

Using Unmanned Aerial Vehicles for Development: Perspectives from Citizens and Government Officials in Tanzania

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“This technology is wonderful, but if there is no control mechanism then it is chaos.”

— Government official

BACKGROUND

Unmanned aerial vehicles (UAVs) could become an important tool for international development. Also known as drones, UAVs are aircraft that can be piloted remotely or flown autonomously. Although they have many humanitarian applications — including emergency food provision, disaster relief, and supply transport — the common use of UAVs for military operations could negatively affect public perceptions of their use for development (Meier, 2014; OCHA, 2014). Only a few studies have explored the public’s perceptions of UAVs for non-military uses (Boucher, 2014; Boyd, 2013; Eyerman et al., 2014; Thompson and Bracken-Roche, 2015). Almost nothing is known about the public’s attitude toward the use of UAVs for humanitarian purposes in developing countries. Such information would help the development community design UAV projects that are responsible, safe, and successful.

To assess citizen and government perceptions of using UAVs for development in Dar es Salaam, Tanzania, FHI 360 conducted a study in March 2015. This study coincided with flights conducted by Drone Adventures¹ for the World Bank and the Tanzania Commission for Science and Technology (COSTECH)² to map areas prone to flooding in several urban neighborhoods within the capital city (Meier, 2015). These flights provided an opportunity to interview citizens who witnessed the UAV flights and government officials who might be in a position to create the policies that guide the use of UAVs in Tanzania. We believe this is one of the first studies to explore perceptions of UAVs in developing countries.

METHODS

For these flights, Drone Adventures used two SenseFly eBee UAVs — small (96 cm wingspan) devices made of foam. A DJI Phantom quadcopter (about 35 cm across) was also flown at some sites to record videos of ascents and landings. Drone Adventures conducted approximately 34 flights over the course of 4 days. Each flight lasted approximately 40 minutes, at an altitude of about 200 meters. The UAV pilots selected the launch sites based on the need for space to launch the devices and for the site’s proximity to the flood zones of interest. The launch sites included an urban open space, a football pitch, and a schoolyard. Prior to each flight, local community leaders were consulted and given an

¹ Drone Adventures is a non-profit organization based in Switzerland, that provides UAV pilot services for humanitarian work.

² The project under which these flights were conducted, Ramani Huria, is funded by the World Bank for COSTECH and in partnership with the City Council of Dar es Salaam, the University of Dar es Salaam, Ardhi University, Buni Innovation Hub, and the Red Cross.

overview of the flights' goals. Drone Adventures provided a brief introduction to UAVs and explained the purpose of the flights to anyone who asked.

FIGURE 1. THE SENSEFLY EBEE



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This study used a mixed-methods approach to explore UAV perceptions among citizens witnessing UAV flights and government officials who have a stake in UAV use in Tanzania.

For the witness interviews, we approached all adults in the immediate vicinity of the launch sites and identified those who had seen the UAVs, either on the ground or

FIGURE 2. DJI PHANTOM



LINO SCHMID AND MOIRA PRATI

in the air. A total of 208 participants (all over the age of 18) answered questions about their awareness of UAVs, the acceptability and perceived utility of the devices, and their potential concerns about the use of UAVs for development.

We also conducted in-depth interviews with 14 randomly selected high-level officials in 12 of Tanzania's 20 government ministries (see Box 1). Selected officials in the other 8 ministries were unavailable for or declined interviews. During these interviews, we showed a short video of a UAV in flight. The video came after questions about awareness and acceptability; after showing the video we again asked about acceptability, concerns, and regulations.

Oral informed consent was obtained prior to all interviews. This study was reviewed and approved by Tanzania's Commission for Science and Technology and the Protection of Human Subjects Committee of FHI 360.

BOX 1: PARTICIPATING MINISTRIES

Ministry of Agriculture, Food Security and Cooperatives

Ministry for Communication, Science and Technology

Ministry of Community Development, Gender and Children

Ministry of East African Cooperation

Ministry of Energy and Minerals

Ministry of Health and Social Welfare

Ministry of Home Affairs

Ministry of Information, Youth, Culture & Sports

Ministry of Lands and Housing

Ministry of Livestock and Fisheries Development

Ministry of Natural Resources

Ministry of Transport

RESULTS

Awareness

Awareness of UAVs was generally low among the witnesses: only 24% had heard of UAVs before the interview day. Among those who were aware of the technology (n=50), imagery (44%) and military operations (40%) were most commonly mentioned; mapping (14%) and disaster relief (10%) were mentioned less frequently.

Government officials were much more aware of UAVs and their potential uses. Twelve of the 14 government officials had heard of UAVs before the interview; they mentioned a range of applications such as warfare, wildlife monitoring, research, natural disasters, surveillance, anti-poaching, mapping, and transport of emergency goods and medical supplies.

"I have known about it for more than 10 years. Unmanned aerial aircrafts can be used for investigations, to collect some information from different countries; to collect data for the purpose of security and defense. That is the main use of drones. Drones can be used in logistics in issues of carrying cargo during emergencies, taking medicines from one point to the affected areas, and for evacuation purposes in case of emergencies."

Although most officials had accurate information about uses for UAVs, a few were unaware of non-military activities and some held misconceptions about the size and purpose of UAVs or had confused UAVs with other types of robots or aircraft (such as satellites):

"So this is the UAV? So it does not carry people? Can it land anywhere, even on a tree? ...I heard yesterday in the news that it could help with transportation, how is that? I thought it would at least have two passenger seats!!"

"UAVs are those aircraft flying to the moon and to the air space to take photos and such like."

Acceptability and Utility

In general, witnesses had positive reactions to the UAV flights. More than half (62%) expressed happiness or awe. About 19% of the respondents expressed wonder that the UAV could fly without a pilot, and 17% believed that UAVs could be a great benefit to society or Tanzania. Among the 50 witnesses who were previously aware of UAVs, 88% said their perceptions of drones had improved after witnessing the flight that day, and none had worse perceptions.

When presented with specific uses ("use cases") for UAVs, more than 90% of the witnesses reported that they were comfortable with each use case (See Table 1). The witnesses were least comfortable with uses related to healthcare (delivery of medicine and transport of blood), but even these uses were highly acceptable. The respondents also ranked the utility of each use case for their community. All use cases ranked high, especially: wildlife management, examining infrastructure, tracking criminals, monitoring traffic, and disaster relief.

TABLE 1: WITNESS SURVEY: ACCEPTABILITY AND UTILITY OF UAVS

Use cases	% Comfortable with UAVs (n=208)	% Believe UAVs useful (n=208)
Agricultural photos or video	96	88
Air pollution measurement	95	88
Blood transport	91	88
Criminal investigations	95	93
Disaster relief	97	92
Infrastructure improvements	99	94
Medicine delivery	91	89
Traffic monitoring	98	93
Wildlife management	98	94

Most ministry officials (12 of 14) were ‘comfortable’ or ‘moderately comfortable’ with the use of UAVs in Tanzania. One official was undecided and one was uncomfortable about their use. In general, government officials said their feelings about UAVs would depend on the purpose of the flights and the identity of the operators. Most of the officials were uncomfortable with the idea of using UAVs for war, if the UAVs harmed the environment, or breached data security. Some officials said that they would be comfortable with the use of UAVs only if the operators were qualified and a couple said they should only be operated by the government, at least initially.

“Yes, I will be comfortable because that is not new in Tanzania, we are using aircrafts to take aerial photos and videos and to collect information related to mining, spraying insecticides..in cases of locusts etc., and this technology does not differ very much with UAVs. So generally all that matters is what purpose they are used for.”

When presented with specific use cases (see Table 1), nearly all of the officials were “comfortable” or “very comfortable” with each use case. All officials were comfortable with using UAVs to monitor air pollution, traffic, and criminals, or for infrastructure improvements. Three officials had mixed feelings about using UAVS to deliver medicine, and one of these officials also had mixed feelings about transporting blood. Two officials were uncomfortable with using UAVs to take videos or photos of farmland because the farmers might not know who was controlling the UAV or why it was being used. One official was uncomfortable with the use of UAVs to track wildlife or respond to emergencies but the reasons why were not mentioned.

Although most of the witnesses and government officials were comfortable with healthcare applications, these use cases elicited the most concern of all potential uses. On average, both groups of participants also ranked medical uses as slightly less important than other applications. Interviews with officials shed some light on these concerns, including a fear of interception or misuse, the

difficulties of transport logistics, and adherence to rules and regulations.

“Unless medicine [delivered by UAVs] is accompanied by instructions and is being received by some very specialized medical doctors and those who are responsible...[it] is not good because people might use it wrongly for things which were not intended.”

When asked to consider how UAVs could be used by their respective ministries or by the country, the officials offered a variety of possibilities (See Box 2).

“So we can use UAVs to reach remote areas for surveys, collecting information about a certain place, etc. Like for us in the ministry, when we have drought, and you can clearly see in pictures how the crops are affected and you could judge whether you can expect something from the remaining [plants] or if they are completely destroyed. You could also assess other conditions like floods; flooded areas can't be accessed but you can send UAVs to assess the housing, crops, water level etc.”

One Ministry respondent was particularly interested in the use of UAVs to reduce the cost of film-making in difficult terrain. Another mentioned that the technology might be useful in surveillance to protect vulnerable populations, like people with albinism.³ One government official thought it would be useful to identify populations that needed to be reimbursed after a construction project.

“This technology can be used.. in areas where we might have a project and in that area we need to know the number of people who are living in that area before giving them compensation, so such a device can be used to take pictures of the community so that maybe by the time we make payment we know exactly who was there.”

³ Kidnapping of people with albinism has been a problem in Tanzania because of superstitious beliefs and prejudice, particularly in parts of the country where populations of albinos are traditionally higher (Wesangula, 2015).

BOX 2: POTENTIAL USE OF UAVS BY TANZANIAN MINISTRIES

Agriculture and ecology (crop condition, habitat, geology)
Border surveillance (land and sea)
Delivery of goods (medical supplies, mail)
Film and advertising
Engineering inspections and measurement (mines, railways, bridges)
Emergency response (fire and rescue, cargo transport)
Mapping area measurement
Population census
Weather forecasting and climatic measurements
Wildlife and livestock surveillance

Concerns

The majority (78%) of the witnesses had no concerns about the use of UAVs in their communities. Those who did express concerns mentioned accidents (22%); security, including use for bombing or criminal activities (20%); and visual privacy (12%). A quarter of the witnesses expressed non-specific concerns.

All of the officials expressed some degree of concern. The most commonly reported concerns were related to costs and regulation (Table 3). All of the officials recognized the need to regulate and control UAVs if they were to be used in Tanzania. As one government official said, *“For me, as long as the reason it is flying is known, then I have no problem.”*

Accidents

When asked specifically about the possibility that UAVs might damage people or property, the majority (76%) of witnesses were not worried. Some said they were not concerned because the device was small and it was controlled by experts. Slightly less than a quarter (22%) of the witnesses expressed concerns because the UAV might crash into another object, the pilot might lose

control of the device, or the landings might not be steady. Some witnesses also said that the lack of information about how UAVs works increased their apprehensions.

In contrast, only three government officials expressed concerns about accidents. These individuals mentioned mid-air collisions, UAVs falling out of the sky and injuring people, inadequate communication between pilots flying different UAVs, and explosions of the devices.

Privacy and National Security

When asked whether they were concerned about breaches of privacy with UAVs, a quarter of the witnesses expressed some apprehension. These individuals mentioned concerns about UAVs flying over uncovered toilets, looking inside buildings, and not knowing the identity of those flying the device.

Government officials were also concerned about the identity of the viewers, but from the perspective of national security and espionage. Half of the respondents did not like having cameras on UAVs because they could be used for spying, whereas the other half believed the cameras were beneficial, even essential, because they could verify the truth of a situation.

“With globalization it [the UAV] is very dangerous. With it I can monitor what people are doing in military camps, at the statehouse and many other sensitive areas.”

“Well, people talk of privacy and security as well, it is a good thing that the camera is there, but I am not sure if the privacy and affairs of people will be assured, it is something that has to be discussed...”

Ownership and Technical Capacity

Several government officials mentioned wanting UAV technology to be owned and operated by Tanzanians; simultaneously, however, they worried that Tanzania lacked the financial and technical capacity to use UAVs. Ownership was also related to their concerns about security; officials said that foreigners might not use UAVs

in a way that benefits Tanzania, and so Tanzania should control the technology.

“Everything will be done by our people, not importing an engineer from abroad; they can even gather some information from you. That is my view and perception as the government and nationalist Tanzania.”

The government officials also expressed concerns about the costs of acquiring, operating and maintaining the device.

“I am also looking at the cost of running this technology; the cost might be affordable and the technology efficient, but does our economic capacity allow for the purchase, expertise and afford operation of the drones without causing any effect?”

Regulations

All of the government officials mentioned the need to regulate UAVs, especially the identity of the operators and the intended use. Officials also mentioned the potential need to regulate pilot licensure, device purchases, the monitoring of flights and communication, device inspections, and safe disposal to minimize harm to the environment. Respondents proposed a range of regulatory mechanisms to address these concerns including: laws, policies, standard operating procedures, and guidelines. The need for a central monitoring institution was important to several officials. The Department of Defense and the Tanzania Civil Aviation Authority were suggested as possible governing bodies. One official said a cross-disciplinary national board with a separate enforcement agency could be easily coordinated across ministries.

“If there are no rules to guide their uses then they might have very negative impacts...everyone will do

what they think is best for them. So if there are no regulations from the family level to the national level then things will not work, there must be regulations.”

Officials were divided on the question of whether UAV ownership should be limited to government institutions. Some said the technology should only be used by professionals in the government, to ensure that it is used carefully and with beneficial intent. Others said the pilot’s affiliation should not matter, so long as rules are in place. One respondent doubted that the UAV regulations would be followed and suggested the use of many checks and balances to oversee all UAV programs, even those managed by the government.

“I think you can see that most of the traffic jam here is because people do not want to follow laws and procedures, so for UAVs to be successful there must be very strict control, which I doubt if we can achieve that.”

TABLE 3. CONCERNS ABOUT UAVS (IN ORDER OF FREQUENCY MENTIONED)

Concerns among witnesses	Concerns among government officials
Accidents	Cost
Security (national, local)	Regulation
Visual privacy	Security (national, personal data)
	Ownership and local capacity to operate
	Public acceptance
	Accidents
	Environmental impact

CONCLUSIONS AND RECOMMENDATIONS

Citizen witnesses and government officials were overwhelmingly positive about the potential of UAV technology in Tanzania. Both groups believed that UAVs could be useful for, disaster relief, infrastructure improvements, transportation of medical supplies (including: medicines, blood, lab reagents, and other medical supplies), traffic monitoring, wildlife management, and criminal investigations. Some government officials also mentioned mapping, population counts, weather sensing, film-making and marketing, and border surveillance.

Government officials expressed many more and more varied concerns than witnesses. Whereas only a few witnesses worried about accidents, security, and visual privacy, all government officials voiced concerns and those focused on costs, regulations, ownership, and local capacity to maintain and use the technology. Many of these concerns could be addressed, in part, by providing officials and citizens with more information on UAV technology and applications.

While some officials are already using UAVs for wildlife surveillance and infrastructure assessments, many others remain unfamiliar with the existing applications of UAVs in Tanzania. A campaign to raise the awareness of Tanzanian-led initiatives in UAV technology could highlight existing capacity and innovation. Several ministries have UAV experts and the Commission on Science and Technology's innovation hub hopes to produce some UAVs. Furthermore, the Ifakara Health Institute won USAID's 2015 Saving Lives at Birth Grand Challenge for a project that will deliver blood and medicine via UAV (Saving Lives at Birth, 2015). Tanzania is growing the local capacity to create, maintain, and use this technology. This capacity could be promoted

to encourage the use of UAVs for development that is grounded in local concerns and needs.

The development of regulations for the use of UAVs should be a priority, and it should coincide with efforts to educate the public about the potential benefits and concerns associated with the technology. All organizations that use UAVs should follow recognized good practices — such as those in the *UAViators Code of Conduct* (UAViators, 2015) — to ensure safe and ethical uses. The most effective uses of the technology will also monitor community reactions to flights as UAV awareness increases.

The adoption of new technology is a communication process that takes time and social engagement. We hope these study results inform conversations about UAV use in Tanzania by recognizing the concerns of communities and the government related to UAVs, and by informing the content of educational messages about the use of UAVs for development.

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About FHI 360: FHI 360 is a nonprofit human development organization dedicated to improving lives in lasting ways by advancing integrated, locally driven solutions. Our staff includes experts in health, education, nutrition, environment, economic development, civil society, gender, youth, research and technology — creating a unique mix of capabilities to address today's interrelated development challenges. FHI 360 serves more than 70 countries and all U.S. states and territories.

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