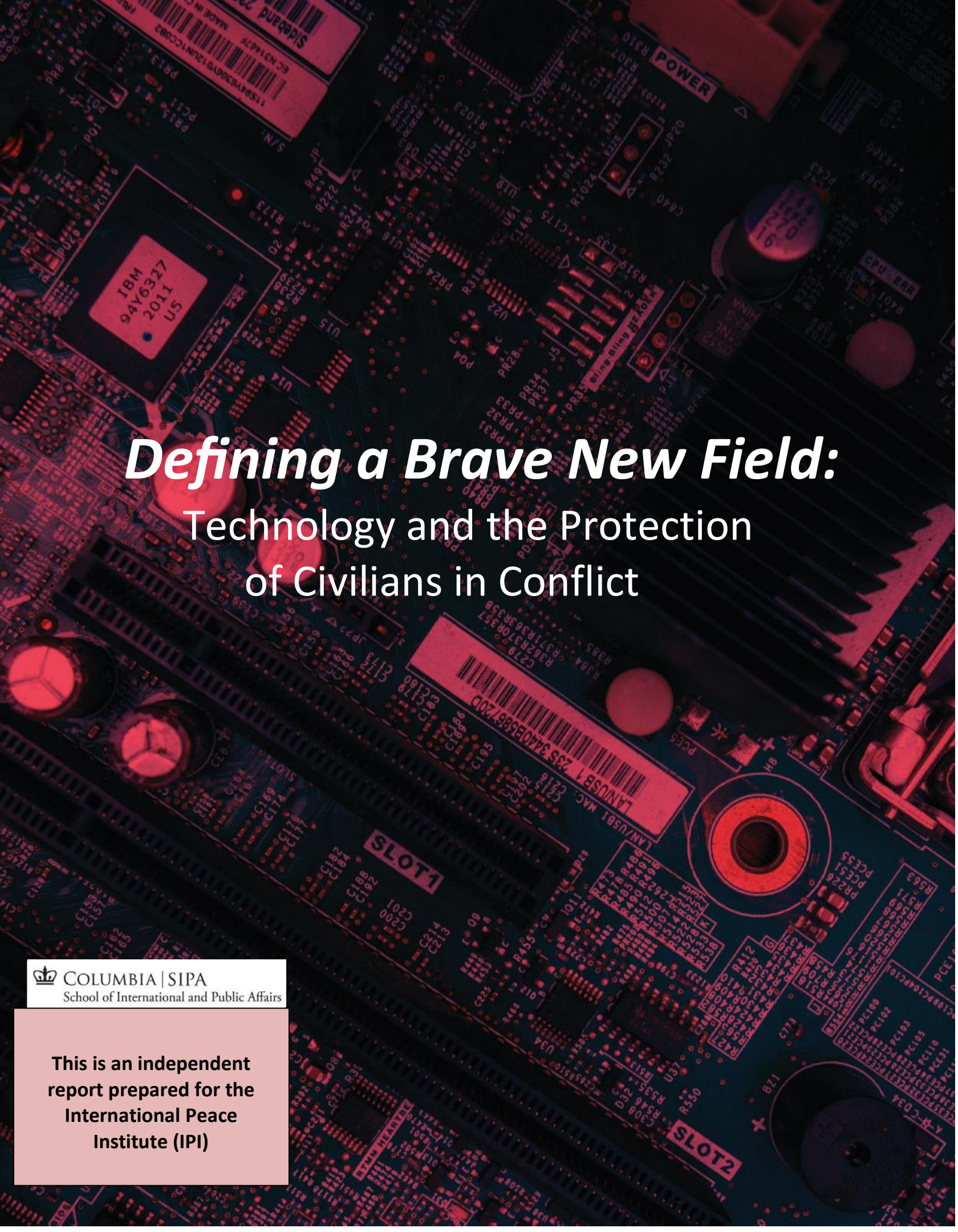


Defining a Brave New Field:

Technology and the Protection of Civilians in Conflict

COLUMBIA | SIPA
School of International and Public Affairs

This is an independent report prepared for the International Peace Institute (IPI)

Acknowledgements

The Capstone team would like to thank all those who have guided and supported us throughout the Spring 2019 semester and who have shared their valuable knowledge and expertise. First and foremost, we would like to thank our SIPA faculty advisor, Professor Walter Miller, for his invaluable advice and guidance. We would also like to thank the staff of the International Peace Institute, especially Daniel Forti, for his feedback and for continuing to challenge us throughout the semester. Finally, we would like to express our gratitude to those who permitted us to interview them as their ideas and experience were crucial along the way to our final project. This report, manual, and mapping document is the final deliverables of the Capstone project led by graduate students at the School of International and Public Affairs (SIPA) at Columbia University.

Table of Contents

Glossary

AI:	Artificial Intelligence
CEWARN:	Conflict Early Warning and Response Mechanism
CPIMS+:	Child Protection Information System
CTP:	Cash Transfer Programing
DFID:	Department for International Development
DLT:	Distributed Ledger Technology
DRC:	Democratic Republic of the Congo
EWRS:	Early warning and response systems
FSD:	Swiss Foundation for Mine Action (Fondation suisse de déminage)
GBV:	Gender-Based Violence
GBVIMS:	Gender-Based Violence Information Management System
GDPR:	Global Data Protection Regulation
GIS:	Geographical Information Systems
HGC:	Humanitarian Grand Challenge
HOT:	Humanitarian OpenStreetMap Team
ICC:	International Criminal Court
ICRC:	International Committee of the Red Cross
IDLO:	International Development Law Organization
IDPS:	Internally Displaced Persons
IGAD:	Intergovernmental Authority on Development
INGO:	International Non-Governmental Organization
IT:	Information Technology
MERON:	Method for Extremely Rapid Observation of Nutritional Status
MSF:	Médecins Sans Frontières
MUST:	Mobile Unit Surgical Trailer
MVAM:	Mobile Vulnerability Analysis and Mapping
NATO:	North Atlantic Treaty Organization
NSC:	National Steering Committee on Conflict Management and Peacebuilding
OCHA:	The United Nations Office for the Coordination of Humanitarian Affairs
OSM:	OpenStreetMap
POCUS:	Point-Of-Care Ultrasound
RC VIEW:	Red Cross View
SBTF:	Standby Volunteer Task Force
SMS:	Short Message Service
SNS:	Simple Notification Service
START:	Syria Transition Assistance and Response Team
TACOPS:	Cisco Tactical Operations
TSF:	Télécoms Sans Frontières

UAV:	Unmanned Aerial Vehicle
UN:	United Nations
UNDP:	United Nations Development Programme
UNHCR:	The Office of the United Nations High Commissioner for Refugees
UNICEF:	United Nations Children Fund
UNITAR:	United Nations Institute for Training and Research
UNOSAT:	United Nations Satellite Imagery
USAID:	United States Agency for International Development
VR:	Virtual Reality
WFP:	World Food Programme
WHO:	World Health Organization

Executive Summary

Over the past 25 years, the protection of civilians has increasingly become an international priority— at least in principle. While the understanding of the concept varies, its scope is commonly viewed to encompass protection from harm, provision of humanitarian assistance, and promotion of human rights and accountability for violations of humanitarian law. Unfortunately, the international community has proven to be either unable or unwilling tomeet these challenges. Innovative technologies to support civilian self-protection and overburdened humanitarian efforts have begun to fill this void.

Our research team was tasked with identifying new technologies that support civilian protection when they can no longer rely on external actors or conventional assistance. Improved **security**, access to **humanitarian aid** and **accountability** are the three areas (or "baskets") that guided our inquiry into the field. This report profiles leading organizations in each basket and enumerates the ways in which parties are adapting to support civilian protection through technology in view of today's challenging operating environment.

The **security** of civilians in conflict is still fundamentally related to a range of political and socio-economic factors. Technology in and of itself cannot end war. However, there are at least some ways that technological advances can provide support. For example, they can help civilians to understand the security threats, detect signs of violence to enable preventive and protective actions, and ultimately improve their survival strategies. Data collection tools, early warning systems, and crisis mapping are emerging to provide safety and security for civilians in conflict.

FrontlineSMS is a company whose platform allows civilians to report incidents of violence via toll-free text messaging, and receive reports filtered by keyword that relate to their specific contexts, ultimately enhancing their situational awareness on the ground. Reporting systems can be plugged in to Ushahidi, a platform that automatically collects text messages, tweets, and posts related to conflict. Civilians can then use that information to find security. Hala Systems' early warning system, Sentry, issues alerts via social media in advance of possible airstrikes in war zones, allowing additional time for civilians to find shelter and for rescue teams to prepare their emergency responses. Crisis mapping is yet another useful tool that, by identifying violent hot-spots, allows civilians in conflict to avoid security risks and find safe places to flee. Through these digital innovations, civilians are apprised of threats to their safety in near real-time and can plan effective self-protection strategies.

Technological advancements continue to re-define **humanitarian assistance**, as well. In view of various impediments to aid delivery, new categories of tools and approaches are being sought to meet the needs of vulnerable populations, often by facilitating aid rather than by providing it themselves. Our research revealed these to include distributed ledger technology; biometrics; unmanned aerial vehicles (or drones) and aerial imagery; mobile solutions and social media; virtual reality; and advances in telemedicine. Specific technologies have been grouped by whether they facilitate the provision of goods or address medical needs.

The World Food Programme has introduced several promising biometric-based identity management solutions to enable safe, secure, efficient and tamper-proof cash transfer programming in humanitarian settings, such as the Building Blocks program being piloted in Jordan, now on the cusp of being expanded to two unnamed conflict regions in the Middle East. They have also introduced SMS and chatbot tools to facilitate two-way communications between recipients and providers— thereby enabling the former to track the pricing, availability and security of food in emergency settings, and the latter to determine how best to customize programs for recipients. In terms of providing medical assistance, Médecins Sans Frontières has developed a mobile surgical trailer that has brought the operating room, intensive care unit and pharmacy to the battlefield in Iraq, and point-of-care ultrasound technology to make potentially lifesaving medical diagnoses to needy populations in South Sudan.

In response to the denial of humanitarian access that plagues complex emergencies worldwide, actors have emerged to serve this growing demand by funding and accelerating new ideas. The Humanitarian Grand Challenge is one example of this trend. The HGC is a multi-governmental partnership co-led by USAID and DFID that engages the private sector to identify, test and scale new solutions to reach communities in crisis, including those in conflict.

Accountability for war crimes and other humanitarian violations is crucial for both the near and long-term protection of civilians in conflict zones. Accountability allows for transparency in conflicts, facilitates human rights advocacy, and promotes awareness of violence in an effort to spur immediate action by the global community and to maintain a record of events for future use. We have identified three specific sub-functions of technology for accountability purposes: collection of evidence; verification of evidence; and increasing access to justice.

An exemplary case is Truepic, a mobile app that authenticates photos, videos, or audio of events on the ground and secures them to an incorruptible blockchain. This platform carries significant implications for the recording of war crimes for future legal processes, as the civilian-captured evidence benefits from a continued chain of custody which minimizes the risk of false content being manufactured for the purpose of misleading the public. Such apps can revolutionize accountability systems and restore agency and power to civilians caught in war.

A number of cross-cutting issues were found to affect all three areas of security, humanitarian assistance and accountability. In the case of mobile technologies, their reliance on connectivity was highlighted by multiple practitioners, given the lack of robust internet infrastructure in conflict zones and the fact that warring parties may even inhibit access. The misuse of tools by actors for whom they were not intended presents another major risk to vulnerable populations. For example, civilians using a new technology to record human rights abuses may be targeted by the perpetrators of said abuses should the tool fail to protect their anonymity.

The need to ensure intersectional access— that is, to analyze the impact of new technologies on all demographics and identities— was echoed by several sources. For instance, using mobile data as the sole basis on which to evaluate interventions would not be suitable in contexts where women were less likely than men to use mobile devices.

Moreover, the digital literacy to use sophisticated modern technologies cannot be presumed in many contexts. Our research also identified ethical and legal considerations; tensions with humanitarian principles; sustainability questions; the effects of displacing traditional means of assistance; the importance of community buy-in; the need for organizational support; and applicability and replicability concerns, as other cross-cutting issues that could influence the success of any new technology.

It has become clear that modern technologies cannot work independently and often rely on multilateral collaboration. From outsiders working at a central level to those on the ground in conflict— as well as intermediaries facilitating the connections between them— the industry is spawning a myriad of arrangements to achieve its handful of common sense goals.

During the course of our research, we faced a number of challenges and limitations. We were unable to create a full accounting of all current and emergent technologies, despite our dutiful research and interview processes. At times, sources also suggested that they were not at liberty to disclose or discuss all the tools that were being used in conflict zones, since it would be dangerous for providers to do so. Additionally, we were unable to gain first-hand accounts from civilians on the ground or quantifiable measures of success for many technologies currently being employed.

There is significant progress to report regarding the protection of civilians in conflict, as new technologies attempt to fill the gaps left by disjointed international responses. While technology is not a panacea and political processes may be necessary for sustainable peace, there is an ever-growing list of technologies that can ease the suffering and increase the chances of survival for civilians mired in active conflict.

Introduction

The global community experienced one of the worst conflicts during World War II, which led to the creation of the United Nations. Unfortunately, roughly 70 years later, a major refugee crisis and protracted intrastate conflicts have plagued the geopolitical context. Protection of civilians arose out of the genocides in Rwanda and Bosnia where the international community failed to intervene. Since then, a multitude of states have pledged to uphold this doctrine. However, this goal is often unmet and, instead, many state governments are active or complacent in perpetuating violence against their own civilians. Humanitarian and peace actors are constrained by the emergence of intrastate wars and non-state armed groups. It is within this challenging and volatile environment that new technologies are arising to assist in the protection of civilians when there are no international actors present and civilians are forced to employ self-protection strategies.

Due to the absence of international intervention or concern, civilians have not only been unprotected and unreachable, but in some cases their suffering has been used as a tactic of war. Whether in Syria, where hundreds of thousands have died in the civil war; or in Yemen, where widespread disease and man-made famine almost overshadow the conflict itself; or in the Rakhine State, where over 700,000 Rohingya have been systematically murdered, raped and expelled from their homes; the denial of humanitarian access has become a ruthless feature of modern-day warfare. As these exceptions become the rule and traditional assistance can scarcely be relied upon anymore, alternative solutions are being sought to protect communities caught in the crossfire. Against this backdrop, the Capstone team was asked to identify the new actors and technologies that populate the civilian protection sphere in three core areas, or "baskets": Security, Humanitarian Assistance and Accountability.

The following deliverables have been enclosed with this package:

- Final report.
- Manual for mass distribution.
- Mapping document.

The report will begin with a methodology outlining the steps that were taken to conduct the research and assess the findings. An analysis of each individual basket will follow, including new technologies that bolster civilian safety (Security); provide or facilitate their means of survival (Humanitarian Assistance); and raise awareness of human rights violations and holding perpetrators accountable (Accountability). Next, a study of the cross-cutting themes that affect all baskets will demonstrate the challenges these new technologies pose. Finally, the team will recommend areas for further research to bring the report to its conclusion.

The manual and mapping document have been added as appendices. Meant for distribution in conflict zones, the manual includes a compendium of technologies that civilians can employ for self-protection and survival strategies, as well as to ensure accountability for human rights abuses. The mapping document illustrates the UN agencies and other key actors in the sector that are applying new technologies to their work.

Beyond the official set of deliverables, this package will also provide a coherent snapshot of the industry as it stands today. To be sure, technology does not provide a singular, self-sustaining solution for the problems that plague the global system. It can at best mitigate symptoms rather than address the root causes of crises, though it still offers life-saving potential for many.

Context

We have been challenged to find a single, authoritative definition for protection of civilians during our research. Intergovernmental, nongovernmental and regional organizations, and individual states maintain different definitions for the term. As the scope of organizational mandates and state interests narrow, so too do definitions and ideas of what the protection of civilians entails.

This has led to several variations on a theme. The UN emphasizes peacekeeping missions;[1] the ICRC discusses obligations under international humanitarian law;[2] NATO mentions "efforts taken to avoid, minimize and mitigate the negative effects... [of] military operations;[3] and the American military focuses on the reduction of risks of violence, securing of essential services, and creation of long-term stability.[4] None of these definitions was broad enough to encompass the wide variety of technologies we intended to research.

For our purposes, we have broadly defined **Technology for the Protection of Civilians** as those technologies which affect the physical security, health and wellbeing, and sharing of information with civilians in active conflict zones. Conflict zones are those states or regions where civilians are either the intended or unintended targets of violence perpetrated by state or non-state actors.

1 United Nations, "Protection of Civilians Mandate," accessed April, 29 2019. https://peacekeeping.un.org/en/ protection-of-civilians-mandate.

2 International Committee of the Red Cross, Enhancing Protection: For Civilians in Armed Conflict and Other Situations of Violence, Second Edition, (ICRC: Geneva, 2012), 9. https://www.icrc.org/en/doc/assets/files/other /icrc-002-0956.pdf. 3 NATO, "NATO Policy for Protection of Civilians," July 2016, accessed May 3, 2019. https://www.nato.int nato_static_fl2014/assets/pdf/pdf_2016_07/20160705_1607-protection-civilians-en.pdf.

4 Department of Defense, Protection of Civilians ATP 3-07.6, (Washington, DC: Department of Defense, 2018), April 25, 2018. http://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_24.pdf?ver=2018-05-11-102418-000.

Methodology

The objective of our research was to explore new technologies that can assist civilian communities in protection strategies, especially when they cannot depend on outside actors and conventional assistance. We sought to identify legal, ethical, cultural, moral and logistical implications of these technologies. The consolidated study of the use of technology for protecting civilians in conflict is a new field, and we have intended to create a holistic view of the space. In doing so, we have included technologies and organizations from the public and private sectors, as well as civil society and academia, at the local, national and international levels.

We have attempted to limit the scope of our research to those technologies in use and organizations at work specifically in active conflict zones. There is a great deal of shared space between active conflicts, refugee crises, disaster relief, and post-conflict development. However, active conflicts present unique challenges including ongoing violence and risks to outside organizations. We have not limited our scope to a specific geographic area, though some countries or regions receive focused attention due to the dramatic nature of the ongoing conflict therein.

In conducting our research and analysis, we identified three areas, or baskets, by which to organize our research and broadly categorize our findings. These baskets were Security, Humanitarian Assistance, and Accountability. **Security** comprises technologies that enable civilians on the ground to understand security threats, make informed decisions, and adopt self-protection strategies. Such technologies include data collection and analysis, early warning and early response, and crisis mapping. **Humanitarian Assistance** identifies various tech-based innovations which facilitate today's humanitarian aid by enabling more efficient and safer information sharing, empowering remote analysis, and providing a longer reach into the targeted area. **Accountability** considers those organizations and technologies which enable the capturing and sharing of information, especially information regarding violence against civilians and human rights violations. Accountability also includes technologies which facilitate access to justice, whether through traditional courts or other means.

These baskets were not mutually exclusive and many of the technologies and organizations we discovered had applications that applied to more than one. However, the baskets remained useful as a reference point when discussing so many varied applications across multiple conflicts, especially as the consolidated study of this field is nascent. Additionally, the baskets were a useful means of dividing labor amongst our research team, as we divided into pairs following our initial literature review in order to provide focused attention to each basket.

After identifying and defining our baskets, we undertook our research using a five-step methodology. First, we reviewed existing literature concerning technology and the protection of civilians. We then identified technologies and organizations that are presently using or innovating

technologies for the protection of civilians in conflict zones. We conducted interviews in person or by phone with various innovators, private companies, UN officials, NGOs, and tech incubators around the world, cataloguing the capabilities, benefits and applications as well as the logistical, ethical, and legal risks of their technologies. After conducting research within our baskets among our research pairs, we consolidated our findings, discussed technologies with cross-basket applications, and identified cross-cutting issues which affected all baskets. We then produced this final report, as well as its two appendices, in an effort to detail this new field.

We faced several challenges in our research, specifically a lack of access to civilians in conflict zones with whom to conduct interviews. Such first-hand accounts would have aided us in truly identifying the most prevalent and useful technologies today. The sector also suffers from a lack of quantifiable data on the impact of technologies in conflict zones and most of the research was based on anecdotal findings and reports. Moreover, we did not want to give the impression that this served as an exhaustive list of all technologies and organizations protecting civilians in conflict zones. Constraints of time and geography prevented us from cataloguing all existing and emergent means that are serving this purpose. However, we see these challenges as opportunities and as confirmation that the field is fruitful and worthy of further research. Specific areas for additional inquiry will be discussed at the end of our report.

Security

For decades, the main victims of conflict have been civilians.[5] The world witnessed genocide in Rwanda and the former Yugoslavia. Armed groups targeted civilians in Somalia, the Democratic Republic of the Congo (DRC), Liberia, Timor-Leste, and many more. States, which are supposed to have the primary responsibility to protect their populations, are attacking their own people in Syria, Libya, and Myanmar. Despite international efforts to counter this trend, civilian casualties, refugee populations, and the number of IDPs have been increasing across the world. Civilians on the ground are living under the grave threat of violence as violations of international humanitarian and human rights law occur in almost all of today's active conflict zones.

Violence in conflict takes many forms: killings, shootings, bombings, airstrikes, rapes, fires, and kidnappings, among others. Oftentimes, the perpetrators are members of military and armed groups. As a result, civilians in conflict and their communities have struggled to protect themselves from these threats. With new technology, however, civilians will be better able to collect information about incidents, understand the security situation surrounding them, predict threats in the future, prevent violent incidents, and flee to safety. We have identified three areas where technology can support civilian efforts to maintain their security: data collection, sharing, and analysis; early warning and response systems; and crisis mapping.

[5]International Committee of the Red Cross, "Civilians protected under international humanitarian law," October 29, 2010, accessed May 3, 2019. https://www.icrc.org/en/doc/war-and-law/protected-persons/civilians/overview-civilians-protected.htm.

Data Collection, Sharing, and Analysis

Data collection is important for upholding the security of civilians in conflict, as it helps them to acquire accurate insights into the various threats that are facing them. Data sharing similarly improves the situational awareness of civilians on the ground by allowing them to share information about new security developments, impending threats, and their personal safety. Data analysis is also critical for helping civilians to access security assessments and formulate security strategies to maintain their physical safety and wellbeing. In intense conflicts, however, civilians simply do not have the time to search online or scroll through social media to learn about imminent security challenges. They may also lack the capability to analyze vast amounts of data.

Hence, technology companies play a crucial role in developing digital tools that both analyze and disseminate the information needed to improve the self-protection capabilities of civilians as well as civilian response mechanisms. This requires technology companies to create digital platforms for civilians to share information, receive updates about new threats, and even monitor the incidents unfolding around them without exposing them to any additional security risks. Consequently, these companies also bear the responsibility of properly managing information reported by civilians to avoid making them targets of harmful actors.[6]

Data collection and analysis tools incorporate information retrieved from instant messaging (SMS), online apps, television and radio broadcasts, and social media, as well as remote sensors and satellite images. Drawing from these various media also helps to counter the spread of false and misleading information that could potentially incite or escalate violence.

Incident Reporting

Communication between civilians in conflict is one of the most traditional ways to disseminate critical information about security threats. However, civilians can expedite the time it takes to share this information with neighboring villages and humanitarian actors by using data collection and sharing tools such as FrontlineSMS rather than waiting for it to spread by word-of-mouth. FrontlineSMS links cell phones to a computer server, filters information sent via text message, codes it according to the content, and submits it into a database for analysis. In turn, the analysis can be used by civilians to enhance their situational awareness of the main security threats facing their communities.

[6] Lisa Schirch, "From Protection of Civilians to Human Security: Comparing and Contrasting Principles, Distinctions, and Institutionalization," 3P Human Security Blog, August 2012, accessed May 3, 2019. www.humansecuritynetwork.net.

Hexagon Geospatial is an organization whose cloud-based Mobile Alert app provides a tool for civilians to report incidents using their smartphones and pinpoint real-time incident reports. Nevertheless, it should be noted that similar mobile services also have the potential to be misused to send agitational messages and false reports that incite violence, which was the case in Kenya in the aftermath of the 2008 elections. Hence, technology companies such as Ushahidi will also need to maintain robust processes for verifying reports and countering false narratives.[7]

The World Health Organization's (WHO) project, Global EWARS, also creates software such as Datahub and EWARS Mobile to assist civilians in remote areas to report dire humanitarian crises and medical emergencies (such as malnutrition) stemming from ongoing conflict. To ensure that these digital tools can be fully utilized by civilian groups, Global EWARS provides mobile phones, laptops, and local servers to help civilians collect and report information to local medical providers in conflict zones. Global EWARS also installs solar generators and solar chargers for phones and laptops to ensure that civilians can better access these platforms.[8]

Oftentimes, children in conflict zones are the most vulnerable group for gender-based violence (GBV) and sexual abuse. Yet they frequently lack cell phones or other digital tools to report these abuses or obtain some degree of protection. In this scenario, it is important to have trained local volunteers who can collect data on the safety of children to ensure that they are not being neglected.

To address these issues, UNICEF works to support organizations collecting data about cases of gender-based violence toward children and providing humanitarian coordination for child protection.[9] For example, local humanitarian actors use UNICEF-funded software systems Primero, the Gender-Based Violence Information Management System (GBVIMS), and the Child Protection Information System (CPIMS+) to account for the security of unaccompanied and separated children living among the nearly 190,000 refugees and asylum-seekers in the Kakuma Refugee Camp and Kalobeyei Settlement in Kenya. These software systems take in reported incidents from children, securely store

[7] Hexagon Geospatial, Mobile Alert: Cloud-Based Citizen Crowdsourcing, accessed April 10,2019. https://www.hexagongeospatial.com/products/smart-mapp/mobile-alert

[8] World Health Organization, "EWARS: A Simple, Robust System to Detect Disease Outbreaks," November 11, 2018, accessed May 3, 2019. https://www.who.int/emergencies/kits/ewars/en/.

[9] UNICEF, "Child Protection from Violence, Exploitation and Abuse," April 5, 2012, accessed May 3, 2019. https://www.unicef.org/protection/57929_62178.html.

them in a child protection case management database, and allow child survivors of sexual and GBV to identify the child protection services that they need.[10]

These online apps and platforms allow civilians in conflict to crowdsource real-time, geolocated, and time-stamped reports about security incidents. Ultimately, these reports enable faster deployment of first responders on the ground to help the victims of violence.

Data Collection for Conflict Prevention & Self-Protection Strategies

In conflict zones, information spread by radio maintains a strong influence— for better or worse. As the Rwandan genocide was incited by radio broadcasting, such content can in some cases be an indicator of widespread violence. On the other hand, citizens can call into the radio to report incidents that they have witnessed or experienced, and local organizations can provide information about the aid and support being offered in the area. To integrate information on the radio with other information sources, the UN Global Pulse Lab Kampala created the Radio Content Analysis Tool. The Pulse Lab uses machine learning to enable a software which dictates recorded conversations and interprets the context. After being fed with hundreds of hours of recordings, the Radio Content Analysis Tool can transcribe the content from the radio and then look up designated keywords from the text.[11] In the same way as for information collected via SMS, the output can then be analyzed to track reports of unrest and implement conflict prevention measures before matters escalate into violence.

Ushahidi is an innovative web-based platform where civilians on the ground can share first-hand reports from using FrontlineSMS, social media, or other online tools. Ushahidi shares reports from civilians that are geolocated and time-stamped using a triggering service to effectively alert other civilians as well as humanitarian actors throughout the world. Following the outbreak of violence after the 2011 DRC elections, for example, Ushahidi provided cell phones equipped with FrontlineSMS software through its Voix des Kivus program. Civilians from 18 villages in the war-torn South Kivu Province then sent thousands of text messages that helped generate analysis regarding the lootings, kidnappings, and killings by rebel groups.[12] In practice, this analysis could be used to create a community-based security strategy for civilians to patrol and protect their villages.

The Sentinel Project utilizes crowdsourcing technology for social media harvesting to track civilian reports of hate speech that has the potential of sparking conflict in at-risk areas where there is a high likelihood of escalation to genocide. This information is then

[10] Primero, "Primero™ is Putting Children First," accessed April 27, 2019. https://www.primero.org/_blog.
[11] UN Global Pulse, *Using Machine Learning to Analyze Radio Content in Uganda*, (Pulse Lab: Kampala, 2017), 8-9. http://unglobalpulse.org/sites/default/files/Radio%20Analysis%20Report_Preview%20%283%29.pdf.
[12] Ushahidi, "Voix des Kivus: A Crowd-Seeding System in DRC," March 16, 2011, accessed May 7, 2019. https://www.ushahidi.com/blog/2011/05/16/voix-des-kivus-a-crowd-seeding-system-in-drc/.

compiled into the world's largest database on hate speech called "Hatebase." The Sentinel Project also verifies online reports and integrated Hatebase data with genocide prevention tools to help local actors. As early as 2013, the Sentinel Project was able to use its "Hatebase" to conclude that there was an extremely high risk of genocide or mass atrocities in Myanmar - nearly three years before the Rohingya genocide began.[13]

Social Media: Sharing Safety Status

Social media is an online tool that grants civilians in conflict the ability to share information, messages, images, and videos via apps and websites such as Twitter, Facebook, WhatsApp, and YouTube. For example, Facebook's Safety Check allows Facebook users to notify those in their network of their safety and wellbeing in the wake of an attack. In this way it supplements humanitarian actors' situational awareness and allows emergency responses to be designed or adapted accordingly. As a matter of company policy, however, safety checks are not activated for "acts of war," defined as incidents involving military entities. Instead, the tool is reserved for distinct episodes of violence or disaster- which may or may not occur in conflict areas. For example, on February 18th, 2019, a twin bombing attack in Idlib, Syria, did indeed generate a safety check, but only because it was seen as unrelated to the war itself. Facebook fears that Safety Check would be instrumentalized by parties to the conflict were it activated for crises that persisted indefinitely.[14]

In a word, data collection, sharing, and analysis are the most effective tools for civilians in conflict when technology plays a facilitative role. Collecting reliable and accurate data about impending security threats is important for civilians and can be used to provide early warnings which will be discussed in the following section. In scenarios where civilians are first-hand witnesses to events of concern, online apps and social media are excellent digital tools to foster community-based data sharing that can further bolster the ability of civilians to prepare for violent conflicts, coordinate self-protection strategies, and notify others of their personal safety and wellbeing. Civilian reports can also be analyzed to identify the major threats facing them and to monitor ongoing incidents of violence. In this field, technology companies can still play a more active role by producing easily accessible digital tools that help civilians protect themselves.

[13] Timothy Quinn, "Introducing Hatebase: The World's Largest Online Database of Hate Speech," Sentinel Project, March 25, 2013, accessed May 3, 2019. https://thesentinelproject.org/2013/03/25/introducing-hatebase-the-worlds- largest-online-database- of-hate-speech/.

[14] Kylie Holmes, Disaster and Crises Manager, Facebook. Interview with Mark Filipovic, April 12, 2019.

Early Warning and Response Systems

While the above data collection and analysis technology is useful, these digital tools alone cannot guarantee the security of civilians in conflict. To survive, civilians still need adequate time to take shelter from an air raid, evacuate their village, prevent violent incidents that are predicted to happen, or otherwise. Early warning and response systems (EWRS) are a powerful tool to provide reliable and readily available warnings about violent attacks, airstrikes, and other near and long-term security threats facing vulnerable civilian populations.

A famous example is Kenya's community-based EWRS, the Uwiano Platform for Peace, which was created from a partnership between the local government, an NGO, and the United Nations Development Programme (UNDP) for Kenya's 2010 referendum on a new constitution. Uwiano provided free text message service for Kenyans to report early signs of conflict such as "hate speech, incitement, and other forms of violence instigation." Afterwards, civilian reports were verified and consolidated into security alerts sent to local police officials, peace committees, and community elders, who then swiftly took a role in mediating the conflict. Civilian reports also helped media outlets in Kenya address sensitive issues or dispel false information that could incite violence using online platforms and national media broadcasts.[15]

In this case, Uwiano relied heavily on citizen reporting to detect signs of conflict. However, emerging technologies provide alternative ways to do so. In some cases, remote sensors detect early signs of conflict sooner than humans, and give civilians on the ground additional time to take action, prevent conflict, or protect themselves.

Remote Sensors: Satellite Imagery and Acoustic Sensors

Remote sensors are one of the fastest growing technology sources for EWRS. Remote sensors are devices to help monitor human activity and generate real-time awareness about impending threats mainly through satellite imagery and sound emissions. Through data analysis, these satellite images can help uncover troop deployment and warn civilians of imminent threats to their communities. Satellite imagery can even detect early warning signs of conflict while the sound emissions from military aircraft are also an important indicator of potential airstrikes. In addition, in regions where conflict is widespread, remote sensors are ideal for monitoring vast areas of land that may otherwise be impossible for peacekeepers and humanitarian actors to access.[16]

[15] United Nations Development Program: Kenya, "Uwiano Platform: A Multi-stakeholder Strategy for Peaceful Elections," accessed April 27, 2019. www.ke.undp.org/content/kenya/en/home/operations/projects/peacebuilding/ uwiano-peace-platform-project.html.

[16] Christy Lazicky, "Improving Conflict Early Warning Systems for United Nations Peacekeeping," Master's Thesis, Harvard University, March 2017.

Companies that use remote sensors to provide satellite imagery services in potential conflict zones include DigitalGlobe and Airbus Intelligence.[17] During the Heglig Crisis in 2012, DigitalGlobe spotted tanks, military vehicles, and troop mobilization leading up to the violent border dispute between South Sudan and Sudan over the oil-rich region of Abyei where 100,000 civilians were displaced from their homes.[18] In South Kordofan and Blue Nile, nearly 665,000 people were reported to be displaced and severely impacted by the fighting and bombings of civilian targets.[19] Despite clear indicators from satellite imagery, humanitarian organizations failed to issue early warnings to civilians, thus demonstrating the need for technology companies to alert civilians directly rather than wait for local humanitarian organizations and governments to intervene.[20]

Remote sensors can also warn of imminent conflict through their ability to detect new infrastructure being built. For example, soon after Eritrea began paving roads near the contested area of Ras Doumeira in 2008, the Djiboutian-Eritrean border conflict erupted. In the same year, Cambodia similarly began road construction near the vicinity of the Preah Vihear Temple, sparking military skirmishes between Thai and Cambodian troops. In 2011, the Cambodian–Thai border dispute once again flared up after Cambodia launched rocket strikes against a residential area which destroyed a school, hospital and several residential properties, ultimately triggering exchanges of artillery fire and forcing approximately 22,000 civilians to evacuate their homes.[21] In both conflicts, DigitalGlobe used satellite imagery to detect the mobilization of military forces (i.e. troops, naval vessels, aircrafts, tanks, military fortifications, etc.) and the escalation of conflict that jeopardized the security of civilians. However, there are increasing legal concerns that the use of remote sensors to capture satellite images pose a threat to the national security of certain states and infringe on state sovereignty.[22] We will discuss this theme of "Ethical & Legal Considerations" later in the report.

[17] Susan Wolfinbarger, Jonathan Drake, and Eric Ashcroft, Introduction to Remote Sensing of Cross Border Conflicts: A Guide for Analysts, American Association for the Advancement of Science, (AAAS: Washington, DC, 2015), 7. https://mcmprodaaas.s3.amazonaws.com/s3fs-public/reports/Handbook.pdf.

[18] United Nations Office for the Coordination of Humanitarian Affairs, "Abyei: An Uncertain Future," August 27, 2013, accessed May 3, 2019. https://www.unocha.org/story/abyei-uncertain-future; 570 News, "Bombs Hit Disputed Sudanese Oil Town, Official Says," April 14, 2012, accessed May 3, 2019. https://www.570news.com/ 2012/04/14/bombs-hit-disputed-sudanese-oil-town-official-says/.

[19] UNOCHA, "Sudan: Humanitarian Dashboard June," June 30, 2012, accessed May 3, 2019. https://m.reliefweb.int/ report/508888.

[20] Ziad Al Achkar, et al, Sudan: Anatomy of a Conflict, (Harvard Humanitarian Initiative, 2012), 129. http://hhi.harvard.edu/sites/default/files/publications/ sudan-anatomy-of-a-conflict.pdf.

[21] Ambika Ahuja, "Thai, Cambodia Troops Clash Again near Temple, 1 killed," Reuters, February 4, 2011, accessed May 3, 2019. https://www.reuters.com/article/us-thailand-cambodia-clash/thai-cambodia-troops-clash-again-near- temple-1-killed-idUSTRE71409020110205#a=1.

[22] B.C. Nirmal, "Legal Regulation of Remote Sensing: Some Critical Issues," Journal of the Indian Law Institute 54, no. 4 (2012): 451-79. http://www.jstor.org/stable/43953609.

Hala Systems is a company that has developed a technology-driven EWRS that combines acoustic sensors to collect the sound of military aircraft and machine learning to detect and even predict violent attacks and airstrikes. Sensor modules placed in trees or atop buildings collect acoustic data, which helps Sentry confirm the type of plane, its location, and flight path. Using this integrative approach, Hala Systems' Sentry program has sent over 225,000 warnings (approximately 134 warnings daily with eight minutes of lead-time) to civilians, first responders, humanitarian actors, television and radio stations, schools, and shelters for internally displaced persons since being founded in 2015. In Syria, Sentry sent alerts to nearly two million Syrian civilians living in communities under heavy bombardment about impending airstrikes with a 52-63% accuracy rate via the Hala Systems online app, mobile phones, and warning sirens from 2016 to 2018.[23] In both the Rif Damascus and the Idlib Governorates, local media reported that Hala Systems' technology decreased civilian casualties from airstrikes by 50%.

Technology for EWRS is crucial to unlocking the potential for civilians to prevent the escalation of conflict, anticipate the outbreak of violence, implement self-protection strategies, and reach safe locations before their physical security is jeopardized. Remote sensors are essential for civilians to detect the early signs of conflict while warning sirens, online apps, social media, and other digital tools are necessary to actually notify them. Yet, EWRS will still need the support of local humanitarian actors to deploy certain remote sensors in war-torn areas where access is not readily granted by the government. In other scenarios, assistance from these same humanitarian actors will be needed to coordinate civilian responses once early warnings of conflict on the ground are received. Nevertheless, EWRS combined with technology provides a robust mechanism that enhances the ability of civilians in conflict to uphold their security.

Crisis Mapping

One of the biggest challenges for civilians in conflict is to understand what is going on around them. When there is little to no access to reliable media that can cover life-threatening incidents— such as an ambush on a village or a clash between armed groups— people traditionally rely on information shared by word-of-mouth.[24] However, in the digital era, social media such as Twitter and Facebook have enabled vulnerable populations to spread information about incidents on the ground. A separate challenge, however, is to receive that information in a way that enables their security. Civilians in conflict zones have enough difficulty as it is in trying to understand the complexity around them without having to search the vast sea of tweets or Facebook posts for data that may assist them. Crisis

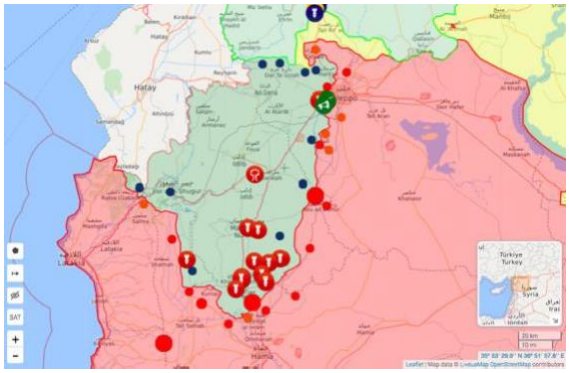
[23] Hala Systems, "Protect Everything That Matters," accessed April 3, 2019. https://halasystems.com/#sentry.

[24] Betcy Jose and Peace A. Medie, "Civilian Self-Protection and Civilian Targeting in Armed Conflicts: Who Protects Civilians?" Oxford Research Encyclopedia of Politics, (December 2016), 9.

mapping— maps to show where emergencies are occurring— has stepped into this gap by giving them a visual understanding of incidents and hot-spots. It has great potential to improve the self-survival strategies of individuals and local communities.

In selecting and executing a self-protection strategy, access to real-time information is vital. Patrick Meier, one of the leaders in the crisis mapping sector today, believes that "having a real-time map is almost as good as having your own helicopter."[25]

For instance, research conducted in the eastern region of DRC (Orientale, North Kivu, and South Kivu) in 2012 showed that conflict-affected communities formed armed/unarmed local patrolling groups to deter violent incidents as a self-protection measure. Some of these groups shared information with other communities or local officials to discuss security priorities given that local officials were friendly to these voluntary activities for security.[26] Avoiding the hotspots of violent incidents and threats is an important strategy, as well. When the security situation worsens, the whole community may be forced to evacuate and resettle elsewhere.[27] With access to Crisis Maps, local communities can set an effective patrolling route for their security teams. Citizens use the maps to avoid dangerous areas. They can also decide to evacuate when the map shows that attacks by armed groups are soon to materialize.



Syria LiveUAmap (https://syria.liveuamap.com/, April 20,

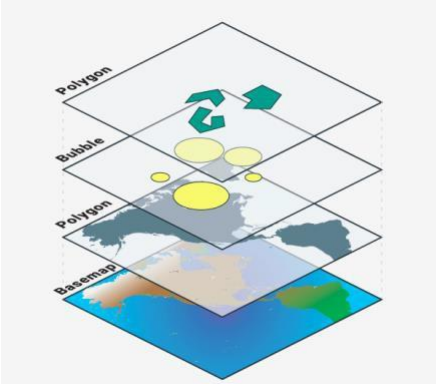
[25] Patrick Meier, ´Crisis Mapping in Action: How Open 6ource 6oftware and Global Volunteer 1etworks Are Changing the World, One Map at a Time,µ *-ournal of Map Geography Libraries 8:2, 89-100* (2012), 91.

[26] Aditi Gorur, ´Community 6elf-Protection 6trategies. How Peacekeepers Can Help or Harm,µ *Civilians in Conflict, no. 1* (August 2013), 3. https://www.stimson.org/sites/default/files/file-attachments/6timson_Community_ 6elf-Protection_Issue_Brief_Aug_2013_0.pdf.

[27] Jose and Medie, ´Civilian 6elf-Protection and Civilian Targeting in Armed Conflicts, 9.

Crisis Mapping for Visualizing Security Threats

A Crisis Map is an online map with a pin, like a Google Map, to indicate the type of incident occurring, its precise location, and the kind of help that is needed.[28] The map can also include updated information, such as who is responding to an incident, provided such information is available. Crisis Maps are commonly updated in near-real time, and fed with information from more varieties of sources than ever before. They have become a standard tool for use in new fields, including security for citizens in humanitarian settings.



Structure of Crisis Map (MangoMap, "GIS Mapping," https://mangomap.com/gis-mapping)

Crisis mapping consists of three phases: information collection, visualization, and analysis.[29] For this work, crisis mappers can complement numerous traditional methodologies with emerging technologies—including those that have been mentioned above in "Data Collection and Analysis" and "Early Warning and Response," such as SMS reporting, radio content analysis software, and remote sensors.

For visualization purposes, Geographical Information Systems (GIS) are a key technology. Several startups and commercial companies such as **Ushahidi**, **Esri** and **MapBox**, have created GIS software with a user-friendly interface, which allows non-specialists to participate in creating a Crisis Map on a free online map such as Google Map, Yahoo! Map, or Bing Map.

For instance, the **Syria Tracker Crisis Map** and the **Libya Crisis Map** are major applications of crisis mapping in conflict zones that use the Ushahidi Platform. The Syria Tracker Crisis Map, which was created to monitor the conflict that began in April 2011, combined crowdsourcing from first-hand reports submitted via social media, video, photos, email, and voicemail, along with data mining from social media, blogs, and news sources, to provide accurate, real-time, and accessible crisis mapping.[30] In the same year, the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) worked with Ushahidi to develop the Libya Crisis Map "to provide situational awareness" following a violent

[28] Patrick Meier, *Digital Humanitarians: How Big Data Is Changing the Face of Humanitarian Response*, (Florida: CRC Press, 2015), 2.
[29] Patrick Meier, "What is Crisis Mapping? An Update on the Field and Looking Ahead," *iRevolutions*, January 20, 2011, accessed May 3, 2019. https://irevolutions.org/2011/01/20/what-is-crisis-mapping/.
[30] Ushahidi, "Crisis Mapping Syria: Automated Data Mining and Crowdsourced Human Intelligence," March 27, 2012, accessed May 7, 2019. https://www.ushahidi.com/blog/2012/03/27/crisis-mapping-syria-automated-data- mining-and-crowdsourced-human-intelligence.

escalation of the Libyan civil war.[31] At the time, OCHA's Information Management Officer Andrej Verity acknowledged that the UN possessed neither the means to gain physical access in Libya nor the technological ability "to harvest, authenticate and administer… online information."[32] This example illustrates how certain technologies may fill some of the gaps in conflict zones where international actors like the UN and INGOs do not maintain a presence.

Another initiative is LiveUAmap, which was launched by software engineers in Ukraine to map violent incidents in the conflict across eastern and southern Ukraine in 2014.[33] Currently, LiveUAmap covers conflicts around the world, including in Syria, Libya, Afghanistan, Kashmir, and ISIS in the Middle East.[34] While the Syria Tracker Crisis Map, Libya Crisis Map and LiveUAmap all rely heavily on online sources and anonymous reports circulated through social media and SMS, the Syrian Civil War Map uses only information gained from the people in Syria with whom they are connected.[35]

In summary, through crisis mapping, civilians on the ground can see what kinds of incidents are happening near their community (killings, gunfights, bombings, explosions, fires, arrests, etc.), whether the threats are intensifying or not, and where they can find safety.

Base Map Editing for Creating Detailed Local Maps

Crisis mapping enables civilians in danger to make the decision of whether to stay or flee. Upon choosing to evacuate, other questions await them: What is their destination? Which route should they take? How far is the journey and how long it will take? Even when people have access to a free online tool such as a Google Map, oftentimes the existing maps lack detailed information from the field, such as local streets, buildings, and neighborhoods. OpenStreetMap (OSM) is a pioneering open-source platform that allows people all over the world to commit to creating more detailed geological maps by adding these local elements. An accurate map helps civilians not only during evacuation but

[31] Ibid.

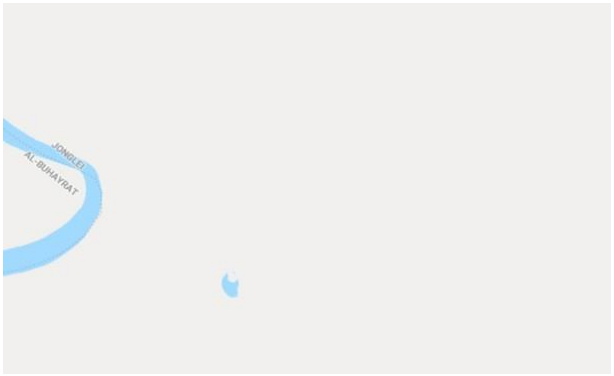
[32] Miren Gutiérrez, "Crowdsourcing and Mapping Data for Humanitarianism: Data Activism and Social Change," Palgrave Studies in Communication for Social Change, May 3, 2018.

[33] Laura Bliss, "Citizen Journalists Are Live-Mapping the Crisis in Ukraine," CityLab, July 28, 2014, accessed May 3, 2019. https://www.citylab.com/equity/2014/07/citizen-journalists-are-live-mapping-the-crisis-in-ukraine/ 375178/.

[34] LiveUAmap, "News Live," accessed April 28, 2019. https://liveuamap.com.

[35] Syrian Civil War Map, "Syrian Civil War Map," accessed April 28, 2019. https://syriancivilwarmap.com/.

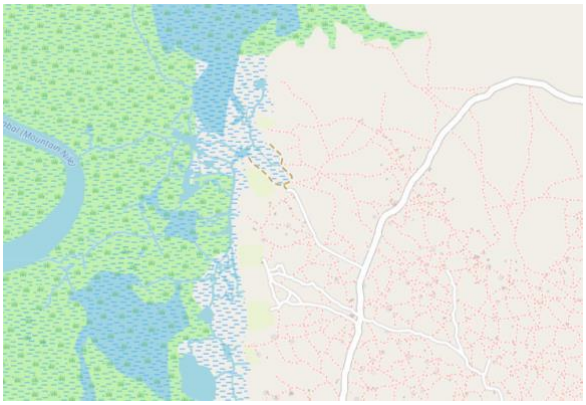
also in their lives after resettlement. Since IDPs usually have no camp to settle in and "refugees are often resettling outside of traditional camps in cities and host communities,"[36] a detailed local map is vital for IDPs and newly arrived non-camp refugees, who have to survive in contexts that are largely foreign to them. OSM publishes online tutorials about how to edit their maps so that even non-experts and beginners can contribute to this effort.[37]



Map without Data: Outskirts of Bor, South Sudan (Apr 20, 2019, Google Map)

While the maps on OSM can generally be edited by anyone, OSM also has its own initiative: **Humanitarian OpenStreetMap Team (HOT)**. HOT is a volunteer-based online international community of mappers, GIS professionals, and software engineers.

One of HOT's map-editing projects related to conflict zones is Refugee Response.[38] Though **Refugee Response** aims to support humanitarian service delivery to refugee communities outside of the camps, the tool itself is useful for civilians on the ground. It also trains community leaders to fill in the blank spots on the map[39], at once expanding the database and making it less reliant on volunteers. Irrespective of whether volunteer mappers or local community members are involved in their production, comprehensive maps improve civilian security on the ground.



Map with Data: Outskirts of Bor, South Sudan (OpenStreetMap, Apr 20, 2019)

[36] Humanitarian OpenStreetMap Team, "Refugee Response," accessed April 19, 2019. https://www.hotosm.org/ impact-areas/refugee-response/.
[37] OpenStreetMap Wiki, "How to Contribute," accessed April 19, 2019. https://wiki.openstreetmap.org/wiki/How_to_contribute.
[38] Humanitarian OpenStreetMap Team, "Refugee Response: South Sudan and Syria," July 31, 2018, accessed May 7, 2019. https://www.hotosm.org/projects/urban_innovations_crowdsourcing_non-camp_refugee_data.
[39] Ibid.

Cooperation Structure Needed for Crisis Mapping

Though new softwares and services have automated and simplified many information collection and visualization processes, human involvement is still indispensable for visualization and analysis. Fortunately, as crisis mapping platforms have become more user-friendly, new volunteers have joined the online community of crisis mappers, such as Standby Volunteer Task Force (SBTF), GISCorps, Missing Maps, and many more. These community members are not necessarily IT, GIS or mapping experts, but rather humanitarian actors, college students, and others who feel obliged to support affected people on the ground in any way possible.

Many of these communities become active in a wake of a crisis, whether it is a natural disaster or an outbreak of violence. For instance, OCHA requested SBTF volunteers to create the Libya Crisis Map in 2011. Upon request, more than 300 SBTF mappers, many of whom were either full-time students or managing full-time jobs, volunteered to create and continue updating the Libya Crisis Map for four weeks.[40] The drawback of relying on a volunteer community is that this momentum only lasts for a short period of time and therefore cannot be relied upon for sustainable change.[41] In order to use crisis mapping to support civilian self-protection strategies in protracted conflict zones, Crisis Maps must be continuously updated and renewed. Therefore, local communities or NGOs may need to take the primary role in keeping Crisis Maps current. For instance, local security teams should incorporate Crisis Map updates into their daily work, and when the number of reported incidents begins to escalate, they can then request international support through the online community of volunteer mappers.

Case Study: Sentry by Hala Systems

Since the beginning of the Syrian civil war in 2011, the estimated number of casualties has exceeded 570,000.[42] Opposition-held areas such as Aleppo and Idlib, sieged by the Syrian regime, have been particularly ravaged. The Syrian regime has used unlawful tactics including chemical weapons, cluster munitions, indiscriminate airstrikes, and the denial of humanitarian aid to cause civilian suffering and force anti-government forces to surrender.[43]

Some of the deadliest threats to civilians in opposition-held areas have been from airstrikes. For instance, Syrian and Russian airstrikes, allegedly aiming to destroy ISIS,

[40] Meier, *Digital Humanitarians*, 57-59.

[41] Ibid: 60.

[42] Syrian Observatory for Human Rights, "More than 570 Thousand People Were Killed on the Syrian Territory within 8 Years of Revolution Demanding Freedom, Democracy, Justice, and Equality," March 15, 2019, accessed May 7, 2019. http://www.syriahr.com/en/?p=120851.

[43] Human Rights Watch, "World Report 2019- Syria: Events of 2018," accessed April 30, 2019. https://www.hrw.org/world-report/2019/country-chapters/syria#909488.

were responsible for two-thirds of civilian casualties in December 2015- mostly in areas that did not feature ISIS forces.[4445] Densely populated neighborhoods, health care facilities, schools, and markets have been destroyed by missiles and barrel- bombs over the years.[46]

Civilians have sought a way to survive under these attacks. In order to gain an extra few minutes to take shelter, they often monitor the sky to capture early signs of planes heading toward them. Over time, networks of volunteer spotters, many of whom are members of the Syria Civil Defense (colloquially known as the "White Helmets"), have developed. These groups intercept military communications, monitor the Russian and Syrian military bases from which planes take off, watch the sky to determine the trajectory of warplanes, and spread warnings of incoming threats via two-way radios ("walkie-talkies") and social media.[47] Unfortunately, this admirable human-based warning system has sometimes lacked for speed and accuracy that would give targeted civilians a better chance to find safety. Hala Systems has stepped in to address the challenge by combining new technology with the existing human network on the ground.

Hala's early warning system, Sentry, relies on both human observers and acoustic sensors to detect warplanes in flight. When observers around the military airbases spot an airplane taking off, they report the type of aircraft and where it is heading. Acoustic sensors mounted on trees and buildings help Sentry's software to confirm the type of plane, its location, speed, and flight path. Armed with this data, the software estimates the possible target and timing of the airstrike by comparing it to past cases of attacks. The software then issues an alert via social media to civilians in the targeted areas.[48]

Hala has also set up air raid sirens that can be activated remotely in order to broadcast alerts for those who lack Internet access. To reach the broader community, these sirens trigger a network of alerts from other actors on the ground, including opposition-affiliated radio stations who have arrangements with Hala.[49] Additionally, Hala has

[44] Mouaffaq Nyrabia, "Syria: Only Civilian Protection and Accountability Will Make a Political Solution Viable," New Europe, January 5, 2016, accessed May 3, 2019. http://neurope.eu/article/syria-only-civilian-protection-and- accountability-will-make-a-political-solution-viable/.

[45] Carter Center, "Syria Conflict Update," October 30, 2015, accessed May 7, 2019. https://www.cartercenter.org/resources/pdfs/peace/conflict_resolution/syria-conflict/Syria-Conflict-Update-103015.pdf.

[46] Natasha Hall, "Waiting for No One: Civilian Survival Strategy in Syria,"Center for Civilians in Conflict (2016), 3.

[47] Ibid: 17.

[48] Danny Gold, "Saving Lives with Tech in Amid Syria's Endless Civil War," WIRED, August 16, 2018, accessed May 3, 2019. https://www.wired.com/story/syria-civil-war-hala-sentry/.

[49] Louisa Loveluck, "The Secret App That Gives Syrian Civilians Minutes to Escape Airstrikes," Washington Post, August 18, 2018, accessed May 4, 2019. https://www.washingtonpost.com/world/the-secret-app-that-

developed a software with a neural network to automatically search online and social media posts for information to confirm the actual timing and location of an airstrike. By comparing what happened to what Sentry had predicted, the data can be used to improve the software's future performance.[50]

Sentry's early warning system gives Syrian people an additional eight minutes on average to run.[51] Alerts also enable rescue teams and doctors to get ready for the emergency response. According to Hala, their project resulted in a 20-27% reduction in casualty rates in several areas under heavy bombardment in 2018.[52] Beyond protecting civilians on the ground, Hala was surprised to discover that the technology had another application: they now possess "the most complete picture of the air war in Syria outside of the classified environment."[53] Since the records of airstrikes by the Syrian regime and Russia could be used as evidence of war crimes, Hala has shared their data with the UN.

Aerial bombardment of civilian populations by the Syrian regime and Russia persists in Idlib and other areas to this day.[54] As such, Hala's technology and observers on the ground continue to provide literally life-saving assistance to Syrians.

Summary - Security

To fundamentally change the security situation on the ground, political and socio-economic efforts are critical. Technology in and of itself cannot end conflict. Technology cannot stop violence. However, there are at least some ways that recent technological advances can provide support. Emerging tools can help civilians to understand the security threats, detect signs of violence so as to take preventive measures and protect themselves, and ultimately improve their survival strategies. The technologies mentioned in this chapter are some of the most powerful examples that the world has ever witnessed. There are surely more to come.

gives- syrian-civilians-minutes-to-escape-airstrikes/2018/08/17/e91e66be-9cbf-11e8-b55e-5002300ef004_story.html?utm_term=.b833a9cf6d09.

[50] Gold, "Saving Lives with Tech."

[51] Ibid.

[52] Hala Systems, "Sentry Overview," accessed April 30, 2019. https://drive.google.com/file/d/ 1fGDOV-r512OTnZef-NJWqUlar4gaM9P4/view.

[53] Gold, "Saving Lives with Tech."

[54] Syrian Observatory for Human Rights, "In 7 Hours…Nearly 60 Explosive Barrels Were Dropped By the Regime's Helicopters on 16 Areas in Both Hama and Idlib Countryside within Putin – Erdogan Demilitarized Zone," April 30, 2019, accessed May 1, 2019. http://www.syriahr.com/en/?p=126295.

Humanitarian Assistance

Technological advancements continue to re-define humanitarian work. As the sector moves from supply to demand-driven models of response management, new tools and delivery systems are increasingly being sought to meet the needs of affected populations. Our research has revealed modern forms of assistance that include distributed ledger technology and biometrics for cash transfer; mobile solutions and social media platforms enabling communications between providers and beneficiaries; virtual reality providing psychosocial support for children in conflict zones; and social media-based telemedicine connecting healthcare workers in conflict with medical experts from around the world. We have grouped the technologies below by their respective goals— improving the delivery of assistance or addressing medical needs. We have also included a final section that speaks of forthcoming solutions that have yet to establish themselves, but show great promise nonetheless.

It bears repeating that the deployment of new technologies that either provide or facilitate assistance in conflict zones is often complicated, though not impossible. Some have been designed and trialed explicitly for this purpose, while others appear customized for emergency or camp settings— though only from a distance. As such, the examples included in this chapter have either directly or indirectly proven their utility for civilians in conflict, or at least hold the potential to be transferred there subject to certain caveats.

[54] UNICEF, "Humanitarian Drone Corridor Launched in Malawi," August 23, 2017, accessed May 4, 2019. https://www.unicef.org/stories/humanitarian-drone-corridor-launched-malawi.

Put simply, the majority of tech-based innovations today are less humanitarian aid than they are facilitators of humanitarian aid. From digital identity management that supports cash transfer programming (CTP) to apps that enable clinicians in fragile settings to leverage medical resources worldwide, new technologies are often merely empowerment tools; that is, faster, safer and more efficient ways of sharing information that beneficiaries can then use to help themselves. [55]

However, this is not meant to diminish their significance. If anything, given today's political climate globally, their timing is impeccable. The world has rarely before been so inept in its responsibility to protect civilians. As the technology revolutionizing humanitarian work seeks to sidestep this roadblock, the only question is whether it can reach them in time.

[55] Relief Web, "The State of the World's Cash Report: Cash Transfer Programming in Humanitarian Aid," February 28, 2018, accessed May 3, 2019. https://reliefweb.int/report/world/state-world-s-cash-report-cash-transfer-programming-humanitarian-aid

Technologies That Improve Aid Delivery

In conflict zones today, civilians are routinely denied humanitarian assistance or are barely scraping by with the minimal supplies they do receive. In Syria, it is estimated that only 2 to 18 percent of UN assistance makes it to civilians, while Syrians in opposition-held areas are almost completely ruled out of this estimate. In either case, the Assad regime retains control over the majority of all UN aid intended for Syrian beneficiaries.[56] In Yemen, meanwhile, desperately needed food, medicine, and other forms of assistance are being blocked at the border by the various parties to the conflict.
Consequently, the nation is now on the brink of famine.[57]

Our research encountered several new technologies that could help to overcome aid delivery challenges in conflict settings. These include: distributed ledger technology for seamless cash transfer; crowdfunding by way of social media for civilians in conflict; and mobile solutions that enable improved communications between beneficiaries and providers.

Cash Transfers and Digital Identity

Considering 60% of the chronically hungry people in the world today (i.e. those unsure of how they will get their next meal) live in armed conflict, the World Food Programme (WFP) maintains an active presence in war zones. Given that the UN System tends to rally around the Sustainable Development Goals and SDG #2 strives to "End Hunger" by 2030, it is safe to assume that this will continue.[58,59]

Not surprisingly, the WFP has been a leader in engaging new technologies for social good. They are at once blessed with having a strong mandate for innovation and challenged by having the most work to do. The WFP distributed $1.74 billion worth of cash transfers in 2018, a record total for the organization and the highest of any humanitarian actor in the world.[60] It is likely for this reason that they have been in the vanguard of exploring new modalities of making cash disbursements more efficient.

[56] Annie Sparrow, "How UN Humanitarian Aid Has Propped Up Assad," Foreign Affairs (September 20, 2018), accessed May 2, 2019. https://www.foreignaffairs.com/articles/syria/2018-09-20/how-un-humanitarian- aid-has-propped-assad.

[57] Daniel Nikbakht and Sheena McKenzie, "The Yemen War is the World's Worst Humanitarian Crisis, UN Says," CNN, April 3, 2018, accessed May 2, 2019. https://www.cnn.com/2018/04/03/middleeast/yemen-worlds- worst-humanitarian-crisis-un-intl/index.html.

[58] Robert Opp, World Food Programme and UN Innovation Network, interview with Mark Filipovic and Woong Seong, April 19, 2019.

[59] United Nations, "Sustainable Development Goals," accessed April 26, 2019. https://sustainabledevelopment.un.org/?menu=1300.

[60] World Food Programme, "Cash Transfers," accessed April 19, 2019. https://www1.wfp.org/cash-transfers.

Distributed Ledger Technology (DLT) has become increasingly popular in this area. Distributed ledgers (e.g. blockchain) provide a digital database of records overseen by a community of users rather than by one central server. Among their advantages include their facilitation of secure, reliable, consistent, and tamper-proof transactions, as well as their inherent transparency.[61] Their greatest value-add to beneficiaries is in how they enable donor organizations to reach them without relying on problematic middlemen and convoluted paper cash delivery systems. Indeed, a contact from a leading research center in the United States affirms that the growing industry trend towards cash-based programming is a major factor propelling DLT and biometrics solutions. For this reason, the advent of biometrics (e.g. iris scans, fingerprints, etc.) for identity management is widely seen as a game-changer, and several innovations have been based on this emerging technology.'[62]

WFP has piloted the use of blockchain to deliver aid to Syrian refugee camps in Jordan through their Building Blocks program. Camps in Azraq and Za'atari have installed an innovative method of payment at supermarkets to allow refugees to redeem their cash transfers through biometric scans. This is done by utilizing the UNHCR's blockchain-based system that contains all refugees' biometric data. A beneficiary first uses the iris scanner at the point of purchase to confirm their identity. The system can then authorize the transaction and update the consumer's virtual account accordingly. [Note: As part of the ID2020 campaign to build a global identity solution, Accenture and Microsoft are developing a similar blockchain on which refugees' biometric data can be stored and their digital identities established.[63] While this application of biometrics extends beyond the scope of the report, identity registration is yet another humanitarian cause that stands to benefit from digital technology's ability to make processes more seamless and minimize human error.]

By way of this medium, the WFP maintains a complete internal record of all transactions between retailers and refugees. As of October 2018, over 100 000 people in camps had redeemed their aid through this blockchain-based system and WFP is now looking to expand the program to two countries in the Middle East, both active conflict zones.[64] Importantly, by virtue of its direct means of payment and elimination of intermediaries, Building Blocks has enabled the WFP to save 98% on bank transaction

[61] TRADEIX, "The Difference Between Blockchain and Distributed Ledger Technology," accessed May 7, 2019. https://tradeix.com/distributed-ledger-technology/

[62] Nathaniel Raymond, Researcher at Yale University, interview with Mark Filipovic, March 19, 2019.

[63] Accenture, "Accenture, Microsoft Create Blockchain Solution to Support ID2020," June 19, 2017, accessed May 4, 2019. https://newsroom.accenture.com/news/accenture-microsoft-create-blockchain-solution-to-support- id2020.htm.

[64] Maddie Seibert, "The World Food Program: Fighting Hunger With Blockchain," Foodtank, January 2019, accessed May 4, 2019. https://foodtank.com/news/2019/01/the-world-food-program-fighting-hunger-with-blockchain/. ; Opp, World Food Programme and UN Innovation Network.

fees.[65] In this sense, as noted by ConsenSys Social Impact, technological advances like distributed ledgers stand to benefit both the aid recipient through improved security and aid provider through improved efficiencies.[66]

One of ConsenSys Social Impact's spin-offs, The Bifröst Initiative, is a consortium of companies focused on cash transfer programming use cases. It aims specifically at supporting blockchain-based "sandbox experiments" and innovations in CTP. Bifröst has partnered with Sempo in Lebanon to enable Syrian refugees to make purchases via SMS messaging. Beneficiaries use digital credits as currency to buy items from participating businesses, who are then reimbursed by a local NGO. While the last step still requires a form of payment, the transaction can be performed more reliably with established businesses than with individual beneficiaries who may lack access to the banking system. In either case, ConsenSys Social Impact and its various partnerships showcase the ways in which technology is reshaping humanitarian work.[67]

For distributed ledger technology in general, the absence of shared infrastructure between actors is seen as its greatest weakness. Mercy Corps' Senior Advisor for Technology for Development, Ric Shreves, believes that until a broad consensus is reached on shared infrastructure and data standards, the full potential of having distributed architecture and decentralized collaboration will not be fulfilled.[68]

In contrast to the stability of blockchain, the cryptocurrencies based on it are viewed quite differently. As cryptocurrencies are a medium of exchange, they can be as volatile as any other liquid asset- if not more so, given the lack of market regulation. This is of particular concern when it comes to cash transfer programming in crisis settings: the unpredictability of cryptocurrencies may expose beneficiaries to significant financial risk. Shreves feels that stable coins will eventually provide a solution for this problem, though not for a while yet.[69] Cryptocurrencies can still add value in two areas today: to facilitate asset preservation for refugees in flight, and for use in hyperinflationary economies. Indeed, the latter point is substantiated by the success of cryptocurrency SmartCash, which has become popular in Venezuela presumably due to the region's lack of secure banking alternatives.[70]

[65] World Food Programme, "Blockchain for Zero Hunger: Building Blocks," March 12, 2018, accessed May 4, 2019. https://innovation.wfp.org/project/building-blocks.

[66] ConsenSys, "Social Impact," accessed April 16, 2019. https://consensys.net/social-impact/.

[67] Robert Greenfield IV, "The Bifröst Initiative," Good Audience, January 12, 2019, accessed April 10, 2019. https://blog.goodaudience.com/the-bifr%C3%B6st-initiative-a0e8bd61b368.

[68] Ric Shreves, Mercy Corps, interview with Mark Filipovic, April 9, 2019.

[69] Ibid.

[70] Institute of International Humanitarian Affairs, "Embracing Complexity: Preliminary Findings From the Humanitarian Blockchain Summit," February 21, 2018, accessed May 4, 2019. https://medium.com/humanitarianpulse/embracing-complexity-preliminary-findings-from-the-humanitarian-blockchain-summit-d51cef268e65.

RedRose is a private company that facilitates cash transfer to civilians in conflict through its encrypted, web-based ONE Platform and offline-capable mobile apps. Initially piloted by the ICRC, RedRose runs a data verification system that, through biometrics, enables cash transfer programming to be more transparent and efficient than traditional methods. Once beneficiaries are registered into the ONE Platform's database, their accounts can then be credited directly by participating NGOs through any combination of cash modalities (paper cash, E-vouchers and smart cards).

One of the ONE Platform's greatest advantages is that it excels in offline environments, as well. Through the use of smart cards, an E-voucher system can be created to track transactions internally while they wait to be uploaded to a central server. This safeguard prevents the beneficiary from redeeming the same voucher multiple times at the expense of the vendor. Moreover, RedRose feels that its system "enables donors to provide assistance to civilians in full confidence that assistance won't be diverted to support militias or warring factions. By being able to trace assistance through the entirety of the supply chain, donors feel comfortable continuing to provide significant amounts of assistance to families in places like Yemen, Syria, or Somalia."[71]

Approximately $200 million worth of assistance was distributed through the ONE Platform in 2018. The organization has partnered with many of the world's largest civil society actors, such as the ICRC, Mercy Corps and Catholic Relief Services in West Africa.[72] While the ONE Platform is not an application that can be run by civilians alone, it is valuable for them nonetheless. RedRose's technology is a prime example of a conduit that allows humanitarian actors to reach families in need more seamlessly. In effect, it allows humanitarians to protect civilians.

Crowdfunding

Facebook's previously mentioned Safety Check includes a crowdfunding platform to reach civilians in crisis. Upon a safety check being activated in response to an isolated incident of violence, the Facebook community can then make donations to affected populations either directly (i.e. account-to-account) or through the platform's accredited list of NGOs on the ground.[73] This function can help civilians in crisis acquire the financial means they need to purchase items essential for their wellbeing.

[71] Courtney Brown, Red Rose, email with Mark Filipovic, May 1, 2019.
[72] Courtney Brown, Red Rose, interview with Mark Filipovic and Adam Robitaille, February 21, 2019.
[73] Holmes, Facebook.

Unmanned Aerial Vehicles for Aid Delivery and Mapping

An Unmanned Aerial Vehicle (UAV or "drone") is an aircraft that can either be controlled remotely or fly autonomously.[74] In the humanitarian sphere, WeRobotics have used UAVs to build disaster resilience in Japan;[75] Médecins Sans Frontières have deployed UAVs to conduct aerial mapping exercises in Malawi;[76] while Zipline has been using drones to deliver medical supplies to needy populations in Rwanda.[77] The Swiss Foundation for Mine Action (FSD) is among the actors studying how drones can be used to deliver smaller aid payloads.[78]

As far as their practical limitations, many professionals draw a clear distinction between using UAVs in authorized humanitarian settings (e.g. refugee camps) and regions mired in armed conflict. A 2016 survey conducted by FSD revealed that drone use in conflict settings was a polarizing issue, with 41 per cent of respondents supporting their potential use and 40 per cent arguing steadfastly against it.[79] iRobotics has enumerated the challenges related to drones, such as their technological weakness; potentially inappropriate use (for example, they may be used as weapons should they be captured by a hostile actor); transparency, consent and privacy issues; and the military stigma they carry among beneficiaries in some contexts, who may have suffered attacks from UAVs in the recent past.[80]

Many humanitarians who were interviewed echoed this list. One official from a leading NGO phrased it in memorable terms: "People are not dying because of problems that the drone can solve. They're dying because of mass access deprivation. What we need is volume."[81]

[74] The UAV, "Home," accessed March 10, 2019. https://www.theuav.com/.
[75] WeRobotics, "Webinar: Building Disaster Resilience in Japan with Drones and Aerial Imagery," September 28, 2018, accessed May 4, 2019. https://blog.werobotics.org/2018/09/28/building-disaster-resilience-in-japan-with- drones-and-aerial-imagery/.
[76] Médecins sans Frontières, "Drones: A helpful humanitarian tool," July 4, 2017, accessed May 4, 2019. https://www.msf.org.uk/article/drones-helpful-humanitarian-tool.
[77] Jonathan W. Rosen, "Zipline's Ambitious Medical Drone Delivery in Africa," Technology Review, June 8, 2017, accessed May 4, 2019. https://www.technologyreview.com/s/608034/blood-from-the-sky-ziplines-ambitious- medical-drone-delivery-in-africa/.
[78] Swiss Foundation for Mine Action, "Drones in Humanitarian Action," December 2, 2016, accessed May 4, 2019. https://drones.fsd.ch/wp-content/uploads/2016/11/Drones-in-Humanitarian-Action.pdf.
[79] Swiss Foundation for Mine Action, "Survey: Most Humanitarians Favour the Use of Drones in Disaster Zones," September 6, 2016, accessed March 7, 2019. https://drones.fsd.ch/en/3898/.
[80] Patrick Meier, "Humanitarian Use of UAVs/Drones in Conflict Zones: Fears, Concerns and Opportunities," iRobotics, November 3, 2014. https://irevolutions.org/2014/11/03/humanitarian-uavs-conflict-zones/
[81] Raymond, Yale University.

This, of course, has not stopped the modality from being trialed. In 2014, Uplift's Syria Airlift Project was founded in the US to train refugees in Jordan to use custom-made UAVs to deliver food and medical supplies throughout Syria. Uplift's leadership team felt that smaller UAVs possessed distinct advantages over cargo drones that were likely to get shot down. Mark Jacobsen, Executive Director of Syria Airlift Project: "We believe that larger numbers of smaller aircraft can get through. It's not worth shooting down a $500 plane carrying a couple of pounds of medicine. We want to send hundreds of airplanes in, or (even) thousands. This is a movement; a movement to bring healing into Syria and give people something to believe in."[82] A volunteer staff of IT experts, lawyers and engineers was enlisted to operationalize the idea. Unfortunately, the program folded less than two years later on account of financial and technical troubles.[83] This story is a microcosm of how the international community has to this point struggled to translate the humanitarian potential of drones from theory into reality.

Mobile Solutions to Help Humanitarians Communicate With Civilians

As social media platforms are close to the action in disaster zones (at times even part of it) , instant messaging can be a useful tool for humanitarians. It can empower affected populations to raise their own voices rather than wait on others to reach them first. The benefits to open communication are self-evident, as humanitarian actors can scan messages on social media to determine exactly what type of aid is required and in what region. In so doing, the framework for a demand-driven response is nourished. The previously mentioned White Helmets, a volunteer crisis response team in Syria, communicate by way of WhatsApp,[84] an instant messaging app that features end-to- end encryption.[85] In addition to the provider, the sheer breadth of information available online is of clear value to the recipient as well.[86]

There are countless examples of organizations using these types of technologies for humanitarian purposes. Mercy Corps has been especially active in the area. Through the Khabrona.info app that they have developed, which offers reliable legal guidance for

[82] BBC News, "Syria: Drones to SAVE Lives," April 25, 2015, accessed April 26, 2019. https://www.youtube.com/watch?v=w8KPh9106CU

[83] Julian Borger, "US and UK Explore Possibility of Aid Airdrops in Syria," The Guardian, December 4, 2016, accessed March 13, 2019. https://www.theguardian.com/world/2016/dec/04/us-uk-explore-possibility-aid-airdrops-syria-drones.

[84] Heba Kanso, "'We are trapped': White Helmets plead for evacuation from Syria," Reuters, July 26, 2018, accessed May 3, 2019. https://www.reuters.com/article/us-syria-whitehelmets-evacuation/we-are-trapped-white-helmets- plead-for- evacuation-from-syria-idUSKBN1KG2XY.

[85] WhatsApp, "WhatsApp Security," accessed May 4, 2019. https://www.whatsapp.com/security/.

[86] Marion, "ICTs During Humanitarian Crisis: Can Social Media Save Lives," Digital (In)equality, March 7, 2018, accessed March 15, 2019. http://wpmu.mah.se/nmict181group1/icts-humanitarian-crisis-social-media-save-lives/.

migrants, Mercy Corps and its partners are "helping Syrian refugees in Jordan, where it's estimated that 62% of refugees don't know how to obtain legal documentation."[87]

The American Red Cross has engineered a solution of their own. RC View is an app built on Esri's GIS that facilitates situational awareness for Red Cross' workforce on the ground. In addition to data regarding water levels and road closures, RC View enables aid delivery and financial assistance programming to be designed on a more efficient and cost-effective basis. In its first two months of use, the platform allowed the Red Cross to respond to "more disasters than the (previous) four years combined."[88] Though RC View has to date been piloted only in natural disaster response, it should not be dismissed out of hand. Insofar as unproven humanitarian tools use natural disasters to assess and improve their performance in the field— as stated by a senior UN Innovation Lab official— RC View may be one to watch in the future. Its goal of optimizing resources and workflows on the ground applies to all settings, including conflict.[89]

WFP has partnered with InStedd and Cisco to hear directly from civilians in conflict. The "mVAM" project (Mobile Vulnerability Analysis and Mapping) uses SMS and interactive voice response technology to help beneficiaries track the pricing, availability and security of food in emergency settings through mobile communications.[90] This data is equally important for aid workers, as it can be used to determine how best to customize food delivery programs for recipients.

mVAM has been scaled to over 30 countries to date, including Afghanistan, Myanmar, Syria and Yemen. For example, since the beginning of Yemen's civil war in 2015, WFP has used mVAM to conduct monthly surveys of Yemenis to assess food consumption, negative coping strategies, and food security within communities.[91] The program reached 2542 households in March of 2019 and, among its conclusions, found that dietary diversity was exceptionally low for women, who had been eating mainly grains and pulses over the previous month.[92] Such data ultimately helps humanitarians make informed choices around aid provision and how to tailor food baskets for their recipients. mVam represents how WFP

[87] Ibid.

[88] Tae Yoo, "4 Ways Technology Can Help Us to Respond to Disasters," World Economic Forum, January 8, 2018. https://www.weforum.org/agenda/2018/01/4-ways-technology-can-play-a-critical-role-in-disaster-response/

[89] Opp, World Food Programme and UN Innovation Network.

[90] Cisco, "CSR Partner: World Food Programme," accessed April 26, 2019. https://www.cisco.com/c/en/us/about/csr/community/partners/world-food-programme.html.

[91] World Food Programme, "VAM food security analysis: Yemen," accessed April 26, 2019. http://vam.wfp.org/sites/mvam_monitoring/yemen.html.

[92] World Food Programme, "Yemen mVAM Bulletin no. 43 (March 2019)," March 2019, accessed May 7, 2019. https://docs.wfp.org/api/documents/WFP-0000104474/download/.

is using AI to acquire data from conflict-stricken communities, which can then be used to design appropriate and even lifesaving humanitarian responses.

WFP and InStedd have taken this idea one step further by developing the "Foodbot" chatbot platform to communicate with target populations. Chatbots are computer programs that can simulate conversations online and are capable of 'chatting' with thousands of civilians simultaneously.[93] In effect, they can conduct surveys on mobile apps that vulnerable populations already use, which allows humanitarians to connect with more people and collect more data than is possible through instant messaging. Foodbot provides a way for vulnerable populations to ask questions of WFP, while at the same time allowing WFP to share information with them on its programs, food prices and nutrition tips. Foodbot runs on Facebook Messenger and Telegram for now, but aims to work across all applications in the future.[94]

Whether by mVAM (SMS) or Foodbot (chatbot), mobile technology has empowered WFP in its efforts to protect civilians. UN Innovation Network co-chair Robert Opp shares the following: "We can't have call centers for 100 million people. But by using something like a chatbot platform, we can send or receive queries: 'Where do I go for the next food delivery? When is it? What's my ration? When is the next cash disbursement and how will it be distributed?' It gives beneficiaries valuable information, but also facilitates for us important two-way dialogue: 'What are your special needs?' "[95]

In the end, however, data is only as useful as systems' capacity to make use of it. Nathaniel Raymond, researcher at Yale University's Jackson Institute for Global Affairs and formerly with the Harvard Humanitarian Initiative, highlights the problem of data deluge: "Our flows are at a point where they're paralytic in many cases, where the challenge is compressing it to actionability in faster and faster time loops- which does not rely on machines alone. It can be supported by machines, but fundamentally relies on managerial capacity, competency and capability to know what to look for and what decision we need to make."[96]

Moreover, basing needs assessments and new innovations on SMS messaging data is problematized by how telecom companies in war environments (including Syria) are often controlled by parties to the conflict. Thus, it can be difficult to verify the integrity of data gathered even with the presence of efficient systems for its management.[97]

[93] Instedd, "Foodbot: Developing a WFP Chatbot to Communicate with Target Populations," accessed April 26, 2019. https://instedd.org/project/foodbot/.

[94] "Our experiment using Facebook chatbots to improve humanitarian assistance." MVAM: The Blog. August 7, 2017. http://mvam.org/2017/08/07/our-experiment-using-facebook-chatbots-to-improve-humanitarian-assistance/

[95] Opp, World Food Programme and UN Innovation Network.

[96] Raymond, Yale University.

[97] Interview with UN Official.

Technologies That Address Medical Needs

Active conflicts are devastating. As the number of injuries and trauma-related disorders skyrocket, while health care facilities are targeted by war strikes and medical infrastructure is on the verge of collapse, the needs on the ground become more dire and services offered more scarce.[98] In this sense, our research set out to identify the emerging tools and technologies being piloted and used to assist medical practitioners in the field who were striving to provide better medical assistance to those in need. Virtual reality for psycho-social therapy, social media-based telemedicine to enable communications between clinicians in conflict and their peers around the world, and mobile surgical units that bring the Operating Room to the battlefield, were some of the solutions we found to address this challenge.

Virtual Reality for Mental Health & Advances in Telemedicine

The emergence of virtual reality (VR) and advances in telemedicine are helping to assist vulnerable populations, particularly to deal with the psychological distress and trauma associated with war— and not a moment too soon, either. In one South Sudanese study jointly conducted by the UNDP and South Sudan Law Society in 2015, 41% of respondents were found to be suffering from post-traumatic stress disorder.[99] This problem was exacerbated by how the entire country reportedly had as few as two practising psychiatrists around the same period. It stands to reason that 'virtual' tools have an opportunity to make a substantial impact in conflict zones.

Mercy Corps, for one, has engineered a solution to help address the mental health of children who have grown up near combat. It has piloted a program in Iraq that provides children with a digital safe space to "create a calming environment. This immersive technology can reach more people for less cost and help to renew the chance for a normal childhood."[100] The effort began with basic 360° video content but has since grown to include fully immersive guided meditation. Born of a desire to supplement PPLAY (its pre-existing psychosocial treatment regimen for adolescents) with the modality of VR, Mercy

[98] Médecins sans Frontières, "War and Conflict," accessed May 2, 2019. https://www.msf.org/war-and-conflict-depth.

[99] Joi Lee and Viktorija Mickute, "Healing trauma in South Sudan through mental health programmes," *Aljazeera,* November 26, 2018, accessed May 7, 2019. https://www.aljazeera.com/indepth/inpictures/healing-trauma-south- sudan-mental-health-programmes-181126090440442.html.

[100] Susim, Jason. "7 Tech Trends that are Transforming Humanitarian Aid," *Mercy Corps,* January 11, 2019, accessed February 13, 2019. https://www.mercycorps.org/articles/7-tech-trends-transforming-humanitarian-aid.

Corps' pilot has seen strong results and is now planning to expand to an additional two regions in Iraq.[101]

It has seen its share of implementation challenges, however. For one, transporting the difficult equipment into Iraq was made difficult by the absence of Oculus distributors on the ground. Localizing the program's content into Arabic and Kurdistani presented another hurdle. Complying with child protection standards was also of concern: "The last thing we wanted to do was put in a therapy program that instead of desensitizing the kids, re-sensitizes them. They've already processed enough stress and we did not want to throw them back into it."[102] Still, the release of any new product is rarely seamless— whether the target environment is at peace or in conflict. The fact that PPLAY has at least demonstrated some early success is promising.

Figure 1 is an app that insiders have dubbed the "Instagram for doctors"[103]. It aims to share knowledge among medical professionals worldwide, particularly those stationed in areas that lack health care resources and facilities. Images are posted online (after being stripped of all personal and geographic information), thereby allowing doctors abroad to offer insights, diagnoses and techniques for treatment. The company has partnered with institutions like Médecins Sans Frontières and Mount Sinai Health System and claims to have assembled the world's largest active network of medical practitioners.[104]Among other places, Figure 1 has been used in Syrian refugee camps to communicate with clinicians around the globe and is available as a free download in over 190 countries today.[105] It can be assumed that such powerful telemedicine apps will become even more prevalent in the future.

Mobile Surgical Units

New innovations need not be exclusive to cyberspace. Médecins Sans Frontières (MSF) has itself been struggling in conflict settings. Helping medical teams reach the wounded— and vice versa— has long been a theme for the organization and it has used technology to pioneer solutions of its own. In 2017, in response to an escalation in fighting in Iraq, MSF developed its Mobile Unit Surgical Trailer— or "MUST". The MUST brought the operating room, intensive care unit and pharmacy to the front lines, while its portability allowed it to be moved along with the conflict's shifting borders. In its first five weeks of use

[101] Shreves, Mercy Corps.

[102] Ibid.

[103] Christina Farr, "How This Doctor is Using Telemedicine to Treat Syrian Refugees," Fast Company, March 9, 2016, accessed April 16, 2019. https://www.fastcompany.com/3057572/how-this-doctor-is-using-telemedicine- to-treat-syrian-refugees.

[104] Figure 1, "Figure 1," accessed April 16, 2019. https://figure1.com/about/.

[105] Figure 1, "FAQ: Where is Figure 1 Available?" accessed April 6, 2019. https://figure1.com/faq/#whereisfigurenbsp1available.

in Mosul, the MUST enabled medical practitioners to treat more than 1800 patients and perform over 1200 surgeries.

Based on user feedback from the initial trial, the MUST2 was recently introduced, a 16-module trailer with greater operational capacity, flexibility and autonomy than the beta version. The unit aims to allow MSF to complement its traditional deployments in medical centres with stand-alone units that can serve all populations in need. While the technologies inside are not new, per se, their assembly under one mobile roof in crisis settings is unprecedented. "We are not changing how we provide care. (But) now we can be completely autonomous… and reach patients everywhere in the world— by road, by boat, by air." says Olivier Delbauve, project coordinator for the MUST2.[106]

MSF has recently used its Transformational Investment Capacity program to gain funding for new initiatives to assist civilians living in crisis.[107] Point-of-care ultrasound (POCUS) is one example. POCUS is a portable imaging tool that allows clinicians at all levels, with only 12 hours of training, to make accurate and potentially lifesaving medical diagnoses that were formerly reliant on telemedicine. POCUS was propelled by recent advances in ultrasound technology, which have made it more affordable, user-friendly and fit for use in low-income settings— including those in armed conflict.

In concert with the South Sudanese Ministry of Health, POCUS was piloted successfully in an MSF-partner hospital in Aweil to diagnose pulmonary pathologies. It has now been adopted by sites in Haiti, Rwanda and Niger, and is expected to grow significantly.

Again, it should be noted that ground support is still required for MSF to field its programs. In extreme cases like Syria where MSF can only operate in regions not controlled by the regime (and even there, in relatively insecure locations), these solutions are harder to apply.

Emerging Technologies

Given the extent to which today's political stalemates are preventing humanitarians from reaching victims on the ground, new solutions for this challenge are being trialed on a regular basis. In some ways the inertia has spawned an ever-growing stable of ideas. For

[106] Médecins sans Frontières, "It's a MUST: Providing Emergency Surgery on the Go," April 6, 2018, accessed March 10, 2019. https://www.doctorswithoutborders.org/what-we-do/news-stories/story/its-must-providing-emergency-surgery-go.

[107] Médecins sans Frontières, "POCUS: Bringing the Revolutionary Potential of Ultrasound to South Sudan," April 6, 2018, accessed April 3, 2019. https://www.doctorswithoutborders.org/what-we-do/news-stories/story/ pocus-bringing-revolutionary-potential-ultrasound-south-sudan.

example, the Humanitarian Grand Challenge (HGC) is a notable partnership between USAID, DFID and the Netherlands' Ministry of Foreign Affairs, which receives additional support from Grand Challenges Canada. By working with innovators, humanitarians and the private sector, the HGC's mission is to catalyze groundbreaking solutions for civilians in complex emergencies. In September 2018, the inaugural HGC approved Transition to Scale funding for 23 hopeful innovators. Included among this group were technologies to produce renewable energy for health care facilities in Syria and machine learning for safe water in conflict environments across the Middle East. The value-add of the former is that it would sustainably support the power grids of hospitals and medical clinics commonly targeted by war strikes. The latter tool, meanwhile, aims to prevent the morbidity and mortality associated with waterborne diseases (e.g. cholera) that prevail in conflict settings. In either case, technology is enabling the protection of civilians.

Within HGC, Intelehealth, a technology-based model to deliver medical services, has produced an open-source telemedicine platform that allows for medical advice to be provided online to health worker communities in remote areas of Syria and Jordan. Its ability to connect workers over low bandwidth networks to an online community of doctors is similar to the Figure 1 app covered earlier. ActionAid UK is an HGC project that has piloted a mobile platform to combat violence against Syrian women in Jordan's refugee camps. Victims are given a virtual location where they can report incidents and issues on the ground, as well as gain access to information about their rights, local services and safe spaces.[108,109]

While the HGC's prospects are unproven, they are reflective of the paralyzing global climate of today and the efforts underway to overcome it in the name of social good. In fact, not only have these and other ideas been resilient, in some cases policymaker inertia was what had inspired them in the first place. The HGC plans to launch its second request for proposals in May 2019 and the successes that emerge from the program are worth following.

[108] EurekAlert!, "First 'Humanitarian Grand Challenge' Finalists: 23 Innovative Projects to Help the Most Vulnerable," September 25, 2018. https://www.eurekalert.org/pub_releases/2018-09/tca-fg092418.php.
[109] USAID, "Administrator Green Announces Finalists For The Humanitarian Grand Challenge, Along With Additional Investment To Assist Conflict-Affected Communities," September 25, 2018, accessed May 7, 2019. https://www.usaid.gov/news-information/press-releases/sep-25-2018-administrator-green-announces-finalists-humanitarian-grand-challenge.

Summary - Humanitarian Aid

Despite how much ground is covered by the above categories, it comprises only a partial, ever-evolving list of emerging humanitarian tools. The research revealed that the word 'new' was relative. Even some technologies introduced to considerable fanfare over the past 12-24 months were now obsolete. Suffice it to say that trials of new humanitarian technologies are constant, failures common, and their roads to success equally unique and complex.

While some tools appear on first glance to not apply to conflict, this is viewed as a common misconception by those in the field. Throughout the research it was underscored by practitioners of varied backgrounds that many technologies ostensibly piloted for emergency response are in fact quietly being shaped for conflict zones as well. In a sense, natural disaster and camp settings are seen as the low-hanging fruit and serve as the most accessible proving ground for humanitarian solutions writ large. As hypothesized at the beginning of the research and aptly described by a leading humanitarian: "The problem is not the tech."[110]

[110] Raymond, Yale University.

Accountability

Accountability for war crimes and other humanitarian violations is crucial for the both the near and long term protection of civilians in conflict zones. Accountability allows for transparency in conflicts, facilitates human rights advocacy, and provides hope for those civilians living in conflict zones. We have identified three specific sub-functions of technology in Accountability: Collection of Evidence, Verification of Evidence, and Increasing Access to Justice.

In using technology to increase accountability, the protection of the personal information and data of civilians is critical. It is of the utmost importance to hold tech companies and incubators to high standards in order to earn the trust of civilians in regards to protecting privacy and keeping the collected data secure and confidential. Given that these technologies are being employed in violent and dangerous areas, ensuring civilian safety is of necessity, especially when the final goal of this technological development is to protect them. However, there are severe, real risks involved with using these apps and technological advances, which will be further addressed in the Cross-Cutting Issues section of this report.

Collection of Evidence

Collecting evidence is the first step of Accountability. It establishes a record of war crimes and atrocities for later use and brings the plight of civilians to the world's attention today. Collection of evidence includes technologies that directly capture photos, video, audio, and text, as well as those that remotely monitor or report information, such as satellite imaging and digital financial tracking. It also includes organizations that facilitate the capture of this evidence. In this era of misleading and "fake" news, it can be challenging to authenticate or rely on civilian-captured images. This developing field provides civilians the tools and training necessary to safely capture, maintain, and distribute evidence for use today and in the pursuit of future justice.

Visual Evidence: Photos and Videos

WITNESS is an organization that trains photographers, journalists, and activists in conflict zones to accurately capture and document events in ways that support transparency and meet standards of legal and journalistic reporting.[111] The organization is at work and partnering with localities and NGOs throughout the world, from the United States and Latin America to Southeast Asia. While not exclusively working in conflict zones, WITNESS has partnered with groups and worked to provide online and in-person training and support to groups in the Syrian War and during the Arab Spring. Additionally, they have partnered with organizations in Africa, such as Watching Western Sahara, to document war crimes and atrocities.[112]

In addition to providing in-person and online training, WITNESS provides access to mobile apps for capturing and securing photos, such as ObscuraCam and CameraV, and networks to disseminate evidence, such as VideoforChange.[113] Technology for securely capturing and disseminating visual evidence is proliferating. The organization Truepic uses secure blockchain technology to create incorruptible chains of evidence for photos and videos captured through the use of its mobile application.[114] This app can be used by civilians in conflict zones to record war crimes and human rights violations securely and in near real-time. Another organization, the eyeWitness Project, also provides an app to securely capture visual evidence and "allows your photos and/or video footage to be stored in a virtual evidence locker for use in trials and investigations."[115]

[111] Witness, "Our Work," accessed April 11, 2019. https://witness.org/our-work/.

[112] Witness, "Regional Programs," accessed April 11, 2019. https://witness.org/our-work/regional-programs/.

[113] Witness, "Resources," accessed April 11, 2019. https://witness.org/resources/.

[114] Truepic, "Photo and Video Verification You Can Trust," accessed on April 11, 2019. https://truepic.com.

[115] EyeWitness Project, "Collect Verifiable Photos and Videos," accessed on April 11, 2019. https://www.eyewitnessproject.org/.

Visual Evidence: Satellite Imagery

Oftentimes, organizations lack direct access to conflict zones, whether out of practicality, level of violence, or because host governments deny them access.[116] In these cases, organizations can use satellite imagery to capture evidence of war crimes and human rights violations. Satellite imagery itself is not new, and its use for humanitarian aid purposes dates at least to the 2000s or earlier.[117] However, in recent years its use has expanded to include the detection of war crimes and human rights violations in conflict zones.

The UN maintains its own program for "mapping support, satellite analysis and capacity development activities."[118] The UN Operational Satellite Applications Programme, or UNOSAT, provides humanitarian relief and coordination, human security and humanitarian law, and human rights mapping support for organizations operating in natural disasters and conflict zones.[119] UNOSAT is able to analyze satellite imagery and provide timely and objective information pertaining to the verification and monitoring of alleged violations of IHL. Gathering this type of clear and incontrovertible evidence, which would otherwise be unavailable, allows the international community to be aware of war crimes and violations, and ultimately work towards justice.[120]

Meanwhile, in a African country, another international actor used satellite imagery to discover that the government was concealing information about the food security status in a camp setting. The images revealed that all the food stores had been destroyed without any feeding operations having been initiated. This evidence was successfully used to pressure the government for access into the area, which had been denied previously. A human rights investigator shared the following about the event: "If we hadn't had those shots [satellite imagery], the famine warning would not have been initiated, the government would not have caved, and we would not have been running convoys 10 days out. And those convoys did save lives."[121] Gathering this type of clear and incontrovertible evidence, which would otherwise be unavailable, allows the international community to be aware of war crimes and violations, and ultimately work towards justice.

The proliferation of satellite imagery in the last two decades means that it is accessible not only to governments and intergovernmental organizations like the UN, but also to private companies and NGOs. Though no longer in operation, the former Satellite

[116] Olivier VanDamme, Programme Specialist in charge of Planning and Coordination at UNOSAT, interview with Mark Filipovic, March 6, 2019.

[117] Raymond, Yale University.

[118] VanDamme, UNOSAT.

[119] UNITAR, "What We Do," accessed April 11, 2019. https://unitar.org/unosat/what-we-do.

[120] VanDamme, UNOSAT.

[121] Interview with Human Rights Investigator.

Sentry Project operated from 2010 until 2015. The organization used satellite imagery taken of Sudan to identify military violations within demilitarized zones and attacks upon civilians in Sudan.[122] Satellite imagery captured and analyzed by the private company DigitalGlobe was used to identify and capture evidence of violence against civilians in Myanmar in early 2018.[123] The Harvard Humanitarian Initiative's Signal Project used satellite imagery to capture evidence of mass government killings at Sednaya military prison in Damascus, Syria, in 2017.[124]

Furthermore, in connection to accountability, it must be understood that drones and satellite imagery collect sensitive data. A director at a leading human rights organization said in an interview: "I was specifically there to alert them, in my mind, to the need for all the drone imagery to be treated as sensitive data for vulnerable populations. It should be subject to all existing security protocols. Meaning, it shouldn't just be dumped online for open source hacktivists to play around with. It should be treated as any intake information about families themselves, like DNA samples, the detailed case histories and family background documents."[125] Sensitive data can include hosts of information such as biometric data, civilians' location, or other private sources. If this information is not protected, it can severely impact the safety of civilians as well as their identity.

Financial Evidence

The above is not to suggest that visual evidence is the only means of establishing accountability. Financial transactions and records can also generate evidence. In conflict zones, illicit finances can be doubly problematic. These cash flows can enable groups to commit crimes against humanity or target civilians. However, violence itself can be a lucrative means to secure cash flows, creating a feedback loop that perpetuates conflict and empowers criminals. Today, technology can enable the analysis and tracking of illicit finances that support regimes, groups, and individuals responsible for committing crimes and violence against civilians.

The Sentry, an initiative sponsored by The Enough Project, "uses open source data collection, field research, and state-of-the-art network data analysis technology, and works in

[122] Satellite Sentinel Project, "Reports and Imagery," accessed on April 11, 2019. http://www.satsentinel.org/reports-and-imagery.
[123] Colin Dwyer, " PHOTOS: Myanmar Apparently Razing Remains Of Rohingya Villages," National Public Radio, February 28, 2018. Accessed May 7, 2019. https://www.npr.org/sections/thetwo-way/2018/02/23/588217754/ photos-myanmar-apparently-razing-remains-of-rohingya-villages.
[124] Louisa Loveluck and Zakaria Zakaria, "Syria's Once Teeming Prison Cells Being Emptied By Mass Murder," Washington Post, December 23, 2018, accessed May 7, 2019. https://www.washingtonpost.com/graphics/2018/ world/syria-bodies/ ?noredirect=on&utm_term=.b8369af1de62.
[125] Josh Lyons, Human Rights Watch, interview with Mark Filipovic and Woong Seong, April 14, 2019.

partnership with local and international civil society organizations, journalists, and governments."[126] While the organization requires a substantial presence from human sources and investigators inside conflict zones to conduct investigations, technology has facilitated the Sentry's operations. Their investigations have revealed substantial illegal cash flows throughout Africa, often tying them directly to the developed world and established financial institutions. One report by the organization demonstrated how conflict gold from the Democratic Republic of Congo was being smuggled out of that country and "through a series of companies to the United States and Europe, potentially including Amazon, General Electric (GE), and Sony."[127] The proceeds from the sale of unlicensed gold has encouraged violence against civilians and human rights violations. Another report by the Sentry revealed how the war profiteer Abdoulaye Hissène perpetuated violence against civilians in the Central African Republic. The organization exposed his illicit finances which underscored his strategy that "People need to die, the blood must flow for people (like me) to become rich."[128]

Technology is only a part of the solution to financial tracking for the Sentry, and this is true for all of the organisations involved in the collection of evidence. Each, to varying degrees, relies on the individuals working in the field conducting interviews and taking photographs or in labs analyzing imagery or designing training programs. Yet, overall technology is increasing access to evidence of war crimes, whether by capturing and transporting it more securely, overcoming geographic or political obstacles, or by automating analytical processes to complement human investigation.

Verification of Evidence

Verification of evidence combines the efforts of individuals and technology to prove and maintain its veracity. Organizations use encryption technology to create digital, incorruptible chains of photographic evidence from conflict zones. Blockchain technologies have become a central aspect in ensuring accountability as it secures and extracts evidence from conflict zones and facilitates distribution to the international community.

[126] The Sentry, "About the Sentry," accessed on May 9, 2019. https://thesentry.org/about/.

[127] The Sentry, "The Golden Laundromat: The Conflict Gold Trade from Eastern Congo to the United States and Europe," October 2018, accessed May 7, 2019. https://thesentry.org/reports/ the-golden-laundromat/.

[128] The Sentry, "FEAR, INC.: War Profiteering in the Central African Republic and the Bloody Rise of Abdoulaye Hissène," November 2018, accessed May 8, 2019. https://cdn.thesentry.org/wp-content/uploads/ 2018/11/ FearInc_TheSentry_Nov2018-web.pdf.

Truepic is an app that has revolutionized verifying evidence. Truepic allows smartphones to take photographs and videos using the app's Controlled Capture feature.[129] This ensures that a recorded photo or video is immediately sent to the blockchain where it is stored and incorruptible. The moment the photo is taken, the app leverages all the data sensors analyzing coordinates, geolocation devices, satellite imagery and location, news reports, and human analysis.[130] Truepic has contributed to protection of civilians as it is a means to hold war criminals accountable for their actions by documenting their crimes. This technology is important because it can strengthen legal cases by providing machine-generated images that have had a secured chain of custody from the moment the image was captured. While connectivity is still the Achilles heel for this technology, civilians can still access it through the use of satellite connection. A future goal of the organization is to form partnerships with mesh networks, such as RightMesh, to ensure continuous connectivity.[131]

Evidence preserved with this technology can later be cross-referenced with satellite imagery or news reports by organizations such as the Berkeley Human Rights Investigation Lab to verify its authenticity. The Berkeley Human Rights Investigation Lab examines online open source information to verify human rights abuses. To do so, it uses a three-step process: Event Detection, in which they learn that an incident has occured; Discovery, where they confirm that the incident happened; and Verification, where they provide evidence through imagery, coordinates, and news posts of where the incident took place and who was responsible.[132]

Access to Justice

As with all technologies discussed in this report, those which capture, prove and maintain the veracity of evidence must serve a purpose beyond the technical service they provide. The third sub-function of Accountability represents the ends for which many of these technologies provide the means.

Access to justice raises awareness of war crimes to spur public action, informs conflict civilians of legal proceedings, and enables alternate means of justice. Access to justice provides hope to individuals that conflict will end and crimes will be accounted for in court or some form of transitional justice process, which is just as important as immediate results.

[129] Mounir Ibrahim, Truepic, Team interview, April 6th, 2019.
[130] EyeWitness, " Collect Verifiable Photos and Videos."; Truepic, "A Holistic Approach to a Complex Problem," accessed April 25, 2019. https://truepic.com/ technology/.
[131] Ibrahim, 2019.
[132] Interview with Human Rights Advocate, April 9, 2019.

Technologies which help to capture and disseminate evidence naturally help in drawing attention to violence against civilians which would have gone unreported or underreported in the past. Truepic's technology for capturing evidence also facilitates the sharing of that evidence with the world. WITNESS, in addition to training civilians on capturing evidence, advocates for underreported stories.[133] To this end, WITNESS has developed the Mobile-Eyes Us application which "…uses the power of live video to connect you to the causes you care about, and provides meaningful ways that you can act."[134]

Technology and advocacy can increase the likelihood that formal justice processes can occur in conflicts during or after fighting. As discussed above, this has already proven true in places like the DRC, where WITNESS' and eyeWitness' combined efforts were able to lead to war crimes prosecution. The prosecution of crimes helps in preventing and deterring violence against civilians. It can also provide hope to civilians by reassuring them that they are not forgotten and that criminals cannot act with impunity.

One difficulty, however, is disseminating information and updates on legal proceedings to the populations in conflict who would have a vested interest in the outcome. Peacegeeks, a Canadian organization, "partners with community leaders and organizations to understand the challenges they are facing, and collaborates with these stakeholders to create tech-based solutions that strengthen their efforts for peace and humanitarian action."[135] Peacegeeks partnered with the International Criminal Court and created a text message system within Uganda to disseminate court updates to civilians on rebel war crimes trials taking place in the ICC.[136]

Technology and tech organizations are also able to provide alternate means of justice when formal international proceedings are not available. The Sentry discovered South Sudan's devastating civil war has been perpetuated by the wealthiest people and that the opposing sides' leaders were making millions of dollars from the conflict while living in mansions in Kenya, as neighbors.[137] With findings such as these, the Sentry "aims to create significant financial consequences for kleptocrats, war criminals, and their international collaborators through network sanctions, anti-money laundering measures, prosecutions, compliance action by banks, and other tools of financial pressure."[138]

[133] Witness, "WITNESS Makes it Possible," accessed April 25, 2019. https://witness.org/about/.

[134] Witness, "Mobil-Eyes Us: Using Live Video and the Power of Networks for Smart Activism," accessed April 25, 2019. https://blog.witness.org/2015/10/mobil-eyes-us-using-live-video-and-the-power-of-networks-for-smart- activism/.

[135] Peacegeeks, "Peacegeeks," accessed April 25, 2019. https://peacegeeks.org/our-work.

[136] Peacegeeks, "The International Criminal Court Deals with Crimes of Greatest Concern to the International Community," accessed April 25, 2019. https://peacegeeks.org/partner/international-criminal-court.

[137] The Sentry, "War Crimes Shouldn't Pay: Stopping the Looting and Destruction in South Sudan," TheSentry September 2016, 5. https://cdn.thesentry.org/wp-content/uploads/2016/09/Sentry_WCSP_Finalx.pdf

[138] The Sentry, "About the Sentry."

In the end, justice and formal legal proceedings may not be accessible or practical during a conflict despite technological advances and innovations. However, the ability to maintain evidence securely in near perpetuity provides hope that justice can be met in the future. There are other means of achieving justice than criminal courts, such as transitional justice processes following conflicts. These processes, such as the National Unity and Reconciliation Commission in Rwanda, require an accurate historical record of the conflict and of crimes and violations in order to provide meaningful closure. Many of the technologies above will facilitate these processes in the future.

Case Study: Truepic

As complex, protracted conflicts become the norm, civilians are increasingly left to fend for themselves. Too often, international organizations are not able to provide services to civilians since they do not have the state's permission and therefore risk violating state sovereignty.[139] Unfortunately, many government regimes and armed groups are responsible for war crimes, crimes against humanity, genocide, and crimes of aggression against their own civilians. Technologies have emerged to prevent intentional undermining of images and to disseminate truth and, even, capture violations in the hopes of future prosecution.

Furthermore, the global community is in an age of misleading information; images can be manufactured in several ways such as "content manipulation, location spoofing, metadata manipulation, rebroadcasting, repurposing existing images, and AI-generated images."[140] There is a clear need for tools to verify events, images, audio, and video.

Truepic has emerged as a major player in this field in response to this challenge. Truepic recently ranked #16 on Fast Company's Most Innovative Companies 2019 and #1 in the Social Good Category for its image verification technology.[141] Its mobile app has been widely used in both the insurance field (for-profit) and in conflict/non-permissive settings. Truepic allows users to take photos, videos (including audio), and secures them to an incorruptible public blockchain. Truepic is working on a two-pronged approach: controlled capture and advanced image forensics. Controlled capture verifies the image as it is being collected: "verifying their origin, pixel contents, and metadata, from the instant the capture button is pressed. It leverages cutting-edge machine learning, computer vision, and

[139] Mark Ward, former US Government Official, interview with Capstone Team, January 25, 2019.
[140] Truepic, "A Holistic Approach to a Complex Problem."
[141] Truepic, "Photo and Video Verification You Can Trust."

cryptographic techniques to ensure the highest possible levels of trust, credibility, and immutability."[142] Advanced image forensics use forensic algorithms to help identify fraud at the point of capture. If an image is verified, it is secured to the blockchain for future use. Qualcomm, a leading chip manufacturer in San Diego, is examining with Truepic how to install the software into the actual hardware chips that go into smartphones.[143] This advancement will make the corruption of images and software much more difficult.

This tool has real impact on civilians in conflict zones. Humanitarian and civil society organizations working in conflict zones, civilian journalists, and Syrians all use Truepic in their day-to-day lives documenting the abuses in conflict zones. Truepic is enabling authentic, verifiable images to be disseminated outside of Syria and other conflict areas and due to its thorough verification process, the images are becoming harder to label as misleading by bad actors. For example, Truepic's partners captured verified images following an alleged chemical weapons attack in March 2018 outside of Damascus. Their documentation was shared with some of the highest levels of the US Government and other members of the UN Security Council.[144]

Summary - Accountability

Accountability's role in protection of civilians is to highlight and promote awareness of violence against civilians in an effort to spur immediate action by the global community and to maintain a record of events for future use. By empowering civilians to capture and disseminate evidence of war crimes and human rights violations, these technologies are bringing the plight of individuals to the world stage in a way that was never before possible. The speed with which data can be disseminated and the vast geographic range it can cover is unprecedented. We have seen tangible effects of these technologies in Syria, Myanmar, and the DRC.

Yet, despite the initial successes and the optimism these technologies promote for protecting civilians in conflict, there are still obstacles to ensuring accountability. Bad actors can still dispute the veracity of claims and sovereign states can continue to commit violence in the face of credible accusations. The international community may not be equipped to intervene, despite compelling evidence. Civilians capturing evidence may themselves become targets. Thus, in addition to immediate advocacy and traditional court structures, the technologies listed must be tools that are paired with long term transitional

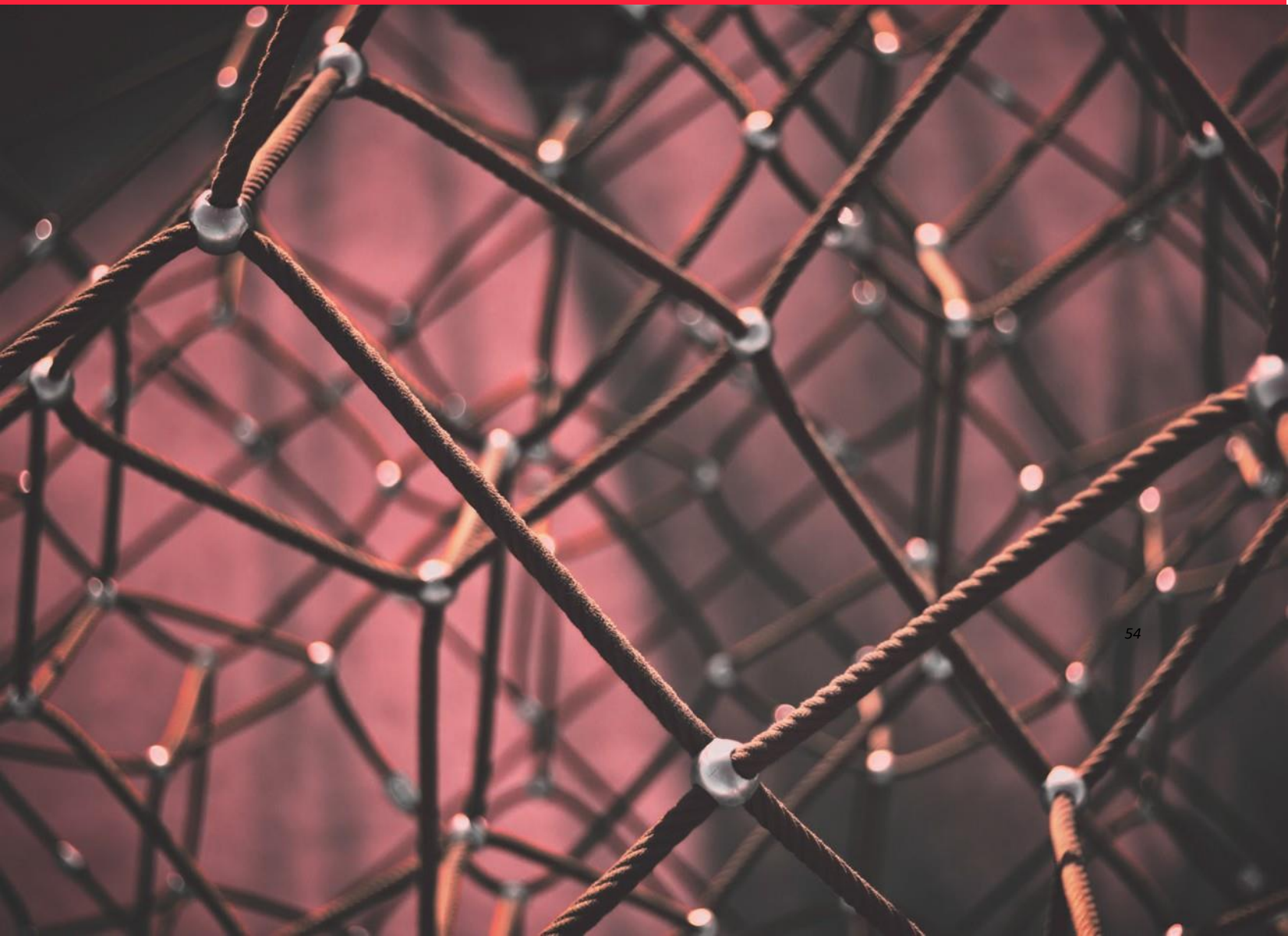
[142] Truepic, "A Holistic Approach to a Complex Problem."
[143] Ibrahim, Truepic.
[144] Ibid.

justice processes. The immutable and tamper-proof nature of many these tools for evidence gathering and dissemination lend themselves easily to such a long term approach.

In the chaos of revolution, civil war, and other violent conflict, traditional justice may be hard to serve. However, credible historical records provided by accountability technologies can enable long term justice and peace. In theory, post-conflict truth and reconciliation commissions could draw heavily upon digitally captured evidence to accurately account for who had committed what crimes during the conflict. This accounting, whether it leads to trials or legal recourse, could help to heal and draw a country together through the creation and acknowledgement of a shared, authoritative history. The continued development and diffusion of the technologies mentioned above will only continue to support such increased accountability and further facilitate peace processes in the future.

Cross-Cutting Issues

Cross-cutting issues are those that impact all three baskets: security, humanitarian assistance, and accountability. It is necessary to address each issue and how it presents itself within each basket in order to give a complete report on the challenges that persist through the development of new technologies.



Security Vulnerabilities: Dual Use Potential

Technological advances are not realized by simply downloading an app. To function, most of them require layers of cooperation including locals in the field who send information and tech support outside of the conflict zones. In cooperating with a service, locals must often take risks and may be targeted by armed groups or authorities in the process.

For instance, as mentioned earlier in the report, Hala Systems cooperates with many engaged Syrian citizens who monitor departures from Syrian military air bases and report the warplanes in flight to Hala. Those observers are evidently a critical component of Hala Systems, and therefore the company goes to great lengths to protect the personal information and location of the observers. A compromised network may lead to arrests of or attacks on engaged citizens for harassment or retaliation. It is not only the collaborators but also often the end-users who are confronted by danger.

The vulnerability of some systems can be taken advantage of by "bad actors." For example, if the authorities or armed groups successfully hack an information collection tool that searches social media for tweets and posts related to hate speech, they might be able to cook or delete the data in order to conceal actual events on the ground. At that point, hackers could continue to spread hate speech to incite violence virtually unobstructed.

Dual-use technologies have a risk of misuse and reverse engineering. Armed groups may capture humanitarian UAVs that are delivering aid or patrolling UAVs that are taking aerial pictures for a local security team. Armed groups can then use the captured drones for their own purposes. The military may be able to perform reverse engineering to produce their own UAVs.

These technologies have clear benefits to vulnerable communities in certain contexts. However, if such technologies are acquired by a violent group or government, the civilians the technology is trying to protect now assume an even greater risk. Service providers and users must balance the benefits that the technologies bring with their corresponding drawbacks.

Ethical & Legal Considerations

The emergence of new technologies for the protection of civilians has been met with obstinance from international law. The principle of sovereignty has been one of the greatest roadblocks for technology companies to gain consent from overly suspicious governments. Under international law, national governments have protested the use of certain tools in conflict zones - such as remote sensors or satellite images - on the grounds that such technology jeopardizes their national security and infringes upon their sovereign rights.

Civilians and humanitarian actors are therefore deprived of crucial tools needed for early warning systems, delivery of aid, or accessing digital evidence. Reflecting on his time as the Director of the Syria Transition Assistance and Response Team (START) for the US Government, Mark Ward recalled how many aid organizations were blocked from reaching hospitals and people in need due to resistant governments.[145] Paul Margie, a U.S. representative for Télécoms Sans Frontières, also noted that governments were becoming more sensitive to telecommunications.[146]

Even when parties are granted access to the conflict zone, domestic data privacy laws may tightly regulate how technology companies and humanitarian actors manage data; specifically biometric data from civilians and digital evidence of war crimes. Robert Greenfield, a co-founder of ConsenSys Social Impact, believes it is possible to address the needs of civilians in conflict, but governments and politics are the largest obstacle for technology companies. For example, anti-terrorism laws increase the scrutiny of INGOs' use of cryptocurrencies in conflict zones, since States fear that the organizations are supporting terrorist initiatives.[147] This exemplifies the stifling legal environment that actors are trying to navigate so as to promote the use of cryptocurrencies, blockchain and other technologies by civilians in conflict.[148]

However, companies operating in countries without strong privacy laws may create unintended security risks for civilians and humanitarian actors who use their technology. UN Global Pulse gathers data from civilian reports about al-Shabaab activities via the radio in Somalia. Since the country has weak privacy laws, it jeopardizes the security of callers if their personal information is not secured. The ICRC stresses that "protecting individuals' personal data is an integral part of protecting their life, integrity and dignity."[149] As a result, this requires strong adherence to confidentiality and proper storing methods when handling sensitive information.

Nevertheless, evidence captured by civilians documenting human rights violations that meet the aforementioned legal standards are not always permitted in international courts. Ward shared that civilian captured evidence, even if verified through apps, can be

[145] Mark Ward, former U.S. Government Official,

[146] Paul Margie, Télécoms Sans Frontières, interview with Adam Robitaille, March 13, 2019.

[147] Robert Greenfield and Silvana Rodriguez, Blockchain for Social Impact, ConsenSys, interview with Mark Filipovic and Christopher Franklin, April 3, 2019.

[148] Ibid.

[149] Christopher Kuner and Massimo Marelli, "Handbook on Data Protection in Humanitarian Action", (International Committee of the Red Cross: Geneva, 2017), p. 14. https://www.icrc.org/en/publication/handbook-data-protection-humanitarian-action.

rejected as “fake news.” In addition, the International Criminal Court (ICC) has been struggling with the admissibility of digital evidence due to possible tampering, despite the evidence being time-stamped, verified, and secured.[150]

In summary, governments and international organizations must overcome their suspicions and take steps to mitigate their ignorance of these technologies in order for the technology to reach its maximum potential. These restrictions on the use of certain technologies have hindered the ability of civilians to maintain their security, receive humanitarian assistance, and hold perpetrators accountable.

Humanitarian Principles

International humanitarian principles are a complicating factor for any program built around the protection of civilians. Neutrality is a core principle defined by the IFRC as not taking sides in hostilities, whereas impartiality prohibits discriminating between recipients; aid must be delivered equally to populations in need regardless of where they stand in the conflict.[151,152] Along with humanity and independence, these standards are widely upheld by the INGO community.

Humanitarians may at times be hampered by their own dedication to the code, however, while emerging technologies exacerbate this tension further since there is a lack of precedent for their use. Mesh networks, for example, enable affected groups to communicate with both their peers on the ground and actors on the outside. Humanitarian principles demand that accessibility improvements be provided to victims and perpetrators alike. Thus, how can such tools be brought to those in distress without arming the same parties responsible for their suffering? The answer is often unclear.

A senior official at a leading NGO acknowledges this paradox while also deferring to the big picture, “As an industry we are adopting many technologies. I don’t think we’re allowing the perfect to be the enemy of the good.”[153] Evidently, practitioners may at times be willing to blur the lines— if informally— and choose beneficiaries on an individual case basis, despite the risk of deviating from their operative norms.

[150] Nikita Mehandru and Alexa Koenig, “Open Source Evidence and the International Criminal Court.” Accessed April 15, 2019, https://harvardhrj.com/2019/04/open-source-evidence-and-the-international-criminal-court/
[151] International Federation of the Red Cross, “Neutrality,” accessed April 5, 2019. https://www.ifrc.org/en/who-we-are/vision-and-mission/the-seven-fundamental-principles/neutrality/
[152] International Federation of the Red Cross, “Impartiality,” accessed April 5, 2019. https://www.ifrc.org/en/who-we-are/vision-and-mission/the-seven-fundamental-principles/impartiality/
[153] Interview with leading humanitarian agency, March 14, 2019.

Still, it is actors from the private sector who are best positioned to overcome this tension as they are neither bound by international humanitarian law nor core humanitarian principles. Unfortunately, their partnerships may be somewhat less potent given the scarcity of agencies willing to work in those margins.

In short, international humanitarian law applies to states, but to whom do international humanitarian principles apply? And when exactly are parties willing to bend some of these rules in favor of moral and ethical considerations? These questions must be confronted before any new technology can be deployed successfully and its value in 'principle' translated into practice.

Connectivity

Most of the new technologies analyzed in this report rely on internet connectivity and mobile device access, which is a challenge for several reasons. Many conflict zones lack sustained internet infrastructure, host governments may intentionally inhibit connectivity, and conflict zones may not have the capacity to support broad wireless connections. However, organizations have developed solutions to overcome this challenge in three ways: by restoring established infrastructure, creating system functionality using intermittent internet access, and creating crowdsourced networks distinct from government or private infrastructure.

Some areas have mass telecommunications infrastructure that has been damaged by war. Télécoms Sans Frontières (TSF) is an international NGO that deploys small teams of telecommunications experts to disasters and conflict zones in order to restore internet communications. Highly responsive, TSF has worked in Syria and conflicts in Africa in various capacities. In some instances, such as in Syria, TSF volunteers have followed directly behind the front lines of combat to restore communication for medical personnel and facilities, enabling the treatment of wounded civilians.[154] While TSF has the capacity to establish and maintain internet connections independently, their primary goal is the restoration of existing networks and the transfer of control of those networks to local stakeholders as quickly as possible. Cisco has also been active in this sphere. Through their TacOps disaster response team, Cisco supports regions with damaged communications infrastructure. This was most famously showcased in Greece during the migration crisis of 2015, where Cisco partnered with NGOs to provide connectivity for Syrian, Iraqi and Afghan refugees. Since its inception, TacOps has been deployed to over 50 disasters around the world.[155]

[154] Margie, Télécoms Sans Frontières.

[155] Cisco, "Cisco Tactical Operations," accessed February 14, 2019. https://www.cisco.com/c/en/us/about/supplier-sustainability/tactical-operations-tacops.html

Other areas lack telecommunications infrastructure required for permanent internet connections. RedRose, discussed earlier in the section on Cash Transfers and Digital Identity, provides a model for operating in such an environment. Smart cards and mobile devices capture transactions which are later uploaded when an internet connection is available.[156] This process of data collection and consolidation is repeated again and again, bridging the divide between the disconnected and connected worlds caused by intermittent signal.

Finally, while in some conflicts telecommunications infrastructure may exist, it may still be subject to government censorship, surveillance, or accessibility restrictions. To overcome these problems, RightMesh is developing a tool that provides internet connections through a crowd-sourcing model that works when typical infrastructure fails or is otherwise obstructed. It provides emergency alerts, messaging, and geolocation data for when regular Internet services are unavailable.[157] Though their applications are not yet publicly available, RightMesh is aiming to be able to provide direct device-to-device information sharing, secure transfers of data, and secure sharing of internet connections in the near future.[158] These networks will reward mobile device users for joining the network, automatically sharing information and forwarding messages from device to device until internet access is restored. The system will require a density of users and mobile devices, but has the potential to overcome unreliable telecommunications infrastructure and protect users from surveillance and censorship.

Internet connectivity itself cannot save lives of civilians in conflict zones. However, it enables many of the applications and technologies which strive to do so. As an example, NetHope has a variety of projects working to connect people and use technology to advance human potential. NetHope created a project to assist displaced Syrians when it became clear there was a lack of technical infrastructure along travel routes, which prevented people from reaching out and trying to locate family members. In an effort to leverage internet connections, NetHope created WiFi hotspots and charging stations along common routes within Syria to try to keep migrants safe and connected.[159]

Given that infrastructure is often very weak in the areas where the connectivity is most needed, transporting necessary equipment can be complicated and expensive, and few organizations have the resources to provide connectivity alone. In the end, securing connectivity typically involves considerable financial and operational risk, whether the goal is to help civilians towards safe locations or to receive aid. Mesh network technology, as

[156] Brown, RedRose, interview.
[157] RightMesh, "Cases," accessed May 2, 2019. https://www.rightmesh.io/use-cases.html.
[158] Saju Abraham, RightMesh, interview with Adam Robitaille and Mark Filipovic, April 4th, 2019.
[159] Nethope, "Emergency Response," accessed May 2, 2019. https://nethope.org/project/emergency-response-syrian-refugee-crisis/

developed by organizations like RightMesh and NetHope, is viewed as one of the most practical ways to address such a challenge.[160]

Sustaining & Financing Initiatives

Putting new technologies in place requires financial resources, which of course also holds true in the context of protecting civilians. The providers behind the new technologies are in need of sustainable funding in order to keep supplying their tools or services to agencies or organizations, while the users of the technologies also need to secure money and other resources to continue running their projects. Our research showed that many of the technology providers source funds from both private donors and international organizations such as the UN and EU. For their part, the agencies deploying the technologies are usually self-funded and/or receive financial support from various private or governmental entities.

Tech providers consulted for this report mostly showed a decent consistency in funding. For instance, RedRose generates its revenue by charging a service fee to the user-agencies. RedRose then makes up the remaining difference on its balance sheet with financial investments from the private sector.[161] Télécoms Sans Frontières, an emergency telecommunication NGO, secures resources in a relatively sustainable manner from its corporate donors and several national governments.[162] The organization, with its signature compactness and adaptability in field operations, bolsters its financial sustainability as it keeps protraction and over-expenditure at bay.

The agencies assisting civilians with new technologies generally seem determined to continue incorporating them into their operations. A senior official at Mercy Corps stated that, despite the challenges of programs and projects driven by "grant cycles" with finite lifespans, the organization was committed to assuring their sustainability.[163] As shown throughout this report, numerous humanitarian organizations are establishing or have

[160] Meghann Rhynard-Geil, Mercy Corps, interview with Mark Filipovic and Woong Seong, March 12, 2019. "You're likely to put a target on whatever place you put the equipment in… in some cases (up to) $50 000 worth of equipment that's just waiting there to be stolen- not to mention the safety issues of just getting it there and someone not stopping it. So we generally don't do that. But we have been talking to a partner who's developing a mesh network tech, which is a small device that can be dropped anywhere. They're testing it in the natural disaster space but if it works, I see applications for it in conflict as well."

[161] Brown, RedRose, interview.

[162] Télécom Sans Frontières. "Our Funding," accessed May 2, 2019. https://www.tsfi.org/en/who-are-we/our-funding

[163] Rhynard-Geil, Mercy Corps.

already established innovation divisions within their structures with a view to scaling up their technologies.

Nevertheless, with innovative efforts indeed come several challenges. In the case of many tech startups, financial consistency at an early stage does not guarantee mid- or long-term sustainability. For those tech-providing companies, earning any profit whatsoever is almost a cause for celebration.[164] Should these companies with modern technological tools be confronted with financial turmoil that causes them to cease operations, the impact on the actors who have been deploying and using their tools would of course be detrimental.

Also, as mentioned above, the limited lifespans of programs by NGOs and other agencies working to protect civilians do affect the continuity and outcomes of their efforts. Without adequately designed follow-up programming, the initial impact may be significantly limited or compromised. This is where sustainability planning must take a role. Multiple experts suggested that an agency needs to set up a well thought-out program plan to ensure "sustainable partnerships" among the agency, local and national authorities, along with tech providers, so that the applied technology can continue to support beneficiaries even when the agency itself phases out of field operations.[165]

Displacing Traditional Means

Not all new civilian protection technologies are meant to replace proven, tried and tested alternatives. Rather, they work to complement and/or supplement them. That said, there is a risk when actors in the field focus too much on promoting the latest "game-changing" technologies and, in the process, end up displacing traditional means that have worked well.

For instance, radio broadcasting has been and continues to be a strong tool in conflict zones, where people do not have consistent access to online media. Radio programming is a great way to share details about a security situation, raise awareness on a variety of topics such as tolerance and mutual understanding, and spark daily conversation about social issues.[166] It also serves as a platform for information collection or public debate. Radio broadcasters allow listeners to call-in to report the incidents, voice their needs, express their opinions, and/or promote their local organization's activities. If stakeholders focus too much on social networking services and other online sources for the collection or dissemination of information, it stands to reason that they will neglect a large portion of the population who are not online.

[164] Brown, RedRose, interview.
[165] Rhynard-Geil, Mercy Corps.
[166] United Nations, "Radio still a powerful worldwide tool for 'dialogue, tolerance and peace': Guterres," *UN News*, February 13, 2019. https://news.un.org/en/story/2019/02/1032591.

Handheld two-way radios (i.e."walkie-talkies") are another stable communication tool at risk of being displaced by modern technology. In war zones, internet infrastructure may be disrupted, destroyed or shut down at any time by parties to the conflict. Cellular and internet connections are, thus, not as reliable as they are in developed countries. However, as the mobile phone revolution continues uninterrupted, walkie-talkies are less likely to be used on account of their relative inconvenience (e.g. weight, portability, etc.). Given the inherent vulnerability of cellular and internet infrastructure in conflict zones, to rely exclusively on mobile technology moving forward presents a risk that tends to be overlooked.

Intersectional Access

As with any progressive solution driven by a social need, it is important to analyze impact and access. This remains true for new technologies. While developing technologies to support civilian protection in conflict zones is crucial, an analysis is necessary to understand whether these advances have different impacts on different identities. Caribou Digital is an organization focused on the digital technology space and they emphasize the importance of understanding a social context before deploying technologies to new locations.[167]

In many conflict zones, there are accepted gender norms, which can limit different genders' ability to access and use these technologies to ensure their own protection. According to Caribou Digital, women are 10% less likely to own a mobile device and 18% less likely to use the internet compared to men.[168] It is therefore necessary to analyze how accessible technologies are based on identities. When analyzing how these technologies impact women and men, it is critical to do a gender analysis to ensure that the technologies are doing no harm. A humanitarian interviewed stated: "It's about providing it [technology] in a way that even people who are invisible from view are able to access it. Are you asking the right questions to get the answers you need, to solve for the problem of people who are usually left out and, thus, face heightened vulnerability?" [169] Mercy Corps is currently at the forefront of mainstreaming gender into their work and designing gender-appropriate programming that they hope is replicated by other organizations.[170]

Literacy also dictates access, not only the ability to read and write, but also in understanding technology. There is a significant gap in being able to access technology if civilians cannot read or do not understand how the technology works. In order to use distributed ledger technology to facilitate cash transfer, for example, civilians need to be able to understand numbers but also how the technology is working, which is a challenge in

[167] Savita Bailur, Caribou Digital, interview with Ai Nakashio, April 2, 2019.
[168] Oliver Rowntree, "The Mobile Gender Gap Report 2018," GSM Association, February 2018, 3.
[169] Interview with leading humanitarian agency, March 14, 2019.
[170] Rhynard-Geil, Mercy Corps.

conflict zones. An interview source stated: "Right now the issue is that most of the time, user experience isn't that great because it assumes technical literacy- it assumes literacy in general. In some areas you don't even have you numeric literacy, so they can't even differentiate numbers. So I think that's one of the bigger issues in a lot of these emerging economies."[171] Ensuring that people can actually use these technological tools is essential if hoping to use them to protect civilians.

Community Buy-in & Credibility

This need for technical literacy can hinder the successful roll-out of a new idea. Likewise, the fact that unconventional technologies are literally foreign to their beneficiaries presents another challenge. Without a proven distribution network on the ground, winning over the support of local populations has become a key point of focus for practitioners. For example, feedback mechanisms that come in the form of a mobile app may be more widely adopted by the countries in which they were engineered than by the people for whom they were engineered. As suggested by a representative from Mercy Corps: "You won't roll-out a feedback mechanism on an app when people in that culture don't feel comfortable (and/or are unable) to share things in writing."[172]

As a result, practitioners overwhelmingly emphasize the need to involve locals during product development. A human-centered design process with focus groups and pilot testing is generally seen as the ultimate solution. For more urgent crises, rapid assessments may be more appropriate to shorten response time, particularly if they can be adjusted later. In either case, sources agree that innovations in the humanitarian sphere must be developed with the end-user in mind.

ConsenSys' Silvana Rodriguez: "Often you'll find that the tech is not the most difficult piece. You have to think about having local buy-in and the right voices at the table that provide the subject matter expertise or have networks on the ground. By having validators on the ground, they can see if it's working and (can draw on their longstanding) relationships to help you do the training that's needed." [173]

Beyond the design phase, humanitarians underline a pressing need to also involve locals in the delivery of aid. In Syria, for example, Hala Systems has successfully liaised with fiduciaries or community banks to convert cryptocurrency and/or digitized vouchers into actual cash for beneficiaries.[174] For their part, the U.S. Department of State's Humanitarian

[171] Greenfield and Rodriguez, ConsenSys.
[172] Rhynard-Geil, Mercy Corps.
[173] Greenfield and Rodriguez, ConsenSys.
[174] Ibid.

Task Force for Syria occasionally overcame the denial of access by establishing reliable civil society partnerships on the ground.[175] Meanwhile, Télécoms Sans Frontières highlights the importance of simply "using local providers to support the local economy."[176]

In the end, securing local buy-in is a critical step whether providers aim to assist vulnerable populations with a new tool, tactic or otherwise. Given the intractable nature of global conflicts today, localizing humanitarian work has become more crucial than ever. New technologies will struggle to meet their potential without this support.

Organizational Support

Considering the devastating impacts of contemporary humanitarian crises and the limited ground access that is commonplace in the field, it is unlikely that any given newly developed technology can be easily deployed by a handful of vigorous workers. Successful deployment of technologies requires all-out support and coordination of different levels of actors throughout the varied stages of operations.

According to Télécoms Sans Frontières, it is crucial to guarantee the continuity of service by established international organizations such as the UN and to maintain their level of involvement in the service in order to ensure unabating network connectivity in the target area.[177]

Some practitioners mentioned that there had been a number of cases where successful emerging technologies were neglected in the midst of organizational restructuring, such as leadership changes, mandate shifts, and so on. Such lack of information management and archival efforts led to the waste of the developed technologies and even to double-spending on developing the same technologies or toolkits again.[178]

Moreover, a multiple number of humanitarian experts pointed out that each organization offers a unique set of strengths, expertise and experience. Systematized cooperation and integration of activities would allow the humanitarian community at large to deliver more successful assistance to the targeted populations.

[175] Ward, former US Government Official.
[176] Margie, Télécoms sans Frontières.
[177] Ibid.
[178] Lyons, Human Rights Watch.

Applicability & Replicability

Technological solutions for protecting civilians in conflict are not universal and each basket above addresses specific challenges. As such, there are constraints which hinder or preclude the successful transfer of technologies between conflicts. The applicability and replicability of technologies must be considered before attempting to apply even proven technological solutions in a new conflict environment. Evaluating applicability ensures that technology provides an appropriate solution to a specific challenge in a new setting. Evaluating replicability ensures that requisite infrastructure or other requirements exist within the new context. These evaluative criteria can allow organizations working to protect civilians in conflict to identify viable technological solutions for their unique situations.

As discussed above, Hala Systems' network of automated sensors, civil volunteers, and multiple means of alerting civilians has saved hundreds of lives.[179] Such a system would be applicable in other conflicts where threats to civilians are largely from airstrikes, such as in Yemen. However, in cases where violence against civilians comes largely from combatants on the ground, such as in South Sudan or Uganda, such early warning systems are less applicable. This is not to say that concepts and technologies cannot be adapted to meet new challenges, only that this issue should be considered in advance of deployment rather than after the fact.

Replicability considers whether the requisite infrastructure exists for an applicable technology to be applied from a previous conflict. Just as each conflict is unique in its specific set of challenges, so too are they unique in their ability to support technological solutions. Even if technology has proven itself to be a potential solution to an identified problem elsewhere, that does not necessarily mean that it can be applied universally. Technologies require certain minimum levels of infrastructure or social support, such as internet access, power generation, mobile device access, or trust on the part of the user. Examining these requirements should increase the likelihood of success in employing technology to save lives, while failing to do so would again risks resources and continued loss of life.

Returning to the early warning networks discussed above, civilians in Yemen continue to suffer from several challenges, including airstrikes. Hala Systems' early warning system would be applicable to this specific challenge. However, the system in Syria has developed over several years and is reliant on established and redundant communication networks (radio, cell phone, internet), civil organizations (White Helmets), and private industry (Hala). Such a system is not replicable in Yemen at present, where the network infrastructure is less robust, civil organizations on par with the White Helmets have not developed, and external support is minimal. Though the technology would save lives and is applicable, the costs

[179] Dan Henebery, Hala Systems, Team interview, January 24, 2019.

and means required to make it replicable may preclude its use in Yemen for the time being and may warrant the direction of time and resources toward other solutions.

Replicability issues do not mean that a lack of infrastructure for technologies cannot be overcome. As an example, the crux of many of the technologies in use and being innovated for protecting civilians today is internet and mobile device access. Many conflicts lack the communication infrastructure needed to support these technologies. Yet, organizations and industry continue to innovate and develop means to defuse internet access or overcome its absence. This expands the replicability of proven technological solutions. Several examples of tools and organizations dedicated to internet and mobile device access were discussed above in the section on Connectivity.

Areas for Further Research

As repeated throughout this report, the consolidated study of technology for the protection of civilians in conflict is a nascent field. During the course of our research, we have faced challenges and limitations. We were unable to create a full accounting of all current and emergent technologies, despite our dutiful research and the wide range of sources we consulted. Additionally, we were unable to gain first-hand accounts from civilians in conflict or quantifiable measures of success for many technologies that are being used. We contend that these challenges that we have faced represent opportunities for further research.

Throughout our research, we have sought to provide a holistic collection of technologies and the organizations which employ them. In doing so, we have paid special attention to categorize technologies broadly, best upon their effect on civilians in conflict. Yet, we recognize this is not an exhaustive compendium of technologies but rather just a first step towards defining the sector. The ever-growing number of technological solutions is first among our reasons for promoting further research into this field.

An additional limitation in our research was a lack of access to conflict civilians or conflict zones for the purpose of conducting interviews or gaining first-hand assessments of technologies at their point of use. Our research was restricted to available literature and the accounts of those individuals we interviewed, and we are unsure of how well we controlled for an array of potential biases. Additionally, lack of direct access to conflict zones prevented our team from directly assessing the impacts of technologies in use.

Further adding to the lack of first-hand accounting was a lack of quantifiable data to explain the effects of individual or groups of technologies on civilians in conflict zones. The majority of our evidence was anecdotal. Access to quantifiable data would be beneficial as it could help to define success and highlight the most successful technologies on a standardized scale, thereby strengthening the arguments for or against them.

Our research also revealed the possibility of market competition occurring between private companies providing aid in conflict zones.[180] It could be a cause for concern if market forces between private companies and/or non-profit organizations were to crowd out otherwise viable technological solutions for civilians in conflict. However, we have only anecdotal evidence of this phenomenon and it would require further research to determine whether this is a trend and how such competition would adversely affect the protection of civilians. This research could likewise extend to the possibility of technologies or outside organizations crowding out local markets and infrastructure in general.

[180]Brown, RedRose, interview.

Conclusion

There is significant development to report within the protection of civilians space as far as new technologies filling the gaps left by misguided international responses. Civilians in conflict zones are facing a multitude of challenges which require a comprehensive approach to solve. While technology is not a panacea and political processes may be necessary for sustainable peace, the tools highlighted in this report can ease suffering and increase chances of survival among civilians living in active conflict.

For security, technologies have stepped in to improve civilians' ability to make informed decisions on their preventive and protective strategies. The data collection, sharing and analysis tools, early warning and response systems, and crisis mapping platforms examined in this report are just some of the emerging technologies that assist civilians by increasing their access to information in conflict. The more that people are connected through mobile phones or the internet, the more important these tools will be.

The categories of tools designed to facilitate the delivery of humanitarian aid and provision of medicine in conflict are multiplying. From distributed ledger technology and biometrics to streamline cash transfer programming, to social media platforms that enable seamless communications between providers and beneficiaries— to all those in between— it is clear that modern tools shall exert substantial influence on the humanitarian sector moving forward, in lieu of more sustainable political solutions. In many cases they already have.

Technologies have proven to be incredibly useful and continue to show potential in the accountability space, as well. While most conflicts seem to persist indefinitely, they will one day end and due to the mass collection of civilian-captured evidence, there may be justice. The United States is the first country to pass a law allowing civilian captured evidence to be used in court without requiring the civilian who captured the content to be present. This is a positive step in setting the precedent for the use of civilian captured evidence to be used in other international and national courts. The tools highlighted in this report represent the start of a burgeoning field that will continue to grow as apps develop, connectivity increases, and the geopolitical landscape continues to change.

Each of these technologies is contingent upon varying levels of external support and community acceptance. Security technologies are saving lives and identifying risks to civilians. Humanitarian assistance technologies are ameliorating suffering and improving quality of life. Accountability technologies are bringing the plight of civilians to the fore and creating a permanent record of events. Overall, there is substantial hope that technology can be utilized to address the holes left by national and international policymakers in

regards to protecting civilians. Through this report, the team hopes that the incredible, pioneering improvements happening today within the tech community for protecting civilians are evident. Though there is still a long way to go to meet technology's true potential for social good, we have demonstrated that the field is fruitful and worthy of further research and consideration. The team concludes this project hopeful that the field will continue to be studied and analyzed in order to best serve civilians living in conflict.

Bibliography

570 News. “Bombs Hit Disputed Sudanese Oil Town, Official Says." April 14, 2012. Accessed May 3, 2019. https://www.570news.com/2012/04/14/bombs-hit-disputed-sudanese-oil-town-official-says/.

Abraham, Saju. RightMesh. Interview with Adam Robitaille and Mark Filipovic, April 4, 2019.

Accenture. “Accenture, Microsoft Create Blockchain Solution to Support ID2020.” June 19, 2017. Accessed May 4, 2019. https://newsroom.accenture.com/news/accenture-microsoft-create-blockchain-solution-to-support-id2020.htm.

Achkar, Ziad Al, et al. Sudan: Anatomy of a Conflict. Harvard Humanitarian Initiative, 2012. Accessed May 3, 2019. http://hhi.harvard.edu/sites/default/files/publications/ sudan-anatomy-of-a-conflict.pdf.

Ahuja, Ambika. “Thai, Cambodia Troops Clash Again Near Temple, 1 Killed.” Reuters, February 4, 2011. Accessed May 3, 2019. https://www.reuters.com/article/us-thailand-cambodia-clash/thai-cambodia-troops-clash- again-near-temple-1-killed-idUSTRE71409020110205#a=1.

Bailur, Savita. Caribou Digital. Guest lecture at Columbia University’s School of International and Public Affairs. New York, NY, April 2, 2019. Attended by Ai Nakashio.

Baldwin, Clare, Simon Lewis, Andrew R.C. Marshall, and Zeba Siddiqui. “Tip of the Spear.” Reuters, June 26, 2018. Accessed May 3, 2019. https://www.reuters.com/investigates/special-report/myanmar-rohingya-battalions/.

BBC News. “Syria: Drones to SAVE Lives.” April 25, 2015. Accessed April 26, 2019. https://www.youtube.com/ watch?v=w8KPh9106CU.

Bliss, Laura. “Citizen Journalists Are Live-Mapping the Crisis in Ukraine.” CityLab, July 28, 2014. Accessed 3 May, 2019. https://www.citylab.com/equity/2014/07/citizen-journalists-are-live-mapping-the-crisis-in-ukraine/ 375178/.

Borger, Julian. “US and UK Explore Possibility of Aid Airdrops in Syria.” The Guardian. December 4, 2016. Accessed March 13, 2019. https://www.theguardian.com/world/2016/dec/04/us-uk-explore-possibility-aid-airdrops- syria-drones.

Brown, Courtney. Red Rose. Email with Mark Filipovic, May 1, 2019.

Brown, Courtney. Red Rose. Interview with Mark Filipovic and Adam Robitaille, February 21, 2019.

Carter Center. “Syria Conflict Update,” October 30, 2015. May 7, 2019. https://www.cartercenter.org /resources/pdfs/ peace/conflict_resolution/syria-conflict/Syria-Conflict-Update-103015.pdf.

Cisco. “CSR Partner: World Food Programme.” Accessed April 26, 2019. https://www.cisco.com/c/en/us/ about/csr/community/partners/world-food-programme.html.

Cisco. “Cisco Tactical Operations.” Accessed February 14, 2019. https://www.cisco.com/c/en/ us/about/supplier-sustainability/tactical-operations-tacops.html.

ConsenSys. “Social Impact.” Accessed April 16, 2019. https://consensys.net/social-impact/.

Department of Defense. Protection of Civilians ATP 3-07.6. Washington, DC: Department of Defense, 2018. http://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_24.pdf?ver=2018-05-11-102418-000.

Dwyer, Colin. “PHOTOS: Myanmar Apparently Razing Remains Of Rohingya Villages.” National Public Radio, February 23, 2018. Accessed May 7, 2019. https://www.npr.org/ sections/thetwo-way/2018/02/23/588217754/ photos-myanmar-apparently-razing-remains-of-rohingya-villages.

EurekAlert! “First ‘Humanitarian Grand Challenge’ Finalists: 23 Innovative Projects to Help the Most Vulnerable.” September 25, 2018. https://www.eurekalert.org/pub_releases/2018-09/tca-fg092418.php.

EyeWitness Project. “Collect Verifiable Photos and Videos.” Accessed April 11, 2019. https://www.eyewitnessproject.org/.

Farr, Christina. “How this doctor is using telemedicine to treat Syrian refugees.” Fast Company. March 9, 2016. Accessed April 16, 2019. https://www.fastcompany.com/3057572/how-this-doctor-is-using-telemedicine-to- treat-syrian-refugees.

Figure 1. “FAQ: Where is Figure 1 available?” Accessed April 6, 2018. https://figure1.com/faq/ #whereisfigurenbsp1available.

Figure 1. “Figure 1.” Accessed April 16, 2019. https://figure1.com/about/.

Gold, Danny. “Saving Lives with Tech in Amid Syria’s Endless Civil War.” WIRED, August 16, 2018. Accessed May 3, 2019. https://www.wired.com/story/syria-civil-war-hala-sentry/.

Gorur, Aditi. “Community Self-Protection Strategies. How Peacekeepers Can Help or Harm.” Civilians in Conflict, no. 1 (August 2013). https://www.stimson.org/sites/default/files/file-attachments/Stimson_Community_ Self-Protection_Issue_Brief_Aug_2013_0.pdf.

Greenfield, Robert IV. “The Bifröst Initiative.” Good Audience. January 12, 2019. Accessed April 10, 2019. https://blog.goodaudience.com/the-bifr%C3%B6st-initiative-a0e8bd61b368.

Greenfield, Robert IV and Silvana Rodriguez. Blockchain for Social Impact and ConsenSys. Interview with Mark Filipovic and Christopher Franklin, April 3, 2019.

Gutierrez, Miren. “Crowdsourcing and Mapping Data for Humanitarianism.” Palgrave Studies in Communication for Social Change, 2018.

Hala Systems. “Sentry Overview.” Accessed April 30, 2019. https://drive.google.com/file/d/ 1fGDOV-r512OTnZef-NJWqUlar4gaM9P4/view.

Hala Systems. “Protect Everything That Matters.” Accessed April 3, 2019. https://halasystems.com/#sentry.

Hall, Natasha. “Waiting for No One: Civilian Survival Strategy in Syria.” Center for Civilians in Conflict, 2016. https://civiliansinconflict.org/wp-content/uploads/2017/09/Syria_Civilian_ Survival_Strategies_FINAL_-_lores_ for_web.pdf.

Henebery, Dan. Hala Systems. Team interview, January 24, 2019.

Holmes, Kylie. Disaster and Crises Manager, Facebook. Interview with

Mark Filipovic, April 12, 2019.

Humanitarian OpenStreetMap Team. “Refugee Response.” Accessed April 19, 2019. https://www.hotosm.org/ impact-areas/refugee-response/.

Humanitarian OpenStreetMap Team. “Refugee Response: South Sudan and Syria.” https://www.hotosm.org /projects/urban_innovations_crowdsourcing_non-camp_refugee_data.

Human Rights Watch. “World Report 2019- Syria: Events of 2018.” Accessed April 30, 2019. https://www.hrw.org/world-report/2019/country-chapters/syria#909488.

Ibrahim, Mounir. Truepic. Team Interview, April 6th, 2019.

Instedd. “Foodbot: Developing a WFP Chatbot to Communicate with Target Populations.” Accessed April 26, 2019. https://instedd.org/project/foodbot/.

Institute of International and Humanitarian Affairs. “Embracing Complexity: Preliminary Findings from the Humanitarian Blockchain Summit.” February 21, 2018. Accessed May 4, 2019. https://medium.com/ humanitarianpulse/embracing-complexity-preliminary-findings-from-the-humanitarian-blockchain-summit-d51cef268e65.

International Committee of the Red Cross. “Civilians Protected Under International Humanitarian Law.” October 29, 2010. Accessed May 3, 2019. https://www.icrc.org/ en/doc/war-and-law/protected-persons/ civilians/overview-civilians-protected.htm.

International Committee of the Red Cross. Enhancing Protection: For Civilians in Armed Conflict and Other Situations of Violence, Second Edition. ICRC: Geneva, 2012. https://www.icrc.org/en/doc/assets/ files/other/icrc-002-0956.pdf.

International Federation of the Red Cross. “Impartiality.” Accessed April 5, 2019. https://www.ifrc.org/en/ who-we-are/vision-and-mission/the-seven-fundamental-principles/impartiality/.

International Federation of the Red Cross. “Neutrality.” Accessed April 5, 2019. https://www.ifrc.org/en/ who-we-are/vision-and-mission/the-seven-fundamental-principles/neutrality/.

Jose, Betcy and Peace A. Medie. “Civilian Self-Protection and Civilian Targeting in Armed Conflicts: Who Protects Civilians?” Oxford Research Encyclopedia of Politics (December 2016). Accessed May 3, 2019. https://oxfordre. com/politics/view/10.1093/acrefore/ 9780190228637.001.0001/acrefore-9780190228637-e-216?print=pdf.

Kanso, Heba. “‘We are trapped’: White Helmets plead for evacuation from Syria.” Reuters, July 26, 2018. Accessed May 3, 2019. https://www.reuters.com/article/us-syria-whitehelmets-evacuation/we-are-trapped-white-helmets-plead-for- evacuation-from-syria-idUSKBN1KG2XY.

Kuner, Christopher and Massimo Marelli. Handbook on Data Protection in Humanitarian Action. International Committee of the Red Cross: Geneva, 2017. https://www.icrc.org/ en/publication/handbook-data-protection-humanitarian-action.

Lazicky, Christy. “Improving Conflict Early Warning Systems for United Nations Peacekeeping.” Master’s Thesis. Harvard University, March 2017. https://www.hks.harvard.edu/sites/default/files/degree%20programs/MPAID/files/Improving%20Conflict%20Early%20Warning%20Systems%20for%20United%20Nations%20Peacekeeping_SYPA_Christy%20Lazicky_2017.pdf.

Lee, Joi and Viktorija Mickute. “Healing trauma in South Sudan through mental health programmes.” Aljazeera. November 26, 2018. Accessed May 7, 2019. https://www.aljazeera.com/indepth/inpictures/ healing- trauma-south-sudan-mental-health-programmes-181126090440442.html.

LiveUAmap. “News Live.” Accessed April 28, 2019. https://liveuamap.com/.

Loveluck, Louisa. “The Secret App That Gives Syrian Civilians Minutes to Escape Airstrikes.” Washington Post, August 18, 2018. Accessed May 4, 2019. https://www.washingtonpost.com/ world/the-secret-app-that-gives-syrian-civilians-minutes-to-escape-airstrikes/2018/08/17/ e91e66be-9cbf-11e8-b55e-5002300ef004_story.html?utm_term=.b833a9cf6d09.

Loveluck, Louisa and Zakaria Zakaria. “Syria’s Once Teeming Prison Cells Being Emptied by Mass Murder.” Washington Post, December 23, 2018. Accessed May 7, 2019. https://www.Washingtonpost.com /classic-apps/ syrias-once-teeming-prison-cells-being-emptied-by-mass-murder/2018/12/22/b638678e-95a0-11e8-818b-e9b7348cd87d_story.html?noredirect=on.

Lyons, Josh. Human Rights Watch. Interview with Mark Filipovic and Woong Seong, April 14, 2019.

Mango, “GIS Mapping.” Accessed April 28, 2019. https://mangomap.com/gis-mapping.

Margie, Paul. Télécoms Sans Frontières. Interview with Adam Robitaille, March 13, 2019.

Marion. “ICTs During Humanitarian Crisis: Can Social Media Save Lives.” Digital (In)equality, March 7, 2018. Accessed March 15, 2019. http://wpmu.mah.se/nmict181group1/icts-humanitarian-crisis-social-media-save-lives/.

Médecins sans Frontières. “Drones: A Helpful Humanitarian Tool.” July 4, 2017. Accessed May 4, 2019. https://www.msf.org.uk/article/drones-helpful-humanitarian-tool.

Médecins sans Frontières. “It’s a MUST: Providing Emergency Surgery on the Go.” April 6, 2018. Accessed March 10, 2019. https://www.doctorswithoutborders.org/what-we-do/news-stories/story/its-must-providing-emergency-surgery-go.

Médecins ssans Frontières. “POCUS: Bringing the Revolutionary Potential of Ultrasound to South Sudan.” April 6, 2018. Accessed April 3, 2019. https://www.doctorswithoutborders.org/what-we-do/news-stories/story/pocus- bringing-revolutionary-potential-ultrasound-south-sudan.

Médecins sans Frontières. “War and Conflict.” Accessed May 2, 2019. https://www.msf.org/war-and-conflict-depth.

Meier, Patrick. “Crisis Mapping in Action: How Open Source Software and Global Volunteer Networks Are Changing the World, One Map at a Time.” Journal of Map & Geography Libraries 8:2, 89-100 (2012).

Meier, Patrick. Digital Humanitarians: How Big Data Is Changing the Face of Humanitarian Response. Boca Raton, Florida: CRC Press, 2015.

Meier, Patrick. “Humanitarian Use of UAVs/Drones in Conflict Zones: Fears, Concerns and Opportunities.” iRevolutions, November 3, 2014. Accessed May 7, 2019. https://irevolutions.org/2014/11/03 /humanitarian-uavs-conflict-zones/.

Meier, Patrick. “What is Crisis Mapping? An Update on the Field and Looking Ahead.” iRevolutions, January 20, 2011. Accessed May 3, 2019. https://irevolutions.org/ 2011/01/20/ what-is-crisis-mapping/.

Nethope. “Emergency Response.” Accessed May 2, 2019. https://nethope.org/project/ emergency-response-syrian-refugee-crisis/.

Nikbakht, Daniel and Sheena McKenzie. “The Yemen War is the World's Worst Humanitarian Crisis, UN Says,” CNN, April 3, 2018, accessed May 2, 2019. https://www.cnn.com/2018/04/03/middleeast/yemen-worlds-worst- humanitarian-crisis-un-intl/index.html.

Nirmal, B.C. "Legal Regulation of Remote Sensing: Some Critical Issues." Journal of the Indian Law Institute 54, no. 4 (2012). http://www.jstor.org/stable/43953609.

North Atlantic Treaty Organization. “NATO Policy for Protection of Civilians.” Public Media Division, July 2016. Accessed May 3, 2019. https://www.nato.int/nato_static_fl2014/assets/pdf/ pdf_2016_07/20160705_1607- protection-civilians-en.pdf.

Nyrabia, Mouaffaq. “Syria: Only Civilian Protection and Accountability Will Make a Political Solution Viable.” New Europe, January 5, 2016. Accessed May 3, 2019. https://www.neweurope.eu/article/ syria-only-civilian-protection-and-accountability-will-make-a-political-solution-viable/.

OpenStreetMap Wiki. “How to Contribute.” Accessed April 19, 2019. https://wiki.openstreetmap.org/wiki How_to_contribute.

Oxfam. “Struggle to survive near-famine conditions in Yemen.” December 6, 2018. Accessed May 3, 2019. https://www.oxfamamerica.org/explore/stories/famine-yemen/.

Peacegeeks. “The International Criminal Court Deals with Crimes of Greatest Concern to the International Community.” Accessed April 25, 2019. https://peacegeeks.org/partner/ international-criminal-court.

Peacegeeks. “Peacegeeks.” Accessed April 25, 2019. https://peacegeeks.org/our-work.

Primero. “Primero™ is Putting Children First.” Accessed April 27, 2019. https://www.primero.org/_blog.

Quinn, Timothy. “Introducing Hatebase: The World’s Largest Online Database of Hate Speech.” Sentinel Project. March 25, 2013. Accessed May 3, 2019. https://thesentinelproject.org/2013/03/25/introducing-hatebase- the-worlds-largest-online-database-of-hate-speech/.

Raymond, Nathaniel. Researcher at Yale University. Interview with Mark Filipovic, March 19, 2019.

Rhynard-Geil, Meghann. Mercy Corps. Interview with Mark Filipovic and Woong Seong, March 12, 2019.

RightMesh. “Cases.” Accessed May 2, 2019. https://www.rightmesh.io/use-cases.html.

Robert Opp. World Food Programme and UN Innovation Network. Interview with Mark Filipovic and Woong Seong, April 19, 2019.

Rosen, Jonathan W. “Zipline’s Ambitious Medical Drone Delivery in Africa.” Technology Review, June 8, 2017. Accessed May 4, 2019. https://www.technologyreview.com/s/608034/blood-from-the-sky-ziplines- ambitious-medical-drone-delivery-in-africa/.

Rowntree, Oliver. “The Mobile Gender Gap Report 2018.” GSM Association, February 2018.

Satellite Sentinel Project. “Reports and Imagery.” Accessed April 11, 2019. http://www.satsentinel.org/ reports-and-imagery.

Schirch, Lisa. “From Protection of Civilians to Human Security: Comparing and Contrasting Principles, Distinctions, and Institutionalization.” 3P Human Security Blog, August 2012. Accessed May 3, 2019. www.humansecuritynetwork.net.

Schwirtz, Michael. “Anguish at U.N., but No Action Plan for Rohingya Atrocities.” New York Times, August 28, 2018. Accessed May 3, 2019. https://www.nytimes.com/2018/08/28/ world/asia/un-rohingya-myanmar-blanchett.html.

Seibert, Maddie. “The World Food Program: Fighting Hunger with Blockchain.” Foodtank, January 2019. Accessed May 4, 2019. https://foodtank.com/news/2019/01/the-world-food-program-fighting-hunger- with-blockchain/.

The Sentry. “FEAR, INC.: War Profiteering in the Central African Republic and the Bloody Rise of Abdoulaye Hissène.” November 2018. https://cdn.thesentry.org/wp-content/uploads/ 2018/11/FearInc_TheSentry_ Nov2018-web.pdf.

The Sentry. “The Golden Laundromat: The Conflict Gold Trade from Eastern Congo to the United States and Europe.” October 2018. Accessed May 7, 2019. https://thesentry.org/reports/ the-golden-laundromat/.

The Sentry. “About the Sentry.” Accessed on May 9, 2019. https://thesentry.org/about/.

The Sentry. “The Sentry: Crime Shouldn’t Pay.” Accessed April 25, 2019. https://thesentry.org/.

The Sentry. “War Crimes Shouldn’t Pay: Stopping the Looting and Destruction in South Sudan.” TheSentry, September 2016, 5. https://cdn.thesentry.org/wp-content/uploads/2016/09/Sentry_WCSP_Finalx.pdf.

Shreves, Ric. Mercy Corps. Interview with Mark Filipovic, April 9, 2019.

Sparrow, Annie. “How UN Humanitarian Aid Has Propped Up Assad.” Foreign Affairs, September 20, 2018. Accessed May 2, 2019. https://www.foreignaffairs.com/articles/syria/2018-09-20/how-un-humanitarian- aid-has-propped-assad.

Specia, Megan. “How Syria’s Death Toll is Lost in the Fog of War.” New York Times, April 13, 2018. Accessed May 3, 2019. https://www.nytimes.com/2018/04/13/world/middleeast/syria-death-toll.html.

Susim, Jason. “7 Tech Trends that are Transforming Humanitarian Aid.” Mercy Corps. January 11, 2019. Accessed February 13, 2019. https://www.mercycorps.org/articles/7-tech-trends-transforming-humanitarian-aid.

Swiss Foundation for Mine Action. ”Drones in Humanitarian Action.” December 2, 2016. Accessed May 4, 2019. https://drones.fsd.ch/wp-content/uploads/2016/11/Drones-in-Humanitarian-Action.pdf.

Swiss Foundation for Mine Action. “Survey: Most Humanitarians Favour the Use of Drones in Disaster Zones.” September 6, 2016. Accessed March 7, 2019. https://drones.fsd.ch/en/3898/.

Syrian Civil War Map. “Syrian Civil War Map.” Accessed April 28, 2019. https://syriancivilwarmap.com/.

Syrian Observatory for Human Rights. “In 7 Hours…Nearly 60 Explosive Barrels Were Dropped by the Regime’s Helicopters on 16 Areas in Both Hama and Idlib Countryside within Putin – Erdogan Demilitarized Zone.” April 30, 2019. Accessed May 1, 2019. http://www.syriahr.com/en/?p=126295.

Syrian Observatory for Human Rights. “More than 570 Thousand People Were Killed on the Syrian Territory Within 8 Years of Revolution Demanding Freedom, Democracy, Justice, And Equality.” March 15, 2019. Accessed: http://www.syriahr.com/en/?p=120851.

Szybala, Valerie. “Siege Watch, Final Report, Out of Sight, Out of Mind: The Aftermath of Syria’s Sieges.” PAX, February 2019. Accessed May 4, 2019. https://siegewatch.org/wp-content/uploads/2015/10/ pax-siege-watch-final-report-spread.pdf.

Télécoms sans Frontières. “Our Funding.” Accessed May 2, 2019. https://www.tsfi.org/en/who-are-we/ our-funding.

TRADEIX, "The Difference Between Blockchain and Distributed Ledger Technology," accessed May 7, 2019. https://tradeix.com/distributed-ledger-technology/

Truepic. “A Holistic Approach to a Complex Problem.” Accessed April 25, 2019. https://truepic.com/technology/.

Truepic. “Photo and Video Verification You Can Trust.” Accessed April 11, 2019. https://truepic.com.

UAV. “Home.” Accessed March 10, 2019. https://www.theuav.com/.

UN Global Pulse. Using Machine Learning to Analyze Radio Content in Uganda. Pulse Lab: Kampala, 2017. Accessed May 3, 2019. http://unglobalpulse.org/sites/default/files/ Radio%20Analysis%20Report_ Preview%20%283%29.pdf.

UNICEF. “Child Protection from Violence, Exploitation and Abuse.” April 5, 2012. Accessed May 3, 2019. https://www.unicef.org/protection/57929_62178.html.

UNICEF. “Humanitarian drone corridor launched in Malawi.” August 23, 2017. Accessed May 4, 2019. https://www.unicef.org/stories/humanitarian-drone-corridor-launched-malawi.

UNITAR. “What We Do.” Accessed April 11, 2019. https://unitar.org/unosat/what-we-do.

UN Office for the Coordination of Humanitarian Affairs. “Abyei: An Uncertain Future.” August 27, 2013. Accessed May 3, 2019. https://www.unocha.org/story/abyei-uncertain-future.

UN Office for the Coordination of Humanitarian Affairs. “Sudan: Humanitarian Dashboard June.” June 30, 2012. Accessed May 3, 2019. https://m.reliefweb.int/report/508888.

United Nations. “Protection of Civilians Mandate.” Accessed April 29, 2019. https://peacekeeping.un.org/en/ protection-of-civilians-mandate.

United Nations. “Radio Still A Powerful Worldwide Tool for ‘Dialogue, Tolerance And Peace’: Guterres.” UN News, February 13, 2019. Accessed May 7, 2019. https://news.un.org/en/story/ 2019/02/1032591.

United Nations. “Sustainable Development Goals.” Accessed April 26, 2019. https://sustainabledevelopment.un.org/?menu=1300.

United Nations Development Programme, Kenya. “Uwiano Platform: A Multi-Stakeholder Strategy for Peaceful Elections.” Accessed April 27, 2019. www.ke.undp.org/content/kenya/ en/home/operations/projects/ peacebuilding/uwiano-peace-platform-project.html.

USAID. “Administrator Green Announces Finalists For The Humanitarian Grand Challenge, Along With Additional Investment To Assist Conflict-Affected Communities.” September 25, 2018. https://www.usaid.gov/ news-information/press-releases/sep-25-2018-administrator-green-announces-finalists-humanitarian-grand-challenge.

Ushahidi. “Crisis Mapping Syria: Automated Data Mining and Crowdsourced Human Intelligence.” March 27, 2012. https://www.ushahidi.com/blog/2012/03/27/crisis-mapping-syria-automated-data-mining-and-crowdsourced-human-intelligence.

Ushahidi. “Voix des Kivus: A Crowd-Seeding System in DRC.” March 16, 2011. Accessed May 3, 2019. https://www.ushahidi.com/blog/2011/05/16/voix-des-kivus-a-crowd-seeding-system-in-drc/.

VanDamme, Olivier. Programme Specialist in charge of Planning and

Coordination at UNOSAT. Interview with Mark Filipovic, March 6, 2019. Ward,

Ward, Mark. Former US Government Official. Team interview, February 7, 2019.

WeRobotics. “Webinar: Building Disaster Resilience in Japan with Drones and Aerial Imagery.” September 28, 2018. Accessed May 4, 2019. https://blog.werobotics.org/2018/09/28/building-disaster-resilience-in-japan-with- drones-and-aerial-imagery/.

WhatsApp. “WhatsApp Security.” Accessed May 4, 2019. https://www.whatsapp.com/security/.

Witness. “Mobil-Eyes Us: Using Live Video and the Power of Networks for Smart Activism.” Accessed April 25, 2019. https://blog.witness.org/2015/10/mobil-eyes-us-using-live-video-and-the-power-of-networks-for-smart-activism/.

Witness. “Our Work.” Accessed April 11, 2019. https://witness.org/our-work/.

Witness. “Regional Programs.” Accessed April 11, 2019. https://witness.org/our-work/regional-programs/.

Witness. “Resources.” Accessed April 11, 2019. https://witness.org/resources/.

Witness. “WITNESS makes it Possible.” Accessed April 25, 2019. https://witness.org/about/.

WVAM: The Blog. “Our Experiment Using Facebook Chatbots to Improve Humanitarian Assistance.” August 7, 2017. Accessed May 7, 2019. http://mvam.org/2017/08/07/our-experiment-using-facebook-chatbots-to-improve- humanitarian-assistance/.

Wolfinbarger, Susan, Jonathan Drake, and Eric Ashcroft. Introduction to Remote Sensing of Cross Border Conflicts: A Guide for Analysts. American Association for the Advancement of Science. AAAS: Washington, DC, 2015. https://mcmprodaaas.s3.amazonaws.com/s3fs-public/reports/Handbook.pdf.

World Food Programme. “Cash Transfers.” Accessed April 19, 2019. https://www1.wfp.org/ cash-transfers.

World Food Programme. “Blockchain for Zero Hunger: Building Blocks.” March 12, 2018. Accessed May 4, 2019. https://innovation.wfp.org/project/building-blocks.

World Food Programme. “VAM food security analysis: Yemen.” Accessed April 26, 2019. http://vam.wfp.org/sites/mvam_monitoring/yemen.html.

World Food Programme. “Yemen mVAM Bulletin no. 43 (March 2019).” March 2019. Accessed May 7, 2019. https://docs.wfp.org/api/documents/WFP-0000104474/download/.

World Health Organization. “EWARS: A Simple, Robust System to Detect Disease Outbreaks.” November 11, 2018. Accessed May 3, 2019. https://www.who.int/emergencies/kits/ewars/en/.

Yoo. Tae. “4 Ways Technology Can Help Us to Respond to Disasters.” World Economic Forum, January 8, 2018. https://www.weforum.org/agenda/2018/01/4-ways-technology-can-play-a-critical-role-in-disaster-response/.

Images Used

Photo by Fancycrave.com from Pexels.https://www.pexels.com/photo/green-and-black-computer-motherboard-825258/

Photo by Africa Rising. https://www.africarising.tv/downloads/african-stock-video-black-rural-woman-texting-cell-phone-6/

Photo by Pok Rie from Pexels. "Camera-drone-macro-1336211.pdf." https://www.pexels.com/photo/person-holding-white-and-black-quadcopter-drone-1336211/

Photo by Chris Liverani from Unsplash. "Turned on flat screen monitor." https://unsplash.com/photos/dBI_My696Rk

Photo by Clint Adair from Unsplash. "Green rope meshwork." https://unsplash.com/photos/BW0vK-FA3eg

Appendix 1: Manual of Technologies for the Protection of Civilians

The purpose of this manual is to highlight leading technologies which contribute to the protection of civilians in conflict zones. These technologies are available to individuals, communities, and organizations seeking self-protection and survival strategies or to organizations seeking to alleviate the suffering and increase protection of civilians. While this manual is not exhaustive, it identifies general challenges, categorical tools, and specific technologies to facilitate the protection of civilians. The manual is organized by the overarching purposes of the technologies listed: Security, Humanitarian Assistance, and Accountability.

Security: These services help you (1). collect information, (2). understand what is going on around you, and (3). decide whether you would try to prevent violence, stay where you are and endure the suffering, or flee and resettle somewhere else.			
Challenge	Tools	What You Can Do	Contact
Lack of information about a conflict situation, including potential threats of violence, drivers of conflict, and the status of victims	Information Collection and Analysis Tools	Report incidents remotely via SMS or app	Frontline SMS: https://www.frontlinesms.com/
			Hexagon Geospatial: https://www.hexagongeospatial.com/
			Global EWERS: http://ewars-project.org/
			Primero: https://www.primero.org/
			Gender-Based Violence Information Management System (GBVIMS): http://www.gbvims.com/
			Child Protection Information System (CPIMS+): https://www.cpims.org/
		Collect reports, tweets, and posts related to violent threats or incidents from SMS, radio, and social media	Ushahidi: https://www.ushahidi.com/
			UN Global PulseLab Kampala: https://radio.unglobalpulse.net/uganda/
			The Sentinel Project: https://thesentinelproject.org/
		Let families and friends know that you are safe	Facebook Safety Check: https://www.facebook.com/about/crisisresponse/

Threat of violence	Early Warning Systems	Provide early warnings to civilians	Hala Systems: https://halasystems.com/
Various threats against civilians	Crisis Mapping	Create a map includes locations of incidents, helps needed, and humanitarian service access points, see the location of violent incidents around you, decide stay or flee, and look for a safer place	Ushahidi: https://www.ushahidi.com/
			Esri: https://www.esri.com/en-us/home
			MapBox: https://www.mapbox.com/
			OpenStreetMap: https://www.openstreetmap.org Humanitarian OpenStreetMap Team: https://www.hotosm.org/

Humanitarian Assistance: These tools and organizations are considered to have high potential in facilitating assistance for civilians in conflict zones so that you can: (1) get better access to external assistance; (2) seek medical treatment & support.			
Humanitarian Challenge	Tools	What You Can Do	Contact
Aid delivery	Distributed Ledger	Digitized, direct, paperless cash transfer for more secure, cheaper transaction	WFP (Building Blocks Program): https://innovation.wfp.org/project/building-blocks
		Direct retail purchasing with SMS messaging, without a bank account or paper cash	ConsenSys Social Impact: https://consensys.net/social-impact/
		Encrypted Cash Transfer by paper cash; E-vouchers; smart cards	RedRose: https://www.redrosecps.com/
	Online Consultation	Online legal consultation	Mercy Corps (Khabrona): https://www.khabrona.info/
		Online Q&A Support regarding food programs	WFP-InStedd (Foodbot): https://instedd.org/project/foodbot/
	Online Communication	GIS Mapping for workforce locations, alerts, local infos	American Red Cross (RC View): https://rcview.redcross.org/home/
		Local vulnerability mapping by SMS Analysis	WFP-InStedd-Cisco (mVAM): http://vam.wfp.org/sites/mvam_monitoring/

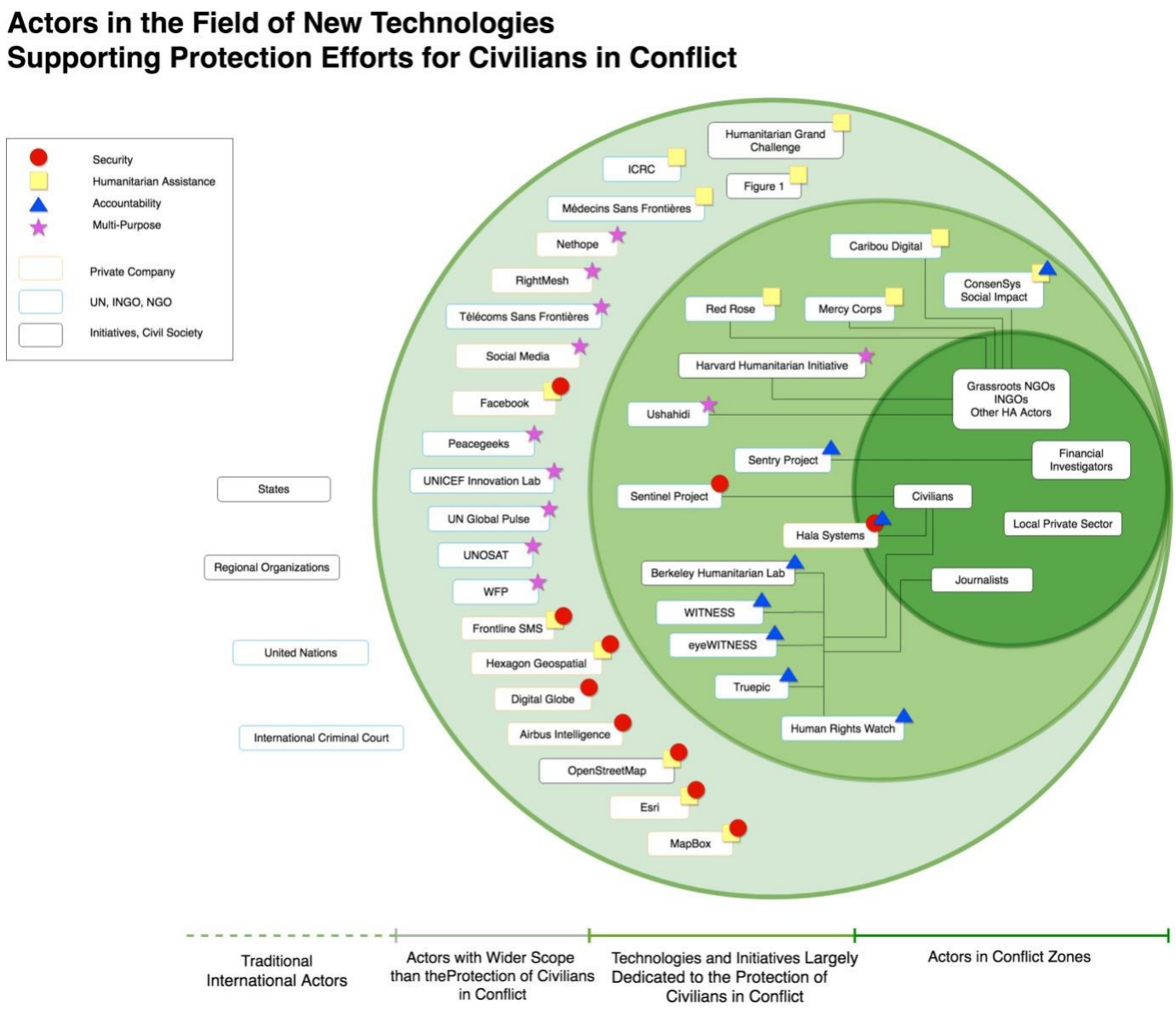
Limited Medical Access	Virtual Reality (VR)	VR psychological treatment	Mercy Corps: https://www.mercycorps.org
	Telemedicine	Telemedicine by remote diagnosis, technic sharing	Figure 1: https://figure1.com/
	Mobile Surgical Tools	Mobile Unit Surgical Trailer (MUST) at work MUST2 (larger trailer with greater capacity) in testing Point-of-care Ultrasound tool to better equip local health workers	MSF (MUST, MUST2, POCUS): https://www.doctorswithoutborders.org
Limited Innovation	Tech Development Challenge Platform	Platform for facilitating new technology for humanitarianism: e.g. telemedicine app (Intelehealth), gender violence reporting platform (ActionAid UK)	Humanitarian Grand Challenge (HGC): https://humanitariangrandchallenge.org/

Accountability: These technologies, tools, and organizations address violence against civilians, disinformation, credibility and access to justice by collecting, securing and disseminating evidence of atrocities, war crimes, and crimes against humanity.			
Challenge	Tools	What You Can Do	Contact
Violence Against Civilians	Evidence Collection	Controlled captured images and videos that are then stored and verified to a blockchain for later use	Truepic: https://truepic.com/
			ObscuraCam: https://guardianproject.info/apps/
			CameraV: https://guardianproject.info/apps/camerav
			Videos for Change: https://videosforchange.org
			eyeWitness: https://www.eyewitnessproject.org/
		Online resources and in-person trainings for civilians and NGOS on how to accurately capture evidence	WITNESS: https://witness.org/

		Capture and analyze satellite imagery to identify potential war crimes and crimes against humanity	Digital Globe: https://www.digitalglobe.com/
			UNOSAT: https://unitar.org/unosat/
Credibility of collected evidence	Verification of Evidence	Integrate technology and human analysis to verify photographic and videographic evidence	Berkeley Human Rights Lab: https://humanrights.berkeley.edu/
			Harvard Humanitarian Initiative: http://hhi.harvard.edu/research#humanitarian-data-and Initiative
Connectivity	Mesh networks; Satellite Communications; Communications support	Alternative internet access	RightMesh: https://www.rightmesh.io
		Internet connectivity in austere and conflict areas	NetHope: https://nethope.org/
		Internet connectivity and restoration of local infrastructure	Télécoms sans Frontières: https://www.tsfi.org/en/
Lack of Legal Systems	Access to justice	Disseminate ongoing legal proceedings to conflict civilians via mobile networks	Peacegeeks: https://peacegeeks.org/our-work

Appendix 2: Map of Actors in the Field of New Technologies Supporting Protection Efforts

The purpose of this mapping document is to illustrate leading technologies and organizations which contribute to the protection of civilians and their relationship to conflict zones. The innermost circle comprises actors inside of conflict; the middle circle comprises actors and technologies largely dedicated to the protection of civilians in conflict; and the outermost circle comprises technologies and actors with broader scopes or which have been repurposed for the protection of civilians. While this mapping document is not exhaustive, it identifies general types and categories of technologies, as well as some actors, which facilitate the protection of civilians.



Student Profiles

Adam Robitaille

Adam is a United States Army officer with ten years experience in combat arms and communication. He is a 2019 Masters of International Affairs candidate whose academic interests include international security policy, conflict resolution, and protracted conflicts.

Ai Nakashio

Ai is a career official from Japan's Ministry of Defense with 6 years experience, including a one-half year deployment to the UN Mission in South Sudan. She is a 2019 Masters of International Affairs degree candidate with a concentration in International Security Policy.

Caitlyn Passaretti

Caitlyn is a 2020 dual degree candidate studying for a Masters of Public Administration and Masters of Science of Social Work

Christopher Franklin

Christopher is a Masters of International Affairs degree candidate in 2019 with the International Security Policy concentration.

Mark Filipovic

Mark is a 2019 Masters of International Affairs candidate from Canada with a particular focus on children's rights and conflict resolution. Mark intends to join the child protection field at the global level upon graduation.

Woong Seong

Woong is a career official from South Korea's Ministry of Foreign Affairs. He is a Master of International Affairs candidate in 2019 with a concentration in Human Rights and Humanitarian Policy.