levels of deliberation – normative orientation, institutional foundation, and a decision chain – addressing different sets of considerations in a holistic manner. The merit of such a contribution as applied ethics guidance is to provide actionable and accessible support for stakeholders to engage with values and ethics in initiating drone-related innovation programs in the humanitarian sector.

The framework was developed following a bottom-up approach. First, key areas of ethical concern for HUDs were mapped based on our previous work on this topic: a scoping literature review and two empirical studies focusing on disaster mapping and medical delivery respectively (Wang, 2019; Wang, 2020; Wang, 2021a; Wang, 2021b; Wang, Christen, & Hunt, 2021). Second, existing guidance documents on HUDs related to the areas of concern identified in the first step were reviewed. Third, based on this analysis, an ethical assessment framework was developed through an iterative four-stage stakeholder consultation process<sup>1</sup>. Insights gained through this process led to the final revision of the framework presented in detail in the Annex.

## 3 State of Knowledge about Ethics and HUDs

### 3.1 Scoping Literature Review

Our scoping literature review aimed to identify and assess how ethical considerations associated with HUDs are discussed in the academic and grey literature (Wang, Christen et Hunt 2021). Our main objective was to map and analyze the state of knowledge regarding what is known – and unknown – about the interplay between technological innovation and ethical values, norms and commitments related to “humanitarian drones”. 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 HUDs. The analysis was complemented by two expert consultation meetings that took place in October 2020, whereby eight experts helped us identify potentially missing or overlooked areas. This step led to refinement of the analysis. The review findings mapped key areas of ethical concern related to HUDs: minimizing harm, maximizing welfare, substantive justice, procedural justice, respect for individuals, respect for communities, regulatory gaps, regulatory dysfunction, perceptions of humanitarian aid and organizations, relations between humanitarian organizations and industry, and identity of humanitarian aid providers and organizations.

The review presents a portrait of the expanding literature from 2012 through early 2020 related to HUDs, 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 ethics of 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 for venture capital funds, and private sector engagement increases in the humanitarian space) (Wang, Christen et Hunt 2021). The findings broadly overlap with the general ethical, legal and social implications (ELSI) agenda that is widely used for technology assessment, while highlighting distinctive considerations for HUDs. 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 (HIF-ALANAP 2019), and which has led to a growing and diverse literature in its own right, including many papers critically

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<sup>1</sup> The stakeholder consultation process consists of five stages: (1) The first draft was circulated among 19 experts to obtain written comments at the beginning of 2021. (2) In an online workshop held on 23-24 March 2021, 14 experts provided remarks and insights to the first draft. (3) The second draft was developed and subsequently sent to the same group of experts to solicit further feedback. (4) The third draft was developed and shared among a small group of stakeholders in a three-day hybrid-format workshop held on 1-3 June 2021, during which time the framework was tested against real-world scenarios in a simulation exercise. (5) Based on the final feedback obtained at this workshop, the framework was finalized and included in this article.

examining ethical issues associated with innovative practices, processes and products, as well as efforts to develop ethics guidance for innovation projects (Bloom et Faulkner 2016, Scott-Smith 2016, White 2019, Roth et Luczak-Roesch 2020).

### 3.2 *Empirical Studies*

The aim of our empirical studies was to provide an in-depth analysis of the scope, type and level of ethical considerations raised by practitioners and stakeholders in using drones in the humanitarian and development settings in specific locales. Our 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 attempted to find a solution to restore safety by using drones to map the area (Wang, 2019; Wang, 2020). Based on qualitative interviews conducted in 2019, this study demonstrates a lived example where different stakeholders, who previously never crossed each other's paths, were brought together in a humanitarian innovation initiative. At the centre of the analysis lies an ideology of technological utopia, around which the post-earthquake Nepal has been repeatedly portrayed by the advocates of technological innovation in the humanitarian sector as "a success story that can be sold" (Wang 2019). In such narratives, technology is often depicted as the "magic solution" to resolve social and structural problems, while the aid sector is branded as forwarding-looking innovation pioneers as opposed to aid providers (Wang 2019). Ultimately, the analysis can be distilled to two aspects: (1) the role of technology in a sensitive and complex context where diverse factors are at play, all of which may trigger vulnerabilities of affected populations; and (2) the role of the aid sector in an increasingly technologized ecosystem, the impact of which may suggest new ways of delivering humanitarian services, and may challenge the fundamental humanitarian principles (Wang 2020). Based on an inductive analysis, ethical considerations were identified related to community, technology, data, regulation, and stakeholders (Wang 2020).

Our 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 (Wang, 2021a; Wang, 2021b). In this context, in-depth interviews allowed us to identify 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, while allowing for tests and trials of their products on a large scale in countries in which need is profound and regulation is relaxed (Wang 2021b). This dual-purpose approach is potentially problematic because introduction of new technology to development programs can have unexpected consequences to the vulnerable populations involved. Additionally, although the culture of taking risks and accepting failure is mainstream in innovation, such attitudes may not suit the humanitarian contexts, where fundamental principles are derived from moral imperatives of humanity, impartiality, neutrality and independence (Wang 2021b). This study offers insights for critical reflection on the trend of the "African Drone Rise" in recent years, 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) in the context of the emergent "African Drone Rise", what are the social implications of such practices across different settings? and (2) what is the normative role of technology in the aid sector, especially where it appears to be a solution looking for a problem? (Wang 2021a). These findings then led to the development of lessons learned regarding safety, operationality, and sustainability (Wang 2021a).

Overall, the two empirical studies complement the scoping literature review by identifying areas of concern through investigations of real-world drone use cases as well as ethical issues that emerged from these cases. A main insight gained through these studies is that the use case (mapping vs. delivery) implicates distinct, and partially overlapping, sets of ethical values. Additionally, the relation between the tech industry and the humanitarian sector adds a new layer of complexity to the power dynamics

among involved stakeholders, especially local communities affected by disasters or living in resource-constrained settings.

### 3.3 *The Ethics Landscape and Implications for HUDs*

Our literature review and empirical studies point to the following issues that are of particular relevance in developing a governance framework that promotes value sensitive innovation for HUDs. Firstly, a key concern for HUDs is the possibility that the humanitarian space has become a “testing zone” to advance drone technology that may be implemented elsewhere. Commentators have suggested that the cost pressure from 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 (Chow, 2012; Sandvik, 2015; USAID, 2017). This arrangement, however, may create a dynamic in which companies and citizens of wealthy countries benefit from the information learned from flight experiments or proofs of concept conducted in low income or disaster affected countries. Conflicts may also result between countries and companies over intellectual-property rights and the sharing of benefits derived from drone testing (Chow 2012, Soesilo, et al. 2016). From this perspective, initiatives to test drones in humanitarian operations should assess how a wide range of benefits and risks will be apportioned, and whether the operations will be sustainable in the long run.

Secondly, concerns have been raised that the drone industry may seek legitimacy through HUDs and that it may facilitate the expansion into new markets as military funding dries up, driven by financial rather than humanitarian motives (Donini & Maxwell, 2013; Sandvik & Lohne, 2014; Sandvik & Raymond, 2017). Similarly, O’Driscoll suggests that drone companies may associate themselves with humanitarian organizations as part of a public relations and marketing campaign to “green wash” lingering perceptions of drones as “killing machines” (O’Driscoll 2017). 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 (Sandvik 2015, O’Driscoll 2017). These aspects highlight the importance that when assessing the ethical implications of a potential drone project, considerations should be directed toward the possibility that enthusiasm for drones as a novel approach in this setting might displace other, potentially simpler and more effective solutions.

Thirdly, there is a fear that the use of drones in humanitarian operations may create distance between humanitarian responders and those in need, turning humanitarian responses into a new form of virtual reality for global audiences, which could eventually lead to less empathy for affected populations (Sandvik et Lohne 2014, Raymond, Card et Al Achkar 2012). In addition to the psychological aspect, responsibilities of humanitarian aid providers also have liability implications: current regulatory frameworks lag behind technological developments, and counter-drone technology such as geofencing is often not fully effective in civilian settings due to legal restrictions. Consequently, those wishing to use the technology face a range of hurdles with respect to legality, coordination and safety (Martins, Lavallée et Silkoset 2020). These concerns lead to the questions of whether humanitarian organizations actually are in the position, or have the capacity, to manage the development, operation, and procurement of drones, and whether these funds should be spent elsewhere (Sandvik et Lohne 2014).

Lastly, the aforementioned concerns related to HUDs resonate with broader ethical issues that have been identified related to the civilian use of drones in High Income Countries. The multiple applications of drones in the current COVID pandemic may serve as an example here. To name just a few: state surveillance through drones (to enforce quarantine measures), technology acceleration with a faster integration of drones in the airspace, function creep, societal concerns regarding privacy and data protection, security and safety issues, as well as the potential abuse of the state of emergency with



the normalization of exceptionalism to pursue other objectives than the fight of public health crisis (Martins, Lavallée et Silkoset 2020). These broader societal issues convey an important message: as humanitarian organizations consider the uptake of HUDs, they should take stock of their capacities and the sorts of partnerships that will be required to facilitate drone activities, while also being mindful of reputational and relational risks that may arise as a consequence.

#### **4 Review of Existing Guidance Documents**

HUDs have the potential to give rise to a range of ethical concerns that need to be addressed. Since conceptual frameworks and practical tools can provide guidance to integrate ethical values to support value sensitive innovation, a comparative review of the existing guidance documents specific to HUDs was conducted. The rationale of selection is that of relevance – selected documents must have the key components related to “drones”, “humanitarian” and “ethics”. The review, therefore, is not exhaustive in nature, but rather illustrative. In what follows, six of the most recent and widely known guidance documents will be presented as examples to illustrate the current state of knowledge regarding the governance of HUDs. These documents are produced by leading international non-governmental organizations (INGOs) as well as academic institutions working on the topic. The review includes two INGO governance documents, two INGO and academic joint guidance documents, and two pieces of academic work. Table 1 at the end of section 4.1 offers an overview of the assessment results of the selected documents.

##### *4.1 Existing Frameworks, Guidance and Tools*

###### **4.1.1 The World Bank Group (WBG) Guidance Note: Managing the Risks of Unmanned Aircraft Operations in Development Projects (2017)**

The WBG Guidance Note (hereafter the Note) (WBG 2017) consists of eight main sections, providing an overview of the recent rapid emergence and possible uses of Unmanned Aircraft System (UAS); discussing potential risks and appropriate operational and regulatory considerations that need to be taken into account while planning and executing UAS operations; and presenting recommendations for how to apply UAS technologies within the WBG operations and related client activities. It contains three Annexes, including a *WBG UAS Operational Checklist Form* (hereafter the Form), providing an operational planning framework for UAS operators to apply to each flying task. The aim of the Form is to facilitate a comprehensive pre-flight planning process to ensure that operations are conducted safely, with appropriate authority, and in accordance with existing regulation.

Since the WBG has a responsibility to ensure that all its activities are conducted safely, and that risks are managed appropriately, 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, to data protection and cybersecurity, as well as to the reputation of the organization. It suggests the risk-management process to cover all activities to reduce the possibility of both cultural and systemic failings causing a catastrophic event. Such a process includes three steps: hazard identification around key risk factors, risk calculation with respect to probability and severity, and practical technical solutions to address the identified risks. The Note concludes by calling for a closer exploration of UAS uses for WBG operations, and of the risk factors and associated considerations.

###### **4.1.2 The International Civil Aviation Organization (ICAO) U-AID: Unmanned Aircraft Systems (UAS) For Humanitarian Aid and Emergency Response Guidance (2020)**

The ICAO refers humanitarian aid and emergency response operations collectively as “U-AID”. The U-AID Guidance (hereafter the Guidance) (ICAO 2020) 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 unmanned aircraft systems (UAS), and to

enable an expedited review process for urgent operations. According to the ICAO, the U-AID operations include scheduled and unscheduled medical deliveries or provide emergency response to victims of natural or man-made disasters. The Guidance, therefore, supports Civil Aviation Authorities (CAAs) in their review of requests for UAS operational authorizations in response to humanitarian emergencies, regardless of the status of their UAS regulations. The CAAs and UAS Operators are encouraged to use the information provided in the Guidance as best practice methods for reviewing submissions and developing operational programs.

With respect to regulatory framework, The ICAO encourages States to write UAS regulations using performance-based criteria that indicate a level of safety to be achieved, rather than using prescriptive requirements to the extent practicable. This may be achieved using industry standards, advisory circulars, or other means of compliance accepted by the CAA, who will determine whether the UAS complies with the regulations and whether the safety risk is considered acceptable, prior to issuing an authorization. Regarding the operational requirements, the ICAO distinguishes Humanitarian missions as a result of a catastrophic event from Humanitarian missions for purposes of routine humanitarian delivery by UAS. For the former, the ICAO recommends an expedited submission for an urgent event using an online application form, which will be sent to the air navigation service provider unit for evaluation. The CAA will provide operational input and make the final determination as to whether the expedited application should be used. For the latter, the ICAO recommends a list of submission requirements for the first-time UAS operators, or for applicants who wish to pre-apply for an authorization for future U-AID.

As regards dangerous goods, the ICAO develops international Standards and Recommended Practices that govern the safe transport of dangerous goods on civil aircraft. The Guidance applies to circumstances when a State has determined that the use of UAS to transport dangerous goods for humanitarian aid and emergency response is appropriate. And when granting an operator approval for carriage of dangerous goods, the State of the Operator must ensure that the operator establishes standard operating procedures for the safe transport of dangerous goods, on board or attached to the UAS. In relation to safety risk management, the ICAO recommends conducting the operational risk assessment (ORA) in a systematic, robust and intellectually cohesive manner. The Guidance states that an ORA of U-AID must be developed by the UAS operator and submitted with the application for authorization, and that the appropriate authority must accept any residual risk remaining prior to issuing the authorization. The Guidance recommends the steps regarding the safety risk assessment process, and provides risk mitigation strategy examples, with several methods offered to help create the ORA.

#### 4.1.3 The Humanitarian UAV Network (UAViators) & The Harvard Humanitarian Initiative (HHI) Humanitarian UAV Code of Conduct & Guidelines (2021)

The aim of the UAViators/HHI Code of Conduct (hereafter the Code) (HHI 2021) and its supporting Guidelines (hereafter the Guidelines) is to present a set of principles, obligations, and standards shared by a practitioner community dedicated to the safe, ethical, and effective use of unmanned aerial vehicles (UAVs) during humanitarian emergencies. The first version of the Code was drafted in March 2014 by the Humanitarian UAV Network. It was disseminated publicly as an open and editable Google Doc to solicit feedback, and subsequently reviewed and revised during 2014 and 2015 through an open consultative process via the UAViators Experts Meetings on Humanitarian UAVs, an International Policy Forum on Humanitarian UAVs, and dedicated webinars. In July 2015, the Code was further revised, and additional guidelines identified as priorities were produced, addressing four key areas: Data Ethics, Community Engagement, Effective Partnerships, and Conflict Sensitivity. In 2018, a dedicated website for the Code and Guidelines was launched at UAVCode.org. The latest revisions were made by the Signal Program on Human Security and Technology at the HHI in late 2020, in addition to its own Signal Code and Obligations.

The document seeks to complement and uphold the human rights of affected populations and centre their humanity and needs, to translate core humanitarian obligations into terms consistent with UAV use including the data derived by using these remote sensing technologies, and to articulate minimum standards of practice necessary to uphold humanitarian-specific obligations. It is recommended to be used either by government and private sector actors to align their practices, legal obligations and partnership terms in ways consistent with humanitarians; or by donors to help ensure that their data and practice requirements can utilize UAV-assisted remote sensing without compromising core principles and obligations as understood by expert practitioners. The Code and the Guidelines are two related but separate documents distinct from each other. The former is a standalone document and briefly describes 16 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; and the latter outlines how humanitarian teams are obliged to observe these humanitarian principles in practice *vis-à-vis* four obligations: engage communities, uphold data protection standards, form ethical partnerships, and engage responsibly in conflict-affected environments.

#### 4.1.4 The International Committee of the Red Cross (ICRC) & The Brussels Privacy Hub (BPH) Handbook on Data Protection in Humanitarian Action (2020)

The Handbook on Data Protection in Humanitarian Action (hereafter the Handbook) (ICRC 2020) is a joint publication of the Data Protection Office of the ICRC and the Brussels Privacy Hub, an academic research centre of the Vrije Universiteit Brussel (Free University of Brussels). It aims to further the discussion launched by the International Conference of Data Protection and Privacy Commissioners' Resolution on Privacy and International Humanitarian Action adopted in Amsterdam in 2015. The objectives were to explore the relationship between data protection laws and humanitarian action, understand the impact of new technologies on data protection in the humanitarian sector, and formulate appropriate guidance. The target audience include humanitarian organizations involved in processing personal data for the humanitarian operations, as well as other parties involved in humanitarian action or data protection.

The Handbook consists of 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 and data processing situations, each with a discussion of the relevant data protection issues. These technologies include data analytics and big data, drones/UAVs and remote sensing, biometrics, cash transfer, cloud services, mobile apps, digital ID, social media, blockchain, connectivity, as well as artificial intelligence. In terms of drones, from a data protection perspective, what is important for data collection and processing is not the use of drones *per se*, but the different on-board sensors they are equipped with, such as high-resolution cameras and microphones, thermal imaging equipment or devices to intercept wireless communications. Other issues and fields of relevance on drones *per se*, such as air traffic control issues, flight licenses, equipment safety certificates or similar matters, are hence not dealt with.

The Handbook 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 legal bases including: 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. The section on drones concludes by stressing that data protection impact assessments should be drafted prior to any drone operations, and should cover the specific risks and considerations outlined in the section and be easy and quick to complete and implement.

#### 4.1.5 Technical University of Delft (TU Delft): Drones in Humanitarian Contexts, Robot Ethics, and the Human–Robot Interaction (2019)

The TU Delft paper (van Wynsberghe et Comes 2020) 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 complimented by a technology-facing approach, namely that of robot ethics. In the paper, they discussed about the principles of humanitarian ethics and robot ethics respectively, and raised concerns about HUDs on two levels: (1) for humanitarian workers, the loss of contextual understanding culminating in the de-skilling of workers; and (2) for beneficiaries, a threat to the principle of humanity by reducing human–human interactions, a threat to dignity through a lack of informational transparency, and a threat to dignity by failing to account for the physiological and behavioural impacts of the drone on human actors. They then examined the ethical frameworks available for an evaluation of HUDs, and pointed out that all existing works is missing a focus on the shift in how humanitarian care is provided as a result of the robot's introduction. By exploring two opposing themes in the humanitarian space, namely, respect for the humanitarian principles on the one hand, and the “technologizing” of care on the other, they proposed 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 evaluations of new robots into the humanitarian space.

#### 4.1.6 University of Southern Denmark (SDU) & Technical University of Delft (TU Delft): An Ethical Framework for the Design, Development, Implementation, and Assessment of Drones Used in Public Healthcare (2020)

The SDU/TU Delft paper (Cawthorne et van Wynsberghe 2020) 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 research and development of drones used in public health, and proposed a framework for ethical evaluations and guidance by: (1) using the 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, 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 revolved 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 noted 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 inputs and field studies.

Table 1: Overview of selected guidance documents relevant to HUDs

Nature of Document	Time	Name of Document	Author & Affiliation	Focus of Document	Principles Introduced	Guidance Proposed	Practical Tools Recommended
INGO Governance Document	2017	WBG Guidance Note	World Bank Group (WBG)	Operational Risk Management	N/A	<ul style="list-style-type: none"> <li>• Considerations for UAS operators</li> </ul>	<ul style="list-style-type: none"> <li>• WBG UAS Operational Checklist Form (Annex C)</li> </ul>
	2020	ICAO U-Aid Guidance	International Civil Aviation Organization (ICAO)	Operational Risks in Emergency Response	N/A	<ul style="list-style-type: none"> <li>• Dangerous Goods Management</li> <li>• Safety Risk Management</li> </ul>	<ul style="list-style-type: none"> <li>• Examples of Dangerous Goods that May Be Necessary for Humanitarian Aid or Emergency Response (Appendix 2)</li> <li>• Elements that should be Included in a UA Operator's Policy and Procedures Manual for the Safe Transport of Dangerous Goods (Appendix 3)</li> <li>• Elements to consider as Part of the UA Operator's Safety Risk Management Procedures (Appendix 4)</li> </ul>
INGO & Academia Joint Guidance Document	2020	ICRC/BPH Data Protection Handbook	ICRC & BPH	Data Protection	<ul style="list-style-type: none"> <li>• Fairness and Lawfulness</li> <li>• Purpose Limitation</li> <li>• Proportionality</li> <li>• Data Minimization</li> <li>• Data Quality</li> </ul>	<ul style="list-style-type: none"> <li>• Basic Data Protection Principles</li> <li>• Specific types of technologies and data processing situations</li> </ul>	<ul style="list-style-type: none"> <li>• Template DPIAs Report (Appendix I)</li> </ul>
	2021	UAViators /HHI Humanitarian UAV Code of Conduct & Guidelines	UAViators & HHI	Principles, Obligations, and Standards	<ul style="list-style-type: none"> <li>• Humanitarian Principles</li> </ul>	<ul style="list-style-type: none"> <li>• Operating Principles</li> <li>• Humanitarian Obligations</li> </ul>	<ul style="list-style-type: none"> <li>• 16 operating principles to support the safe, effective and ethical delivery of humanitarian assistance in emergencies (Code)</li> <li>• 4 obligations for humanitarian teams to observe humanitarian principles in practice, as well as UAV-specific objectives and requirements that shape the engagement (Guidelines)</li> </ul>
Academic Analyses	2019	Drones in Humanitarian Contexts, Robot Ethics, and	TU Delft /van Wynsberghe & Comes	Analytical Approach	<ul style="list-style-type: none"> <li>• Humanitarian Ethics Principles</li> </ul>	<ul style="list-style-type: none"> <li>• Integrating robot ethics into the humanitarian ethics</li> </ul>	N/A

		the Human–Robot Interaction			<p>ples (humanity, impartiality, neutrality, and independence)</p> <ul style="list-style-type: none"> <li>• Robot Ethics Principles</li> </ul>	<p>framework as an approach for nuanced and fine-grained ethical evaluations of HUDs</p>	
2020	An Ethical Framework for the Design, Development, Implementation, and Assessment of Drones Used in Public Healthcare	SDU & TU Delft /Cawthorne & van Wynsberghe	Analytical Approach & Ethical Framework	<ul style="list-style-type: none"> <li>• Bioethics Principles (beneficence, non-maleficence, autonomy, and justice)</li> <li>• AI ethics principle (explicitability)</li> <li>• Value sensitive design principles</li> </ul>	<ul style="list-style-type: none"> <li>• Integrating contextually relevant values that can be operationalized in the design, development, implementation, and assessment of drones used in the public healthcare context</li> </ul>	N/A	

#### 4.2 *Comparative Analysis*

As illustrated above, there has been activity by both INGOs and the academic community in providing guidance for HUDs. However, when comparing the content of these documents with the broad spectrum of ethical issues identified in our own work, the documents lack a holistic view in providing guidance. More specifically, the academic work provides mainly principle-based approaches, whereas the INGO governance documents are more based on detailed and checklist-type instructions for flight operations and the like. Joint guidance documents are more comprehensive with respect to granularity (from principle-based to concrete guidance), yet they tend to focus on particular domains of applications, such as data protection, or airspace 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 INGOs, but missing in academic analyses. While ethical issues are generally covered somewhere in most documents, there does not appear to be a tool that is in itself sufficiently comprehensive. Additionally, none of the tools addressed more than 20 of the 27 ethical considerations identified in our scoping literature review (Wang, Christen et Hunt 2021). The most obvious gaps are with respect to broader societal issues, concerning particularly the relationship between humanitarian organizations and the drone industry, or the identity of humanitarian aid providers. Yet, notably, these are the most essential issues regarding strategic considerations for humanitarian actors, i.e., whether a humanitarian organization should involve drones as an innovation application to address concrete problems and in specific contexts. Table 2 below provides a comparison between the identified areas of concern resulted from our own work and the six selected guidance documents.

Table 2: Comparative results regarding areas of ethical concern for HUDs

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 & TU Delft Paper
<b>Harm/Benefit</b>	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
<b>Justice</b>	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
<b>Respect for Autonomy</b>	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
		Focus on broader forms of stakeholder engagement	X	X		X		X
<b>Regulation and Governance</b>	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		
<b>Broader Societal Impacts</b>	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	
		Focus on the power (im)balance between humanitarian						



	Relations between Humanitarian Organizations and Drone Industry	organizations and the drone industry						
		Focus on using drones through “in-house capacity” vs. “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						



## 5 The Proposed Ethical Assessment Framework

Given the growing interests in drone deployment in the aid sector, and a more favourable regulatory environment in adopting drones in the civilian context in recent years, the ethical implications of HUDs 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. Based on the findings of our research program, which is at the intersection of three domains – applied ethics, humanitarian studies, and science and technology studies, we came to realize that a valuable means of drawing together insights from the theoretical and the practical is the development of a conceptual framework that is interdisciplinary, empirically-informed, and responsive to stakeholders’ expressed interests as well as their real-world needs (Wang, 2019; Wang, 2020; Wang, 2021a; Wang, 2021b; Wang, Christen, & Hunt, 2021).

In this section, we propose an ethical assessment framework, synthesizing up-to-date knowledge about explicit and implicit ethical values implicated by HUDs, and how these values should be interpreted and integrated in HUDs practices. We believe that utilizing an ethical framework can help appraise as well as shape the acceptability of a technology as it is unfolding, rather than having to attempt to foresee all the risks beforehand (Cawthorne et van Wynsberghe 2020). 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 humanitarian stakeholders.

### 5.1 *Rationale of the Framework*

Frameworks may well 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 ethical frameworks, the intent is to guide the performance of appropriate actions by aiding ethical deliberation, making relevant values explicit, and offering a justified account for the answers provided to the problems at hand (Clarival et Biller-Andorno 2014). Our objective of developing an ethical assessment framework is to create a pragmatic device to aid decision-making for the humanitarian drone community with respect to integrating ethical values for HUDs, within the broader context of value sensitive innovation.

While our target audience is primarily aid organizations and practitioners, in both humanitarian and development sectors, the application of the framework can as well be relevant for other stakeholders, including industry members, national governments, regulatory authorities, and scholars and thought leaders working on innovation. Echoing the growing awareness of ethics among technologists and engineers, we also expect that the development of an ethical framework will provide an accessible approach for technology developers and designers to engage with ethical issues in need of attention, and can include an ordered series of questions with a clear guidance on when the framework is to be used, how it is to function, and what factors are to be taken into consideration at each step of deliberation (Cawthorne et van Wynsberghe 2020).

### 5.2 *The FEAHD and Its Application*

The framework for ethical assessment of humanitarian drones (FEAHD) consists of three levels of considerations, asking different sets of questions to the potential users. On an overarching level, the ethical values important to involved stakeholders are outlined to inform the decision-making regarding HUDs. On a foundational level, resources for ethical support are suggested to facilitate decision-making within an organization. These two sources of guidance are interconnected and, together, they provide a value-based decision chain regarding whether to embark upon a drone project, and how to manage drone operations in a responsible and sustainable manner. This set of interconnected resources are different in

form and focus, reflecting some key areas identified through a bottom-up approach. They are functionally independent from each other, but can also be used in a coordinated fashion.

In particular, we propose five value orientations on the normative level, based on the findings of our own study on the ELSI of HUDs. These values include: harm and benefit, justice, respect for autonomy, regulatory and governance standards, and humanitarian principles. On the institutional level, we draw on the notion of “ethical preparedness” regarding an organization’s ability to support their staff to respond to ethical issues. These supports may include the most common instruments such as policy and procedure, or internal organizational structures such as an ethics task force, or external organisational structures such as an ethics advisory board. On the operational level, we propose a sequence of questions that should be answered in making the strategic decision about the HUDs. These questions should be asked at particular decision points, taking into account what each operational alternative could involve. Figure 1 below provides a visual presentation of the FEAH. Further details are provided in the Annex, including questions linked to the different components of the framework.

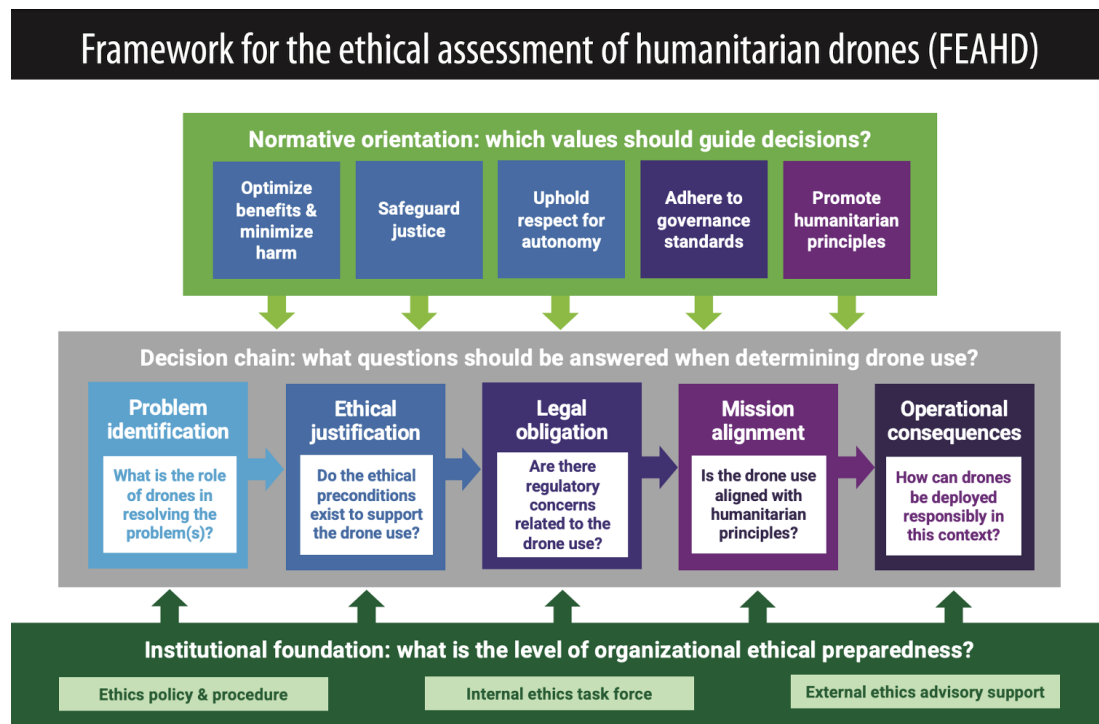


Figure 1: Overview of the Framework for the Ethical Assessment of Humanitarian Drones (FEAHD)

## 6 Conclusion

Like many other contemporary frameworks (European Commission 2019), 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 – problem identification, ethical justification, legal obligation, mission alignment, operational consequences – and operationalizes the areas of inquiry with lists of specific and concrete items. The empirical-informed and consultative process of developing the framework allowed for not only a sufficient scope of inquiry, but also for pinpointing specific issues that are of real-life concern to users.

As a comprehensive practical tool, it can address existing guidance gaps while seeking to avoid the expert-driven, top-down approach that characterizes other guidance documents related to HUDs. One



generic limitation of the framework might be that it is vulnerable to becoming 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 constant revision encompass additional challenges, refinements, and learning as the HUDs continues to evolve in humanitarian action and development programs.

It is worth noting that the development of this framework is our first attempt to propose ethical guidance to assist decision making on HUDs. Against this background, the FEADH provides a starting point for stakeholders to engage with ethics to support value sensitive innovation in humanitarian and development settings – for example, by providing insights for a methodological approach and structure to develop targeted ethical guidance for different domains of innovation. In this sense, the development of FEADH marks the beginning of an important learning process, which can go through iterations in future consultations, or be enriched with more use case studies, both regarding HUDs and beyond. Future work may well take inspirations from our work, conceptually or methodologically, and continue this path of ideation in developing ethical frameworks and actionable normative guidance in particular areas of interest.

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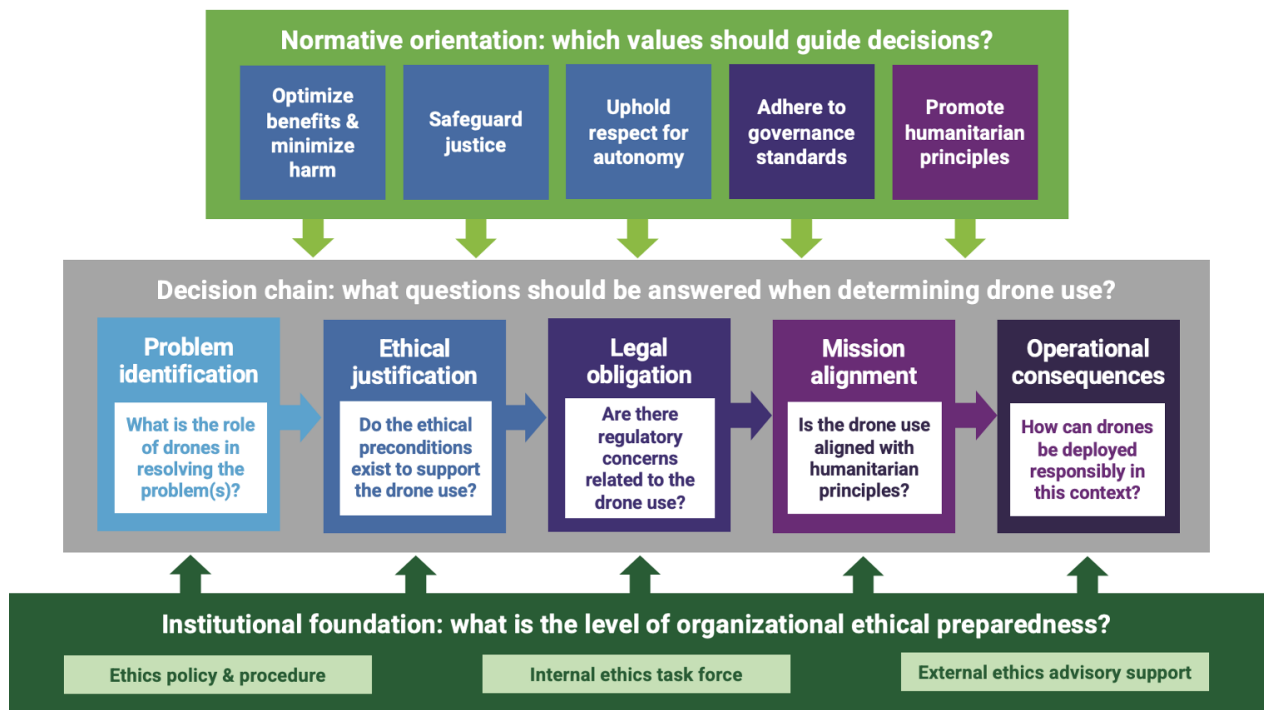
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**Annex: Framework for the Ethical Assessment of Humanitarian Drones (FEAHD)**

**Framework for the ethical assessment of humanitarian drones (FEAHD)**



**I. Normative Orientation: Which values should guide decisions?**



Decision-making process around drone use in the aid sector requires normative orientation. FEAHHD proposes five value orientations based on an extensive study of the literature on ethical issues related to humanitarian drone use<sup>2</sup>.

- **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 questions that should be asked and answered in making the strategic decision regarding whether and how to use drones in a specified context.

- **Problem identification: What is the role of drones in resolving the problem(s)?**
  - ***What is the problem?***
    - Is there a lack of imagery for monitoring or mapping purposes?
    - Are there challenges for the timely delivery of health or emergency supplies?
    - Are there unreliable/unavailable telecommunications in an emergency?
  - ***What is the context of the proposed drone use?***
    - Have drones already been used in this locale?
    - What is the legacy of prior drone activities?
    - What is the general level of literacy, both educational and technological, of the citizens of this locale? What is the leadership structure?
    - Has the local government made long-term commitment regarding the use of drones in this locale?
  - ***Who are the key stakeholders?***
    - Are there any donor(s) involved? What are their specific interests and expectations?
    - Which local governmental authorities will be involved (regulatory authority, relevant ministries, etc)?
    - What are the relationships between the organisation and the local government and key donor(s)?
    - Who are the technical personnel (drone manufacturers, operator, service providers, etc)?
    - Which local communities will be involved? What are their particular needs and expectations?
    - What is required for the organization(s) to interact with the other identified stakeholders?
    - What are the most appropriate stakeholder engagement strategies?

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<sup>2</sup> Table 2 in the main text provides a detailed account of how these value orientations are contextualized with respect to HUDs.



- **Ethical justification: Do the ethical preconditions exist to support drone use in this context?**
  - ***What are the harms and benefits identified?***
    - Are there any harms, actual or potential, that may arise for the involved communities or to the environment due to the proposed drone operation?
    - What are the measures to avoid or mitigate any potential harm(s)?
    - How to ensure the fulfilment of both ethical and legal obligations to optimize benefits and minimize harm?
  - ***How can justice be safeguarded?***
    - Are costs and benefits shared fairly among the stakeholders?
    - Will all affected stakeholders have equitable access to the resources or benefits that the use of drones will generate?
    - Will the costs incurred justify the need to introduce the proposed operation(s)?
    - Is the use of drones cost-effective based on the existing knowledge and evidence?
  - ***How can respect to the involved community be ensured?***
    - Is the involved community aware of the introduction of the proposed drone operation(s)? Might it disrupt the existing relationship with the community?
    - How will the community be engaged and consulted in the project development?
    - What are the ways in which the community members may be informed of the proposed drone operation(s)?
    - Are there dedicated task forces, budget, and communication strategies to proactively engage the involved community?
    - Does the involved community have prior knowledge of, or experience with, drones?
    - Are the community members aware of the concept of “informed consent”, as well as its operational process?
    - What do the community members expect regarding their approval and participation in the process, as well as the outcome of the proposed operation(s)?
    - Has the fair sharing of benefits between the involved communities and the operations teams been appropriately assessed?
    - In the case where the involved communities disagree with or reject the proposed operation(s), what are the alternative solutions to resolve the identified problem(s)?
- **Legal obligation: Are there regulatory concerns related to the drone use?**
  - Are there regulatory and compliance aspects relevant to the proposed operation(s)?
  - Which authorities are involved, and what policies must be adhered to?
  - Are there dedicated personnel to coordinate the regulatory aspects of the proposed operation(s)?
  - Are there any internal compliance procedures that can help manage these processes?





- Are there specific regulations for anticipated risks related to airspace safety, environmental aspects, and data protection?
- Are there any existing regulations or policies governing the involvement of the identified stakeholders (e.g., conflict of interest)?
- In the absence of local regulatory frameworks, is there alternative legal guidance which can be relied upon (e.g., from the home countries of the operations teams)?
- In the worst-case scenario when things go wrong, who will be held accountable?
- **Mission alignment: Is the drone use aligned with humanitarian principles?**
  - Could the introduction of new technology potentially undermine the humanitarian principles of neutrality, impartiality, independence, and humanity, or other committed principles?
  - Will the use of new technology pose potential reputational risks? If so, what are the mitigation measures?
  - Are the roles and responsibilities of involved stakeholders well defined and communicated prior to their engagement?
  - In the case where there may be trade-offs between the proposed solution and inaction (e.g., imbalanced harm-benefits assessment), are there any alternatives to help resolve the identified problem(s)?
- **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 type and degree of inhouse operational expertise is currently available to your organization?
    - Will your organization collaborate with external service providers? What are the terms of these collaborations?
    - Will outsourcing the entire operation(s) as well as related responsibilities to third parties be an option?
    - Are there any third-party organizations based in the locality of the proposed operation(s), which your organization could work with?
  - ***What are the technical conditions required to manage the proposed drone operation(s)?***
    - What type of drones should be deployed?
    - How many drones should be purchased?
    - How frequent should the drone flights be (e.g., short intervals vs. continuous flights)?
    - Are there any adverse factors that may become barriers for drone flights (e.g., weather or connectivity conditions)?
    - What are the anticipated risks in terms of safety, including human, environmental, as well as data safety?
    - Are there any compliance procedures or measures developed, or needing to be developed, to ensure safety and to assist risk mitigation?



- ***Will pilot study be conducted prior to the operation(s)?***
  - Have all technical issues related to safety and security, including human, environmental and data aspects, been properly addressed prior to the proposed operation(s)?
  - Are funds available to allow full operation(s) after the pilot study?
  - Have the immediate and mid- and long-term outcomes been reasonably defined prior to full operation(s)?
  - What is the estimated scope of work and timeline vs. committed human and financial resources for the proposed operation(s)?
  - In the case where donor funds are exhausted, is there any plan B to continue the operation(s) to achieve the intended objectives?
  - Has an equitable data ownership and sharing plan been established at the onset of the proposed operation(s)?
  
- ***How will the full operation(s) be conducted in country?***
  - Is the proposed solution likely to be a long-term sustainable one for the local government and communities?
  - Has there been any industry lobbying or nudging with respect to the deployment of the proposed technology?
  - What are the impacts of the proposed technology with respect to job creation or skill formation for the country/region in which the operation(s) will take place?
  - Are there any local capacity building activities being envisaged, and what are the specific strategies?
  - Can entities within the country manage the operation(s) independently in the long run?
  
- ***Will a final evaluation be conducted after the operations?***
  - Has any internal reporting system been established? Have periodic field reports been developed?
  - What is the appropriate procedure for mid- and end-term evaluation of the operation(s)?
  - How will accountabilities to communities and to donors be addressed throughout the operation(s)?
  - What are the key performance indicators or core criteria for the evaluation of the operation(s)?
  - Who will own the data obtained from the operation(s) as well as the evaluation? Who has access to the data?

### **III. Institutional Foundation: What is the level of organizational ethical preparedness?**

Ethical preparedness concerns the structures and processes in place to support an organization's ability for handling ethical issues. Instruments helps address ethical preparedness may include policies or guidelines, temporary organizational structures such as ethics tasks forces, or fixed organisational structures such as ethics advisory boards.



- **Ethics Policy and Procedure: Are there ethics policies and procedures embedded in your organizational culture?**
  - What policies and procedures are in place that could provide guidance related to ethical concerns?
  - To what extent are the existing policies and procedures applicable to this particular context?
  - What resources are needed, and what potential costs will be incurred, to establish ethics policies and procedures to respond to any gaps?
  
- **Internal Ethics Task Force: Is it feasible to establish a dedicated ethics task force in your organization?**
  - Can any focused efforts be made to address the ethical concerns within your organization by an expert team?
  - Is the concept of “ethicists in-situ” a realistic institutional setup to your organization?
  - What are the resources needed to set up an ad hoc ethics task force?
  - What should be the defined responsibilities of the internal ethics task force?
  
- **External Ethics Advisory Support: Is there any external ethics advisory support available to your organization?**
  - Are there any external oversight, compliance, or control bodies available for ethics advisory support?
  - How responsive are the existing advisory supports? Are there any bureaucratic hurdles in seeking guidance from them?
  - How effective are the existing advisory supports? Can they substantially help reach consensus within your organization?
  - What is the most sensible composition of the advisory support (e.g., including legal and compliance expertise)?