



**ST. MARY'S UNIVERSITY  
SCHOOL OF GRADUATE STUDIES**

**ASSESSMENT OF OPPORTUNITIES AND THREATS OF COMMERCIAL DRONES  
IN CASE OF ADDIS ABABA**

**BY  
HABTAMU MERESA HAILE**

**JUNE 2020  
ADDIS ABABA, ETHIOPIA**

**ASSESSING OPPORTUNITIES AND THREATS OF COMMERCIAL DRONES  
IN CASE OF ADDIS ABABA**

**BY  
HABTAMU MERESA HAILE**

**A THESIS SUBMITTED TO ST. MARY'S UNIVERSITY, SCHOOL OF GRADUATE  
STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE  
DEGREE OF MASTER OF BUSINESS ADMINISTRATION  
(GENERAL MANAGEMENT)**

**JUNE 2020  
ADDIS ABABA, ETHIOPIA**

**ST. MARY'S UNIVERSITY  
SCHOOL OF GRADUATE STUDIES  
FACULTY OF BUSINESS**

**ASSESSING OPPORTUNITIES AND THREATS OF COMMERCIAL DRONES  
IN CASE OF ADDIS ABABA**

**BY  
HABTAMU MERESA HAILE**

**APPROVED BY BOARD OF EXAMINES**

_____ <b>Dean, Graduate Studies</b>	_____ <b>Signature</b>
_____ <b>Advisor</b>	_____ <b>Signature</b>
_____ <b>External Examiner</b>	_____ <b>Signature</b>
_____ <b>Internal Examiner</b>	_____ <b>Signature</b>

## **DECLARATION**

I, the undersigned, declare that this thesis is my original work, prepared under the guidance of Mesfin Tesfaye (PH.D.). All sources of materials used for the thesis have been duly acknowledged. I further confirm that the thesis has not been submitted either in part or in full to any other higher learning institution to earn any degree.

---

Name

---

Signature

**St. Mary's University, Addis Ababa**

**June 2020**

## **Dedication**

This thesis work is dedicated to my beloved wife Tekli, who has been a constant source of support and encouragement; I am truly thankful for having you in my life. This work is also dedicated to my family; who have always loved me unconditionally and whose good examples have taught me to work hard for the things that I aspire to achieve.

## **ENDORSEMENT**

This thesis has been submitted to St. Mary's University, School of Graduate Studies for examination with my approval as a university advisor.

---

Name

---

Signature

**St. Mary's University, Addis Ababa**

**June 2020**

## TABLE OF CONTENTS

ACKNOWLEDGMENTS .....	ii
LIST OF ABBREVIATIONS/ACRONYMS .....	iii
LIST OF TABLES .....	iv
CHAPTER ONE .....	1
INTRODUCTION .....	1
1.1 Background of the Study .....	1
1.2 Statement of the Problem .....	3
1.3 Basic Research Questions .....	5
1.4 General Objective of the Study .....	5
1.5 Specific Objective of the Study .....	5
1.7 Significance of the Study .....	6
1.8 Scope of the Study .....	7
1.9 Limitations of the Study .....	7
1.10 Operational Definition .....	8
1.11 Organization of the Study .....	9
CHAPTER TWO .....	10
LITERATURE REVIEW .....	10

2.1 Theoretical Review .....	10
2.1.1 Trends of Drones in Commercial Applications .....	12
2.1.2 Commercial Drone Operation in In Addis Ababa .....	14
2.2 Empirical Review .....	14
2.2.1 Opportunities .....	15
2.2.2 Threats .....	22
CHAPTER THREE .....	30
RESEARCH DESIGN AND METHODOLOGY .....	30
3.1 Research Approach .....	30
3.2 Research Design .....	30
3.3 Sources and Types of Data .....	31
3.4 Procedures of Data Collection .....	31
3.5 Target Population .....	31
3.6 Sample Size and Sampling Techniques .....	32
3.7 Instruments of Data Collection .....	33
3.8 Data Analysis Techniques .....	33
CHAPTER FOUR .....	35
DATA PRESENTATION, ANALYSIS AND INTERPRETATION .....	35



4.1 Data Presentation.....	35
4.1.2 Opportunities of Commercial Drones.....	36
4.1.3 Threats of Commercial Drones.....	42
4.2 Data Analysis and Interpretation.....	49
4.2.1 Opportunity Analysis and Interpretation .....	50
4.2.2 Threat Analysis and Interpretation .....	54
CHAPTER FIVE .....	59
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.....	59
5.1 Summary of Findings .....	59
5.1.1 Opportunities of Commercial Drones.....	59
5.1.2 Threats of Commercial Drones.....	60
5.2 Conclusions .....	61
5.4 Recommendations .....	63
REFERENCES .....	i
APPENDIXES .....	i
Appendix A .....	i
Appendix B .....	vi

## **ACKNOWLEDGMENTS**

First of all, I am grateful to appreciate my advisor Mesfin Tesfaye (Ph.D.) who takes all the trouble with me while I prepare this thesis for partial fulfilment of the requirement of the Degree of Master in Business Administration in General Management. Especially, his valuable and prompt advice, his tolerance guidance, and useful criticisms throughout the process of preparing this thesis, constructive corrections, and insightful comments, suggestions and encouragement are highly appreciated.

My sincere appreciation also goes to all participants of this study including colleagues, families and friends.

Lastly but nor least I praise and thank almighty God whose blessings have given me the power and confidence to carry out my thesis.

## **LIST OF ABBREVIATIONS/ACRONYMS**

<b>Abbreviations</b>	<b>Full Description</b>
AA	Addis Ababa
ATM	Air Traffic Management
CBRN	Chemical, Biological, Radiological, and Nuclear
Col.	Colonel
CUPID	Chaotic Unmanned Personal Intercept
DIY	Do It Your Self
EASA	European Aviation Safety Agency
ECAA	Ethiopian Civil Aviation Authority
EU	European Union
FAA	Federal Aviation Administration
GPS	Global Positioning System
IED	Improved Explosive Devices
INSA	Information Network Security Agency
MAC	Media Access Control
Mph	Miles per hour
RC	Radio Controlled
RPA	Remotely Piloted Aircraft
RPAS	Remotely Piloted Aircraft System
SESAR	Single European Sky ATM Research
SIM	Subscriber Identity Module
TV	Television
UAS	Unmanned Aerial System
UAV	Unmanned Aerial Vehicle
USB	Universal Serial Bus
EUR	Euro
WMD	Weapons of Mass Destruction

## LIST OF TABLES

Table 1: Drone as an opportunity to improve entrepreneurial activity. ....	37
Table 2: Drone as an opportunity to improve marketers activity. ....	38
Table 3: Drone as an opportunity to enhance filmmakers' activity. ....	39
Table 4: Drone as an opportunity to enhance video producers' activity. ....	40
Table 5: Drone as an opportunity to enhance TV stations' activity. ....	41

## **Abstract**

*In Addis Ababa, Ethiopia commercial drone technology is utilized by entrepreneurs, video makers, film makers, video producers, TV stations as well as by police. By applying descriptive research design; this qualitative research assessed of the opportunity and threats of commercial drones in Addis Ababa. The opportunities explored are; for business practices, entertainment industry and law enforcement activities. The investigated posed threats are to; privacy, government activities and cyber security. The research used census methods and which mainly interviewed primary data from government stakeholder bodies like Ethiopian Civil Aviation Authority, police and Information Network Security Agency; as well as from business side seventeen television stations, thirty one video producers, fifty one film makers, thirty six marketers, and fifty six entrepreneurs, primary data is collected using five scale Likert written questionnaire. As a secondary data government documents, reports, firm documents, research papers, reputable website analysis & reports are used. The analysis technique used for five scale Likert data is averaging responses for each separate question using SPSS software version 24.0; then grand mean of the respective sector is evaluated, on which; mean value 1 represents lowest satisfaction whereas 5 represent highest satisfaction. Drone operations are making easy the drone based business sector like marketers, video producers, entrepreneurs' film makers and television stations. Commercial drones are more utilized by entertainment industry than any other. Police lag behind the private sector on understanding and utilizing commercial drones for law enforcement activities. Drones are also posing a threat to privacy, government activities, and cyber security.*

**Keywords:** commercial drone, threat, opportunity

# **CHAPTER ONE**

## **INTRODUCTION**

An unmanned aerial vehicle is a pilotless aircraft, in the sense of Article 8 of the Convention on International Civil Aviation, which is flown without a pilot-in-command on-board and is either remotely and fully controlled from another place (ground, another aircraft, space) or programmed and fully autonomous.(ICAO, 2015).

Throughout this paper, the term commercial drone, drone, unmanned aerial vehicle (UAV), unmanned aerial systems (UAS), remotely piloted aircraft (RPA) or remotely piloted aircraft systems (RPAS) are used interchangeably.

### **1.1 Background of the Study**

Commercial drones have greatly risen in popularity during the past decade. The rise in popularity is chiefly based on advancements in a battery, motor, stabilization, navigation, camera, and sensor technology as well as the globalized economy. This has created a new industry of modern drones that can be used for many purposes, and that is relatively cheap and easy to use. Drones have become a useful tool for professional applications and a popular consumer item for recreational purposes (Huttunen M., 2019).

Drone manufacturers, service providers, and platform integrators are seriously considering the business potential across these application types. The representation of drones in popular media has diversified from military drones to consumer ones, and this reflects the growing demand in the market (R.L. Finn, D. Wright, 2012). These would change the industry landscape in terms of safety, speed, and consequently costs. For example, drones are currently disrupting the use of helicopters by performing similar functions without endangering the people flying in it while

costing around a tenth of the price (<https://resources.infosecinstitute.com>, 2014). The application of drones in large factories to transport payloads is being explored. Also, thanks to the proximity at which the Unmanned Aerial Vehicle (UAV) can operate, and its limited noise compared to a real aircraft, it can be deployed for stealthier operations, such as detecting wildlife.

Many industries including law enforcement, movie and news production, and construction are using drones instead of manned aircraft for their operations. During the last twenty years, the spread of the Internet as a commerce platform has allowed firms to gain more visibility, reduce costs and the distribution footprint, and thus effectively leave the brick and mortar environment (L.R. Newcome, (2012). However, the logistics and distribution infrastructure is still dependent on ground and air transportation. Drones enable a new form of transportation and delivery and thus can completely change the ground rules: Amazon Prime Air, DHL, and Google are pioneers in exploring the new type of delivery mechanism. Amazon has declared that once the service will be fully deployed they will be able to deliver more than 80% of their goods through air (Bharat Rao, Ashwin Goutham Gopi, Romana Maione, 2016).

In Addis Ababa, based on the advertisement information obtained from local websites (ezega.com, qefira.com, sheger.net) and social media like Telegram and Facebook drones are available for sale and rent; and also movies, video music, documentaries and various videos like rallies, wedding, concerts, etc which contains drone footages are available on YouTube.

In Addis Ababa commercial drones are utilized by Television (TV) stations, movie producers, event organizers, and entrepreneurs, mostly for its cheap, easy to operate and beautiful aerial video and photos of city escapes with low cost.

Thus, we see that science, technology, politics, social movements, and commerce have shaped the design, development and use of commercial drones (Bharat Rao. etl. 2016). The argument can be made that in turn, drones too have the threat and also opportunities to the society. The

processes behind these changes have been widely explored in the field of science, technology, and society, and we now turn the lens to this particular emerging technology. To do so, we will analyze the data collected from users and different stakeholders of commercial drones in Addis Ababa.

Therefore, this research will assess the opportunities and threats created by the drone operation in the capital city of Ethiopia, Addis Ababa.

## **1.2 Statement of the Problem**

Commercial drones, just like manned civil aircraft, could pose a threat to their environment (Huttunen M., 2019). Most notably on the global cable news, we have heard that drones could be used for acts of terrorism, such as assassination or mass murder. They can be weaponized, piloted to target, deliver explosives, or spread chemical or biological weapons. At least since the 1990s, terrorist groups have acquired and experimented with drone technology of the time (Rassler 2016, 13–60). For example, the Japanese Aum Shinrikyo cult purchased remote control helicopters in the 1990s to spraying sarin gas, though ultimately they resorted to other methods (Olson 1995, 42). A more recent case involved two drones carrying explosives in Caracas, which allegedly was an attempt to attack the president of Venezuela (Waters and Fiorella, 2018). Drones might also be used to bring down manned aircraft (Rassler 2016, pp, 52–54) or trains (Shvetsov and Shvetsova, 2017). Saudi security shoots down a recreational drone near the royal palace & creates loud gunfire that lasted for at least 30 seconds, leading to speculation online about a possible coup attempt (Reuters, April 21, 2018 ).

Mikko Huttunen (2019) on his research on civil unmanned aircraft systems and security: The European approach which is published on the Journal of Transportation Security stated that “As a general requirement, every aircraft used in aviation must be airworthy. This means that their design must be certified and that the airworthiness of every individual aircraft is initially approved and continuously maintained.”



Based on a white paper published in (<https://aviation.report>); Drones are proliferating throughout the world's airspace, making them impossible to ignore (Frequentis, 2017). Accordingly, the Ethiopian Civil Aviation Authority, Remotely Piloted Aircraft System (RPAS) regulation has been validated on the workshops with stakeholders; the workshops concluded to prepare directives, rules, and handbooks consecutively after the promulgation of the draft. It is known that ECAA has been rigorously working over RPAS for the past six years following the increasing demand of drone technology for various purposes which posed safety and security issues, it is learned ([www.ecaa.gov.et](http://www.ecaa.gov.et), 2019).

The Ethiopian Civil Aviation Authority (ECAA) director-general Wossenyeleh Hunegnaw (Col.) briefed on February 02, 2018, Ethiopian reporter newspaper and said that there are have been an increased drone activity in the country. ECAA is the sole government organ mandated by law to license any flying object. Ethiopia like many other countries has not yet introduced a drone rules and regulations. However, individuals and businesses are importing and operating drones without the knowledge and consent of the authority (Ethiopian reporter, 2018).

In Addis Ababa peoples are currently using this technology as, entrepreneurs, video makers, film makers, video producers, TV stations, and so on. Due its tremendous benefits and small startup costs, drones are becoming common in marketing, movies, music video, and events like weddings, great run, football (in stadiums) etc. it also supports law enforcement activities.

However; besides its benefits commercial drones operation might create a threat to the society and government activities. Drone operation might violate personal and public privacy, it might crash on individuals, private & public property, critical infrastructures; further commercial drones may use for criminal activities.

So, in this research, the opportunities and threats currently created by operating/utilizing commercial drones are assessed.

### **1.3 Basic Research Questions**

#### **I. Opportunity Basic Research Questions**

- Has drone improved the business practices in Addis Ababa, Ethiopia?
- Does drone enhance the entertainment industries in Addis Ababa, Ethiopia?
- Has drone eased the work of law enforcement activity in Addis Ababa, Ethiopia?

#### **II. Threat Basic Research Questions**

- Does commercial drone operation pose threat to privacy in Addis Ababa, Ethiopia?
- Does commercial drone operation pose threat to government activities in Addis Ababa, Ethiopia?
- Does commercial drone operation pose threat to cyber security in Addis Ababa, Ethiopia?

### **1.4 General Objective of the Study**

- To assess the impact of commercial drone operations in Addis Ababa, Ethiopia.

### **1.5 Specific Objective of the Study**

Specifically, this study is designed to assess the opportunities & threats of commercial drone operations and the specific objectives are present on opportunity and threat categories:

#### **I. Opportunity Assessment objectives**

- To investigate if imported drones create an opportunity to improve the business activities of Addis Ababa, Ethiopia?
- To explore if imported drones create an opportunity to enhance the entertainment industry in Addis Ababa, Ethiopia?
- To explore if imported drone ease the work of law enforcement in Addis Ababa, Ethiopia?

## II. Threat Assessment objectives

- To investigate if imported drones pose a threat to privacy in Addis Ababa, Ethiopia?
- To investigate if imported drones pose a threat to government activities in Addis Ababa, Ethiopia?
- To investigate if imported drones pose a threat to cyber security in Addis Ababa, Ethiopia?

### 1.7 Significance of the Study

Wossenyeleh Hunegnaw (Col.) who is the director-general of ECAA said: *“that there has been an increased drone activity in the country”* (Ethiopian Reporter, 2018). In Addis Ababa commercial drones are emerged and becoming adopted mostly for audio-visual production industries. The advent of new and emerging technologies has broad economic, social, and personal impacts (W.E. Bijker, J. Law, 1992). Most commonly, they influence practice, the way we do things, perform tasks, achieve goals, etc., while creating new capabilities and possibilities for action (H. Mackay, G. Gillespie, 1992).

Various types of video produced in Ethiopia which is broadcasted via satellite-based local TV stations and shared on various social media & online video platforms has drone based video footages. The video types includes advertisement, music video, movies, documentaries, rallies and events like great run, wedding, etc.

Addis Fortune newspaper staff Writer Genet Assmamaw also published an analysis report by interviewing local entrepreneurs, TV stations, video producers, and ECAA which then concluded that “; *“the unregulated business of drone technology has blossomed in Ethiopia, particularly in the capital. Drones, unmanned aerial vehicle systems, with mounted cameras, have become popular features of film, video, photography and television productions; recording of public events, rallies and private events like weddings; documenting landscapes and cityscapes”* (Fortune, 2018)

The live streaming video of Great Ethiopian Run 2019 via Fana Television, showed us the beautiful aerial view of Addis Ababa, the diplomatic capital of Africa; however, on this live broadcasted video, the drone was flown near by the national palace fences.

Under the literature review, this research illustrates the possible threats posed by commercial drones as well as it will greatly elaborate the opportunities created by commercial drones with its direction of retaining the benefits effectively and efficiently while understanding and minimizing the potential threats.

This research will describe the detail of opportunities and threats currently happening in Addis Ababa. The findings, discussions, conclusion, and recommendation will be an input for regulation under formulation and help to create awareness for all commercial drone stakeholders like Ethiopian aviation authority, commercial drone platform service providers, commercial drone-based entrepreneurs', decision-makers, law enforcement bodies and the general public.

### **1.8 Scope of the Study**

The scope of the study is limited geographically in Addis Ababa. The target populations are government bodies such as the ministry of peace, ECAA, & Addis Ababa police, and drone-based entrepreneurs, & commercial drone operators. Researches regarding drone based techno-societal studies are rare; specifically on commercial drones are an infant. Therefore this research will be carried out by using scholarly and non-scholarly articles, news, governmental and non-governmental reports.

### **1.9 Limitations of the Study**

Due to drone-based operations of rules and regulations are under formulation there might be some possibilities not to get adequate information from those who are either getting benefits or posed a threat from drone operation. So hard effort is carried out to convince and to get the

required information from drone owners and operators, either they are in a personal or organizational level.

Due to its variety of participants and the coronavirus outbreak, questionnaire distribution and the re-collection process were very difficult. But participants understand how difficult it was, and helped me a lot to move on such kinds of environment; most of the written questionnaires were recollected back via email and social communication platforms mostly by telegram.

This research did not address the opportunity created on the tourism sector, due to commercial drone operation. Some tour operators and ministry of tourism owned commercial drones according to the data from INSA. But this is a big topic and should be studied separately.

This research is aimed to describe the opportunities and threats created by operating commercial drones in Addis Ababa, Ethiopia.

### **1.10 Operational Definition**

Commercial drones opportunity is assessed from the bottom of how the government is created the playground and how are drone operation stakeholders benefiting from the technology. The opportunity is measured from how much the commercial drone operation is improved the business practices, enhance the entertainment industries, and ease the law enforcement activity in AA.

Commercial drone threat is assessed by questioning how the government operation affected by drone operation in AA, the tendency of its threat to the manned aircraft, threat posed to personal & public privacy, threat posed to government activities and cyber security in AA.

## **1.11 Organization of the Study**

This thesis contains five chapters; as chapter one of introduction included sub topics like background of the study, statement of the problem, research questions, research objective, and significance of the study, scope of the study, operational definition and organization of the study. Chapter two comprises the different theoretical & empirical literature reviews and conceptual framework; chapter three methods of the research which accounts issue such as the research approach, research design, sources and types of data, procedures of data collection, target population, sample size and sampling techniques, instruments of data collection and data analysis techniques. Chapter four data presentation, analysis and interpretation of the study elaborated; finally, summary of findings, conclusions, and recommendations of the research are identified.

## CHAPTER TWO

### LITERATURE REVIEW

This chapter mainly reviews literature concerned with threat and opportunities created due to commercial drone operation. The main body of the content is theoretical review, empirical review and conceptual frame of the research is described.

#### 2.1 Theoretical Review

Either drone is banned or allowed to operate by law; drones have threats and create business opportunities as every technology does. In this section, the opportunities and threats will be elaborated based on the information gathered from literature, news, and industry reports.

Recently drones have made headlines in the global news, quite often. In late 2016, Amazon's first drone delivery was highlighted to mark "a milestone in the race to use unmanned vehicles to transform how customers buy and receive goods" (Levin & Soper, 2016). But, in some cases, drones have made negative headlines (Forrest, 2015), either because they crashed in a notorious place (like the White House or a hot spring in Yellowstone National Park) or because they have been used in restricted spaces like airports or sports stadiums. (Giones F. and Brem A. ,2017)

12 March 2019 the European Commission adopts common EU wide rules setting technical requirements for drones, proposed by European Union Aviation Safety Agency (EASA); by estimating within 20 years, the European drone sector is expected to directly employ more than 100,000 people have an economic impact exceeding €10 billion per year, mainly in services. EASA further proposes design requirements for small drones up to 25kg and do's and un-dos' for safe operation (EASA, 2019).

## **DO**

- Make sure you are adequately insured
- Check your drone before each flight
- Make sure the electronic identification and geo-awareness system of your drone is up-to-date
- Before each flight, check the limitations of the area where you want to operate, defined by the National Authority of that country, and respect them
- Familiarize yourself with the area where you want to operate your drone
- Check the weather conditions
- Keep the drone in sight at all times
- Maintain a safe distance between the drone and people, animals and other aircraft
- Operate your drone within the performance limitations defined in the instructions provided by the manufacturer.
- Inform your national aviation authority immediately if your drone is involved in an accident that results in a serious or fatal injury to a person, or that affects a manned aircraft.

## **Don Not**

- Do not make changes to the drone, unless approved by the manufacturer
- Do not fly higher than 120 m from the ground (Unless otherwise stated by the Competent Authority of the area where you want to operate )
- Do not fly near manned aircraft
- Do not fly in the proximity of airports, helipads, areas affecting public safety or where an emergency response effort is ongoing
- Do not fly over sensitive or protected sites (prisons, military bases, power plants, etc.)
- Do not use the drone to carry dangerous goods



- Do not fly over large groups of people
- When flying over other people's property, do not fly less than 20 m above the property without their permission
- Do not take photographs, videos, or sound recordings of people without their permission. Respect people's privacy

### **2.1.1 Trends of Drones in Commercial Applications**

According to the research of Single European Sky Air Traffic Management (ATM) Research (SESAR, 2016) with collaboration European Union (EU) and European Organisation for the Safety of Air Navigation (EUROCONTROL) predicts and outweigh drone benefits till 2050 in Eurozone, the information is also illustrated below.

The use of drones in many sectors creates significant benefits that should be pursued, in which the growing drone marketplace shows significant potential, with European demand suggestive of valuation over EURO (EUR) 10 billion annually, in nominal terms, by 2035 and over EUR 15 billion annually by 2050. The impact of civil missions by (either for governments or for commercial businesses) is expected to generate the majority of this value as related services are anticipated to represent more than EUR 5 billion of annual value by 2035, highlighting their importance within the marketplace.

The area of filming was among the first commercial applications and uses in imaging have rapidly expanded for mapping, surveying, and inspections. Among the numerous applications being discussed in the media are:

- Inspecting industrial infrastructure, such as flare stacks of an oil refinery, to limit expensive shutdowns and avoid placing personnel in hazardous conditions

- Patrolling of pipeline, electricity power-lines and railways to detect physical abnormal activity like encroachment or intrusion
- Mapping and surveying of mining and construction sites to perform tasks such as stock pile management, pre- & post-blast data collection and vegetation change tracking
- Analyzing crop health and conducting a topographic survey to support agriculture
- Delivering emergency medical supplies such as defibrillators for cardiac arrest
- Transferring real time data from fire and emergency scenes to fire-fighter and police forces on the ground in order to assess danger and locate the at-risk person

The other main sectors, defence, and leisure, will continue contributing to this marketplace and remain the largest sources of value in the near-term. Both together represent nearly EUR 2 billion in annual product-related turnover in Europe over the long term. The development of the civil drone industry is dependent on the ability of drones to operate in various areas of the airspace, especially at very low levels that today are generally defined as being below 150 meters. In aggregate, some 7 million consumer leisure drones are expected to be operating across Europe and a fleet of four hundred thousands (400,000) is expected to be used for commercial and government missions in 2050. Commercial and professional users are expected to demand drones in both rural and urban settings and will be reliant on beyond visual line of sight capabilities to be permitted. Examples of some of the most influential missions, in terms of the potential number of drones and economic impact, include the following:

- Agriculture sector where over 100,000 drones are forecasted to enable precision agriculture to help drive increased levels of productivity that are required

- Energy sector where close to 10,000 drones limit the risk of personnel and infrastructure by performing preventative maintenance inspections
- Delivery purposes where there is potential for a fleet of nearly 100,000 drones to provide society with some kind of urgent service capabilities, such as transporting emergency medical supplies, and “premium” deliveries
- Public safety and security where a forecasted fleet of approximately 50,000 drones would provide authorities like police and fire forces the means to more efficiently and effectively locate endangered citizens and assess hazards as they carry out civil protection and humanitarian missions.

### **2.1.2 Commercial Drone Operation in In Addis Ababa**

According to Fortune staff writer Genet Assmamaw stated on newspaper “*Drone imagery has become a popular vehicle in movie and video productions, for television stations and in documenting occasions such as weddings and rallies*” (Fortune, 2018).

On various social media platforms and local based websites drones are available for sale as well as for rental business. However; besides the advertisement there are no written documents or literatures where the opportunities created by commercial drone operation.

## **2.2 Empirical Review**

The empirical review explores both the opportunities and threats created due to commercial drone operation.

### 2.2.1 Opportunities

The main opportunities created due drone operation, listed and discussed below are: entrepreneurial sector, surveillance and inspection, aerial photography, law enforcement and as a tool during national emergency response.

**The Global Entrepreneurial Opportunity:** Worldwide commercial drones are becoming a new booming entrepreneurial business sector. According to financial times (2018) analysts, “the global commercial drone market will grow tenfold from \$4bn last year (2018) to \$40bn in five years.” Those analysts at Barclays estimated the use of drones will result in cost savings of some \$100bn.” However, those drones come up with potential threats that vary from, personal privacy to national level.

The global expenditure on commercial drones in 2014 stood at \$700 million, with DJI being the market leader, followed by Parrot and 3DRobotics (V. Klochkov, A. Nikitova, 2008). It has been predicted that the market for drones is expected to increase to \$1 billion by 2018, and \$1.7 billion by 2015 (S. O'Brien (<http://money.cnn.com>), 2008). Besides, a fast-growing segment is the do it your self (DIY) market, where the sales are primarily in components (V. Klochkov, A. Nikitova, 2008). The market size of drone related services is also predicted to match that of hardware sales within the next three years. The cost of these drones can range from a minimum of \$50 for micro drones and a standard DJI Phantom for \$699, to the high-end Intuitive Aerial Aerigon that costs up to \$250,000 and is used to shoot high-resolution videos for film production (S. O'Brien (<http://money.cnn.com>), 2008).

Sophia (2017) on her work of commercial drones explains the commercial drones applications and their impacts. In this paper, the opportunities are mainly categorized into four sections; delivery & logistics, entertainment, filmmaking & journalism, and farming. According to Berger and Siuru drones are now used commercially in our society for mapmaking, advertising, delivery, law enforcement, environmental studies, lifting heavy power lines, and agriculture

(Berger, 2014; Siuru, 2015). This wide price-range represents the diversity of capabilities in commercially available drones, and in the following segment, we will take a look at the most common applications.

**Surveillance and Inspection:** In the commercial space, drones are viewed as platforms for sensors of any kind, and they have been used primarily for surveillance and inspection (V. Klochkov, A. Nikitova, (2008)). Today, drones are being used to survey crops, in search and rescue operations, to count wildlife and keep track of animal population, in land surveying, to survey forest fires, and to inspect oil pipelines, power lines and other remote infrastructure (R.L. Finn, D. Wright, 2012). Their ability to carry heavy equipment has been leveraged for spraying crops in large farms and delivering food, medical supplies, and drugs to inaccessible locations (L.R. Newcome, (2012)).

Also, UAVs can be used by the police and other agencies to gather crucial information in dangerous situations with less manpower and money (Jeremy S., 2014); drones were used by the police 372 times across Northern Ireland since 2013. The paper explains the reasons for using drones in the case of aerial surveillance based on real-case incidents as shown below:

- 1. Traffic Monitoring:** UAVs are being used to monitor traffic and accident scenes, such as the case of their use in the state of Illinois since 2015, and in India including Kanpur city (Rosenfeld A., 2019).
- 2. Tracking Escapees:** UAVs were used to monitor escapees from crime scenes and prisons. A prime example of that is when in 2016 the Ohio police department managed to track down an escaped inmate using a drone, which led to his arrest. In 2010, the UK police managed to capture a car thief in the city of Merseyside. In 2011, a Predator drone was used to assist in the arrest of a suspect in North Dakota (Michael P. 2014).
- 3. Forensics Search & Rescue:** UAVs were used in solving crimes incidents such as the case of Ms. Tara Grinstead 2005 murder, where a fixed wing drone, called Spectra, was used by the Irwin County Sheriff's Office in Georgia, while another drone was used by

the specialist Gene Robinson to cover large areas in search of her whereabouts. The case was not solved until February 2017, when one of her students confessed to her murder to the Georgia Bureau of Investigations (GBI)( Maia H.,2018).

- 4. Anti-Rioting:** UAVs saw recent use in counter-protest efforts, as part of crowd control tactic used by Israel towards Palestinians (Michaeli S. B'tselem, 2015). and the Indian police considered using drones armed with pepper-spray (Porter A.A., 2016).

**Aerial Photography:** The most common application for consumer and hobbyist drones is aerial photography. Consumer drones are currently available with in-built cameras or modular arrangements allowing the installation of lightweight devices (V. Klochkov, A. Nikitova, 2008). Under current United States Federal Aviation Administration (FAA) regulations, they also can fly only up to 400 feet and typically require to be controlled in real time by a human pilot during takeoff and landing, as well as monitoring unexpected obstacles (L.R. Newcome, (2012). However, even with these restrictions, they offer an astonishingly wide range of applications, offering solutions to different segments of the market. Though the regulation specifies that drones in domestic airspace can only be flown within line of sight, remote flying is currently possible by using on-board cameras to stream live video and sensor feedback to smartphones, laptops, or in-built screens on controllers (R.L. Finn, D. Wright, 2012).

Drone technology is disrupting industries from infrastructure to media to delivery and mining. Drones are boosting crop yields, verifying insurance claims, and helping photographers as well as filmmakers in productions in a business that's due to boom by more than 6,000 percent by 2020. This drone technology is making waves in the Media & entertainment industry. In this media & entertainment industry, the purpose of drones is not to advance science or technology, but instead to enhance performance (DRONITECH, 2019).

According to US based United Rotorcraft (2018) company; drones can go places that no other devices can, and in ways that even the most sophisticated photography equipment simply can't match. From 200 feet up in the air, a rock-solid steady shot can be filmed by a drone, which is

something that simply couldn't be done until very recently. The only thing even close to that would have been a helicopter shot, and helicopters are so big and bulky that they simply can't get into all the places that drones can, nor can they fly as low.

Drones can also be programmed to film high-speed chases, following the subjects through busy streets, mountainous highways, or any other setting which might be difficult using another approach. The kind of fluid, gliding sequences that drones can film, allows filmmakers to really expand the creative boundaries of the profession, creating scenes that until now could only be imagined.

Instead of having to rent out expensive cranes or pay for high-cost helicopter rentals, a production crew can now use a relatively low-cost drone to capture a higher-quality shot on film and save a ton of money in the process. With no dropoff in high definition quality, the cost for renting a very capable drone might only be 25% of the cost of renting other more expensive equipment, and the resulting film would not be as good.

Drone technology has made aerial photography much more accessible and affordable. Almost all production sets are bound to have a drone and drone photographer handy. These days, drone pilots manage to capture dramatic and cinematic views that could never have been imagined in the movie industry years ago. Additionally, drones gather footage otherwise inaccessible by on-ground camera sets (SkyWatch, 2020).

High demand for drones has recently developed in a slightly unexpected market—the entertainment industry. In the entertainment industry, the purpose of drones is not to advance science or technology, but instead to enhance performance. This new use of drones has taken aerial photography and videography to new heights, allowing even amateur photographers to produce photos and videos that would have been unfathomable just a few years ago. Hollywood has also capitalized on the drone craze. The opening motorcycle sequence of the recent James

Bond film “Skyfall” was filmed by a drone. A drone was also used to capture the frenetic energy of a party scene in “The Wolf of Wall Street” (Jessica G. 2018).

In a very short period of time, drone technology is changing the way movie makers operate, and it is literally changing how Hollywood, the Mecca of movie-making, produces films for public consumption. Perhaps more than any other technological development of the past decade or two, the aerial photography provided by drone technology is having a massive impact on the way movies are made, on how much they cost to produce, and about who can afford to make high-quality movies these days.

In the media industry, drones are becoming popular among production companies for filming shots that require action sequences, literal birds-eye views, dramatic panoramas or 360-degree views of subjects. This modern drone technology is the gateway to developing media business or career to take it to the next level. Drone aerial photography is a simple & cost effective way for photography or cinematography businesses (DRONITECH, 2019).

**Law Enforcement:** Law enforcement can use drones for various purposes; in hostage negotiation, bomb investigation, missing persons, criminal pursuit, drug interdiction, active shooting scenarios, crime scene analysis, and border protection. Drones also help in counterterrorism efforts and can play a role in traffic control by monitoring drivers breaking traffic laws (Lord Richard, September 2017).

The application of drones equipped with optical, zoom, and/or thermal cameras allow law enforcement agents to monitor unfolding crime scenes more accurately and at a safer distance. A quickly deployable camera drone allows officials to have a better vantage point during times of chaotic situations where deploying ground personnel are too risky. Aerial vantage points also allow post-accident scenes or crime scenes to be fully documented and reconstructed to help understand the timeline of events for each incident. The reliance only on ground assets to



respond to emergency events increases threats to the safety of the community and emergency personnel and decreases the efficiency and effectiveness of the emergency response. Drones for public safety act as a force multiplier and cost a fraction of what manned helicopters require. In response to active shooters, IEDs, or armed hostage situations the small UAS can observe threats from a safe vantage point allowing law enforcement on the scene to operate with greater safety (www.dronefly.com, n.d.)

Drones are used to track down suspects using the aerial bird watch view. This proved to be cheaper and more maneuverable than a helicopter. In fact, drones will soon have the ability to contain thermal, motion, and night vision detection, which can be used to track down suspects at any time of the day. Furthermore, drones can be used to enhance traffic efficiency by offering quick response and identification of road conditions. This helps in avoiding traffic congestion, and in responding to a traffic accident or emergency. Moreover, these drones can be used for surveillance purposes, with the ability to detect suspicious targets hidden within public domains, which proved to be more flexible than fixed cameras. The reason is due to their capability in identifying and recognizing suspects from their height, size, and facial recognition, and thus, making it very difficult for suspects to hide in public (Johnson L.K., Dorn A.W., Webb S., Kreps S., Krieger W., Schwarz E., Shpiro S., Walsh P.F., Wirtz J.J., May 09, 2017).

In fact, according to BBC News, the UK prison service and the police are investing their resources to stop drone pilots from flying drugs, mobile phones, blades, knives, Subscriber Identity Module (SIM) cards, Universal Serial Bus (USBs) etc. into prisons (Johnson L.K., Dorn A.W., Webb S., Kreps S., Krieger W., Schwarz E., Shpiro S., Walsh P.F., Wirtz J.J., (2017). These drones were being flown over walls and physical barriers. As a result, reports revealed that almost £ 3m may possibly be spent on the newly assigned task force to overcome this problem.

Both the remote sensing and force application capabilities of UAVs are potentially of use to law enforcement. Remote sensing could be used to identify and capture evidence of crimes, to search for and track suspects and to direct human officers to those requiring assistance. The application

of force by UAVs offers a rapid response capability; it allows the use of tactics not possible solely by human officers and may allow human officers to remain out of harm's way during a force application scenario with an armed adversary (Jeremy Straub, December 2013).

**As a Tool during National Emergency Response:** Together with agricultural technology think tanks, DJI has been working to fight the corona COVID-19 outbreak. DJI also adapted our Agras series of agricultural spraying drones to spray disinfectant in potentially affected areas. Drones can dramatically improve how China attempts to kill the corona COVID-19 virus in public areas: They can cover far more ground than traditional methods while reducing risk to workers who would otherwise spend more time potentially exposed to both the virus and the disinfectant.

Loudspeakers were also mounted on drones to help disperse public gatherings in crowded places. Drones flew banners advising people how to learn more about precautions. Thermal cameras on drones were also used to monitor body temperature so medical staff can identify new potential cases.

The drone delivery was another popular topic during the corona outbreak in china. The outbreak has kept millions of families in their homes to avoid contact with others. A huge help to these households can come in the form of contactless delivery. Organizations can send food, supplies, and medicine to anyone in need. At the same time, avoiding face-to-face contact will cut the risk of infection (DJI, March 2020).

One country is pioneer in using quadcopters in case of epidemic disaster, we are referring to China respectively. In China quadcopters have already proven their value in monitoring areas in quarantine such as the case of the Wuhan-COVIN19 (80,000 infected cases and 3,000 deaths until 29th February 2020). Using quadcopters, the Chinese government and rescue agencies were able to detect and evaluate areas in quarantine conditions, and other population-dense locations (WHO, 2020).

The effectiveness of quadcopters, drones, smart platforms, and large drones in case of massive epidemic contagious diseases highly depend on the perfect balance between the technology development of software and hardware together with a professional training for future pilots (human capital) to generate efficient and effective missions in different stages such as (i) the aerial monitoring post-massive epidemic contagious diseases spread impact; (ii) the channels of distribution or logistic, light cargo, and fast suppliers' for quadcopters, drones, smart platforms, and large drones systems; (iii) the post-aerial evaluation of massive epidemic contagious diseases (Mario Arturo, Ruiz Estrada, March 2020).

### **2.2.2 Threats**

The main threats created due drone operation, listed and discussed below are: operational threat, payload threat, and weaponized threat.

#### **I. Operational Threat**

**Nuisance:** the most benign illicit use of Unmanned Aerial System (UAS) platforms is the interference they create for the general public. Such actions represent any interference with a property owner's rights to use and enjoy their property without substantial or unreasonable interference (Soloman, 2014).

**Monitoring Threat:** One of the most notable concerns about UAS platforms stems from their potential to silently monitor and record their surroundings.

The society is highly concerned about the privacy invasion issues that might arise from consumer drones. Individuals may use drones to spy on their and cameras, news organizations would expand in drones' adoption for news gathering (**Culver, 2014**).

**Surveillance:** UAS platforms, however, change the dynamic of aerial surveillance, making it accessible and affordable for almost anyone. With the availability of highly automated UAS hobby platforms such as the DJI Phantom, one can purchase a relatively sophisticated aerial monitoring platform with high-resolution capability. Newswire stories of such privacy intrusions by UAS platforms are becoming more commonplace. In August 2015, a Hawaii resident spotted an unmanned rotorcraft hovering outside her bedroom window, yet law enforcement was unable to respond as the action violated no established criminal laws (Kawano, 2015). A similar incident occurred in Kentucky, when a concerned father disabled a drone caught observing his young daughters in their backyard, yet again, police efforts were curtailed since no laws had been broken (Chappell, 2015). Perhaps more frightening is the unknown purpose behind many hobby drone flights. While many operators are merely enjoying their UAS devices, others may have more sinister observation intentions, such as observing young children.

**Reconnaissance:** While similar to surveillance, reconnaissance activities take a further step toward illicit behavior. Often confused with surveillance, reconnaissance is an activity derived from military terminology that involves collecting intelligence on a known "enemy" target. To illustrate, consider the example of a criminal seeking to burglarize a house. Surveillance would be the actions taken to observe various neighborhood properties; whereas, reconnaissance involves scoping out a specific property for exploitable weaknesses, such as security, homeowner arrival and departure times, possible entry locations, and other related "intelligence" information. Unmanned systems have the capability of performing both surveillance and reconnaissance functions. An assessment by the Department of Homeland Security (DHS) indicated drug dealers and drug cartels were already beginning to use UAS platforms to monitor police activities along the U.S. border (Levine, 2015). Moreover, UAS automation allows operators to conduct illicit monitoring activities at a sizable standoff distance, effectively preserving their anonymity from potential criminal investigation. Such illicit monitoring actions allow criminals or terrorists to assess vulnerabilities in critical infrastructure, government sites, businesses, and private citizens alike.

**Airspace Interference:** UAS platforms present a genuine threat to safe airspace utilization. The Federal Aviation Administration (FAA) has logged dozens of reports of near-misses between airliners and UAS platforms being improperly operated near airports across the country. In March 2014, a US Airways regional jet nearly collided with a small UAS near Tallahassee, Florida (Whitlock, 2014). September of the same year, Republic Airlines reported nearly striking a small unmanned craft at 4,000 feet. Also in September 2014, three different airlines inbound to LaGuardia reported successive encounters with a UAS operating along the final approach path (Whitlock, 2014). In addition to interfering with normal aviation operations, unmanned aerial vehicles are impeding emergency response functions. In August 2015, a SkyLife helicopter came within 20 feet of being struck by a small-unmanned platform while transporting a patient (Ybarra, 2015). This incident comes just one month after California aerial firefighting teams encountered five hobbyist-operated UAS craft obscured by smoke near a wildfire operation. Fire crews temporarily suspended aerial fire suppression operations for safety while the law enforcement personnel attempted to remove the drones from the area (Martinez, 2015). An airborne UAS creates a collision threat to aircraft and could adversely impact normal and emergency aviation operations. It is conceivable that terrorists or criminals could employ UAS craft to disrupt drug interdiction, law enforcement, or medical aircraft with the intended purpose of curtailing tracking, emergency response, or disaster mitigation capabilities.

**Kinetic/Kamikaze:** Even without armaments, a drone is capable of causing damage or injury to people or property on the ground or in the air. While many UAS accidents are likely accidental rather than intentional, the risk is the same. In March 2015, a small UAS hobby platform crashed into a Miami home, breaking a window. Since the drone went unclaimed and police were unable to determine the identity of the operator, the property owner had little recourse to recover damages (“Mystery,” 2015). In a more serious event in July 2015, a woman was knocked unconscious by a falling UAS platform after its owner lost control of the device at a Seattle gay pride parade (Rawlinson, 2015). To exemplify the potential kinetic lethality of unmanned vehicles, one can simply turn to a gruesome 2003 event in which 13-year old Tara Lipscombe was struck in the head by an out of control Radio Controlled (RC) aircraft (Allen, 2003). Flying

at 50 Miles per hour (Mph), the 5-foot wide aircraft delivered a lethal blow to the young girl, who died merely three hours after the incident (Allen, 2003). While the aforementioned incidents appear unintentional, they exemplify the lethal potential of UAS systems. Should criminal or terrorist elements wish to carry out an attack, an out-of-the-box UAS platform has the potential to deliver a lethal kinetic blow to soft targets, while having the potential added benefit of appearing as accidental or negligent.

According to the official website of Aviation Herald, a LAM Linhas Aereas de Mocambique Boeing 737-700, registration C9-BAQ performing flight TM-136 from Maputo to Tete (Mozambique) with 80 passengers and 6 crew, was on approach to Tete's runway 19 at about 4000 feet when the crew heard a loud bang, no abnormal indications followed. The crew suspecting a bird strike continued the approach for a safe landing.

A post-flight examination revealed a drone had impacted the right hand side of the radome. The airline confirmed the occurrence stating an external body had impacted the radome, a replacement aircraft was dispatched to Tete to perform the return flight. The occurrence of aircraft is being repaired.

In the region, there are frequently drones weighing around about 10kg/22lbs operated for mining survey. Ground witnesses describe those drones are being operated without regard for the aerodrome and aircraft traffic.

## **II. Payload Threat**

**Smuggling:** UAS platforms can also be exploited as a transportation mechanism for illegal contraband or cargo. The Use of these platforms allows terrorists or criminals to bypass traditional security barriers such as fences, walls, and detection measures. Essentially, drones add a skyward dimension to security considerations. The New York Times reported an incident

occurring in Bishopville, South Carolina at the Lee Correctional Institution where a UAS was spotted by prison officials flying from a wooded area near the prison toward the perimeter of the institution (Schmidt, 2015). A guard reported seeing a man running away from the wooded area. Later prison officials found a package left by the UAS, which contained a cellphone, tobacco, and marijuana. The package had become tangled in the power lines near the prison and the crashed remains of a UAS were located nearby. The director of the South Carolina Department of Corrections stated it appeared to be a delivery system (Schmidt, 2015). A similar incident occurred in Tijuana in April 2015. A hexicopter carrying 7 pounds of methamphetamines operating just two miles from the U.S.-Mexico border crashed into a shopping center parking lot (Davis, 2015). The incident marks a novel approach to drug smuggling that law enforcement officials call an emerging threat (Davis, 2015).

### **III. Weaponized Threat**

Perhaps the most fearsome threat produced by terrorist or criminal entities involves the deliberate construction or modification of UAS systems to carry and employ weapons. This application of UAS platforms has received the bulwark of speculation and even fear mongering among industry experts, but is well-justified considering the relative ease in which a UAS platform can be weaponized to produce devastating results. Wilkinson (2012) explains, "Terrorists have demonstrated repeatedly that their goals and objectives can be accomplished by using the same tactics and 'off-the-shelf' weapons (though cleverly modified or adapted to their needs) that they have traditionally relied upon" (pp. 23). Armaments that can be added to UAS platforms vary widely from jury-rigged incendiary or explosive devices to carefully engineered projectile systems.

**Non-Lethal Systems:** While the use of non-lethal systems are not generally associated with criminal activity, the production of such systems is already underway for law enforcement and security purposes. Mounting a drone with systems capable of firing rubber bullets, tear gas, or taser nodes has several promising applications for law enforcement organizations (Kersey,

2012). In March 2014, the technology company Chaotic Moon successfully armed a UAS with an 80,000-volt Taser and test fired the weapon on a volunteer from the company. Called the Chaotic Unmanned Personal Intercept Drone (CUPID), the experimental device was controlled by a smart phone, with further automated features currently under development (Metro, 2014). It is not unreasonable to speculate that terrorist or criminal elements could foreseeably gain access to such systems through either proliferation or theft.

**Projectile Threats:** While the prospect of UAS platforms carrying firearms or other lethal projectile weapons might seem particularly troubling, the likelihood of such a modification is reasonably low compared to other weaponization efforts. The development of an effective projectile weapon system such as a gun or missile requires highly specialized engineering and fabrication expertise. Without engineering expertise, access to these types of UAS systems is generally limited to a select group of special operations or military organizations. Moreover, such technology generally remains tightly guarded against physical theft or proliferation, making the acquisition of such systems by terrorists or criminal elements extremely improbable. Despite the aforementioned complications, some individuals have self-produced UAS projectile systems that show alarming ingenuity. In June 2015 an 18-year old mechanical engineering student equipped his UAS with a semi-automatic pistol and successfully fired the weapon while his UAS was airborne (Kerley, 2015). Local and federal authorities were investigating the incident to determine if any criminal statutes had been violated.

**IED/Explosive:** The use of drones as a delivery system for improvised explosive devices (IEDs), incendiary devices, or other combustibles remains high. Terrorists in particular have shown great ingenuity in crafting rudimentary explosives. According to Wilkinson (2012), "Relying on unconventional adaptations or modifications to conventional explosive devices, these terrorist organizations have been able to develop innovative and devastatingly effective means to conceal, deliver, and detonate all kinds of bombs" (p. 19). Dolnik (2007) further explains that some terrorist groups are already considering the benefits of a UAS delivery system, "Terrorists in Kashmir have experimented with remote-control model planes and Unmanned Aerial Vehicles



(UAV) to deliver explosives from the air" (p. 45). The 2011 plot by Rezwan Ferdaus to use remote control aircraft to deliver and detonate explosives against the U.S. Capital building and Pentagon show that terrorists already consider UAS platforms as a viable method of weapon delivery (Model, 2011).

**Weapons of Mass Destruction (WMD):** Weapons of mass destruction represent particularly lethal threats stemming from the use of hazardous materials including Chemical, Biological, Radiological, and Nuclear (CBRN) substances. The use of UAS platforms as a delivery system for Chemical, Biological, Radiological, and Nuclear (CBRN) substances are particularly troublesome, as such delivery systems could easily bypass traditional security measures. Moreover, such systems can effectively cause mass casualties without the need for precision flying. A drone could merely over-fly the target area where a CBRN substance could be deployed in aerosol form or a dispensing mechanism dropped from the craft. One such plot by the al-Qaeda terrorist organization was foiled in 2013 by Iraqi military intelligence personnel ("Iraq," 2013). The organization planned to employ remote control aircraft to release chemicals including sarin gas, mustard gas, and chlorine bombs ("Iraq," 2013). According to U.S. officials, these substances were selected to enhance the lethality of the planned attack ("Iraq," 2013).

Conversely, some experts argue that CBRN substances are less likely to be used by terrorist organizations. Davis et al. (2014) note that WMD substances are less than ideal for terrorist use, as they are difficult to weaponize and generally produce fewer casualties than traditional explosives. Davis et al. (2014) further explain that radiological or nuclear substances in a particular pose as much threat to terrorists as the general public and that the prolonged exposure required weaponizing a radiological threat would likely be fatal to the instigator. Nevertheless, the 2015 incident in which a drone landed on the roof of the Japanese Prime Minister's office emphasizes the reality of such threats. The canister carried by the drone was believed to contain a radioactive Cesium compound ("Drone laced," 2015).

**Cyber Security Threat:** A particularly novel threat presented by drones is the potential to use them as platforms to commit an electronic attack or electronic theft. The Sense Post "Snoopy" UAV can be equipped to digitally hijack a smartphone's wireless signal and gain access to personal information contained on the device (Gittleston, 2014). Snoopy developer Glenn Wilkerson alludes that any Wi-Fi-enabled device is vulnerable to the Snoopy system. He further describes how the Snoopy system can impersonate a Wi-Fi trusted network and even exploit the phone's unique Media Access Control (MAC) address to track its location (Gittleston, 2014). Wilkerson goes on to explain that the mobility of the device allows it to bypass traditional security measures and simultaneously maintain stealth (Gittleston, 2014). The device bears a striking similarity to the Stingray phone tracking system, with substantially enhanced capabilities. It is conceivable that such technology would be highly sought-after by intelligence agencies and law enforcement entities and could be easily adapted by unscrupulous elements to be used for identity theft, blackmail, corporate espionage, or any number of other illicit activities.

The main security risk from drones is still their ability to bypass traditional physical controls by breaching fences or accessing the top floor of a building. Equipment is now available to hack drones so they can bypass technology controls. Low cost and easy to use, drones can deliver a payload to carry out surveillance, to capture data, or to disrupt networks. Making matters worse, drones are hard to detect and defeat Organizations should conduct threat-modeling exercises to identify and understand the potential threats (Stephen Pritchard, 2019).

## **CHAPTER THREE**

### **RESEARCH DESIGN AND METHODOLOGY**

#### **3.1 Research Approach**

This research employed qualitative methods of approach which aim to describe the opportunities created and threats posed by commercial drone operation in the city of Addis Ababa, Ethiopia.

#### **3.2 Research Design**

To assess the opportunities created and threats created by commercial drone operation in Addis Ababa, this research applied a descriptive research design. The data for this assessment is included major stakeholders of drone operation that will help to significantly contribute to these research objectives.

First, the research explored the legal framework on which how the drone operations are managed by the respective body of ECAA and examine the threats posed to manned commercial planes. Then cyber security threat, the threat to security facilities, and critical infrastructure issues are also raised to INSA.

Then, the same interview question is applied for Addis Ababa & Ethiopian federal police. The questionnaire illustrates how the commercial drone is making easy the law enforcement activities and the threats posed by commercial drones like privacy (personal and public), criminal activity, and smuggling and any damage/accident caused and threats posed to critical infrastructures, government security facilities, and protected sites by operating commercial drones.

Finally, entertainment and business sector are addressed to explore how the commercial drone operation made ease the business activities (entrepreneurs and marketers) and enhance the entertainment industry (filmmakers, producers, and TV stations).

### **3.3 Sources and Types of Data**

Primary data is collected from government, non-government, and individuals: whereas an interview data from Ethiopian Civil Aviation Authority (ECAA), Federal Police, Addis Ababa Police, INSA and five scale Likert data from Addis Ababa based TV broadcasters, video producers, filmmakers, marketers, and entrepreneurs.

As a secondary data government documents, reports, firm documents, research papers, reputable website analysis & reports are assessed.

### **3.4 Procedures of Data Collection**

First, a pilot test was made for 10 participants of each category in entrepreneurs, marketer's filmmakers, video producers and for 5 TV stations are employed, to check the reliability of the questionnaires designed and prepared. As stated in the data sources above, the written questionnaires of the primary data were collected; side by side, primary data was also gathered using interviews from governmental bodies ECAA, INSA, Addis Ababa police, and federal police. On the other hand secondary data collected from INSA regarding the imported commercial drones in AA, documents from entrepreneurs, TV stations, marketers and filmmakers are utilized.

### **3.5 Target Population**

The target populations are Ethiopian civil aviation authority (ECAA), the ministry of peace, Addis Ababa Police, Addis Ababa based TV broadcasters, video producers, filmmakers,

marketers, and entrepreneurs have participated in this study. Selected participants from ministry of peace are federal police and INSA.

### **3.6 Sample Size and Sampling Techniques**

Ethiopian civil aviation authority (ECAA), federal police, INSA, Addis Ababa Police are the major stakeholders that are participants from government bodies.

There are twenty-two (22) Addis Ababa based TV broadcasting companies based on the collected data from the official website of Ethiopian Broadcasting Authority (<http://www.eba.gov.et>, 2010): AA based TV broadcasting companies are listed as follows: Afri-Health TV, Ahadu TV, Arts TV, Asham TV, Balageru TV, Bisrat TV, EBS TV, ESAT TV, Ethiopian TV, Fana TV, J TV, Kana TV, L TV, Nahoo TV, OMN TV, ONN TV, RON TV, TV 9, Walta TV, Ethiopian Orthodox TV, Mahebere Kidusan TV, Ethiopian & Evangelical TV; written questionnaire is designed and distributed for all AA based TV stations.

Drones are imported with joint collaboration of ministry of revenue & INSA's registration process; all imported drones are registered with the purpose of drone and end-user address. There are also drone sellers and renters in AA. Mostly for warranty issues personal addresses of drone buyers are registered by sellers. Drone renters also register addresses of their customers. Those three collected documents helped me to reach drone based entrepreneurs, marketers, video producers, and filmmakers. And also from the official website of Ethiopian filmmakers' association ([www.iefta.org](http://www.iefta.org), 2020) forty six (46) video production companies and thirty seven (37) film makers are identified.

Through the above process; sixty-five (65) drone based entrepreneurs, forty five marketers (45) forty-six (46) video producers, and fifty-seven (57) filmmakers, those who utilize commercial drones are identified.

Totally; two hundred and thirty nine (239) participants are identified. Since each category of participants has a small population size, the researcher has used census methods to consult respondents.

### **3.7 Instruments of Data Collection**

Two sets of methods are used for data collection purpose: an interview and a written questionnaire. Both the interview and written questionnaires are carried out at organization level. For government institutions; ECAA, INSA, Addis Ababa police, and federal police interview questions are designed and applied.

For drone based entrepreneurs, marketers, TV stations, video producers, and filmmakers; five scale Likert written questionnaires are used as study tool for data collection. Total two hundred and thirty five (235) close-end questionnaire is prepared and distributed by a person for each category of participants.

### **3.8 Data Analysis Techniques**

More specifically, the analysis of qualitative data will have their own procedures recommend by Creswell (2003).

1. Data are reads a number of times to identify points that are significant for the study
2. Thematic contents are formulate based on the major research questions
3. Emerging theme titles are list out on a separate sheet in to find connection between them.
4. A master list of themes was produce and order coherently
5. Sub-themes, which go with each master theme, are identified
6. The relevant information is organize under each theme and will be analyzed.

After having the above information; the analysis technique used in this study is averaging likert responses for each separate question using SPSS software version 24.0; after calculating the mean of each likert scale the grand mean were calculated. The value of number '5' is equal to 'strongly agree'; the number '4' is equal to 'agree'; the number '3' is equal to 'neutral; the number '2' is equal to disagree; and the number '1' is equal to strongly disagree (Bryman and Bell, 2011).

Those data from TV stations, video producers, filmmakers, marketers, and entrepreneurs, which is only to assess the opportunity created because of operating commercial drones. The analyses are made as a mean for each questionnaire separately for each participant. These separate analyses would help to explore the opportunities on detail with their own independently prepared data.

The interviewed information from ECAA, AA police and Ethiopian federal has two-part; opportunity and threat assessment, where the information from INSA was threat only. The collected information is analysed, synthesized, organized and prepared to elaborate the opportunity created and threat posed by operating commercial drones in AA.

After analyzing the data & information gathered; through appropriate interpretation, findings are summarized based on the major findings, conclusions drawn and finally, possible recommendations are forwarded.

## **CHAPTER FOUR**

### **DATA PRESENTATION, ANALYSIS AND INTERPRETATION**

This chapter presents the data presentation, analysis, and interpretation of the collected data; it is organized in the order of answering each research questions with the category of opportunities and threats created by commercial drone operation.

The sample size of 239 was determined, collected, and investigated among which 235 were written questionnaires from Addis Ababa based TV broadcasters, video producers, filmmakers, marketers, and entrepreneurs. Four of them were interviewed data from ECAA, INSA, federal police and Addis Ababa police which were interviewed by a person. While Out the rest of 235 questionnaires distributed and 191 (81.27%) were filled and collected back; a 100% were responded.

Out of 22 TV stations 17 (77.27%); out of 65 drone based entrepreneurs 56 (86.15%), out of 45 marketers 36 (80%), out of 46 video producers 31 (67.39%), and out of 57 filmmakers 51(89.47%) were fully responded.

#### **4.1 Data Presentation**

The interviewed data which is collected from the main stakeholders of government bodies are; ECAA, INSA, Federal Police, and Addis Ababa Police. The data from those four institutions are presented as institutions. And also the data from entrepreneurs, filmmakers, marketers, video producers, and TV stations is collected individually and analyzed separately.

The data presentation is organized according to the list of the research questions category of opportunities and threats.



#### 4.1.2 Opportunities of Commercial Drones

- Has drone improve the Business practices in Addis Ababa, Ethiopia?
- Does drone enhance the entertainment industries in Addis Ababa?
- Has drone ease the work of law enforcement in Addis Ababa, Ethiopia?

##### 1. Has drone improve the Business practices in Addis Ababa, Ethiopia?

To analyze how the commercial drone operation is improved the business (entrepreneurs' and marketers) practices in AA, two tables are prepared for data presentation.

<b>Entrepreneurs</b>	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>	<b>Mean</b>
<b>Opportunity Assessment</b>						
Does commercial drone photo/video footages satisfy the need of entertainment industry in Addis Ababa?	30	21	5			<b>4.45</b>
Does commercial drone photo/video footages satisfy the need of marketers/Advertisers in Addis Ababa?		19	37			<b>3.34</b>
Does commercial drone ease aerial photo/video footages in Addis Ababa?	34	22				<b>4.61</b>
Does a commercial drone operation has improved your income?		35	13	8		<b>3.48</b>
Does a commercial drones operation have created temporary job opportunity?	40	16				<b>4.71</b>
Does a commercial drone have created permanent employment opportunity?	31	25				<b>4.55</b>
Does a commercial drone operation is a profitable business?	30	13	5	8		<b>3.89</b>
Does a commercial drone operation pay/contribute income tax to the government?		13	10	30	3	<b>2.54</b>

<b>Grand Mean</b>		<b>3.94</b>
-------------------	--	-------------

Table 1: Drone as an opportunity to improve entrepreneurial activity.

Table 1 describes how drone are improved the entrepreneurial activities in AA. On which on which the entrepreneurs 36.83% strongly agreed, 36.61% agreed, 16.63% neutral, 10.27% disagreed, and 0.67% strongly disagreed for the opportunities of commercial drones. The minimum value is 2.54 which is for commercial drone operation business' income tax to the government, commercial drone photo/video footages satisfy the need of marketers/Advertisers in Addis Ababa is 3.34, commercial drone operation has improved entrepreneurs income is 3.48, and commercial drone operation is a profitable business for entrepreneurs is 3.89 respectively. The rest values are close to 5; whereas the mean is 3.94.

<b>Marketers</b>	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>	<b>Mean</b>
<b>Opportunity Assessment</b>						
Does commercial drone photo/video footages increase the demand of video advertisement works?	15	12	9			<b>4.16</b>
Does commercial drone photo/video footages outweigh an advertisement video work from competitors?	10	20	6			<b>4.11</b>
Does a commercial drone operation have created temporary job opportunities?		30	6			<b>3.83</b>
Does a commercial drone have created permanent employment opportunities?	29	7				<b>4.81</b>
Does a commercial drone operation is a		23	13			<b>3.64</b>

profitable business?						
Does a commercial drone operation pay/contribute income tax (from salary) to the government?	1	27	8			<b>3.81</b>
<b>Grand Mean</b>						<b>4.06</b>

Table 2: Drone as an opportunity to improve marketers activity.

Table 2: describes drones as an opportunity to improve marketers' activities. On which the marketers 25.46% strongly agreed, 55.09% agreed, 19.44% neutral for the opportunities of commercial drones. The minimum values 3.64 for commercial drone operation is a profitable business and followed by its income tax contribution to the government 3.81 and commercial drone operation have created temporary job opportunities 3.84. The rest of the values are greater than the grand mean 4.06.

## 2. Does drone enhance the entertainment industries in Addis Ababa?

The selected participants for entertainment industry that uses drone operation are filmmakers, video producers, TV stations. Three tables are prepared for each participant.

<b>Filmmaker</b>	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>	<b>Mean</b>
<b>Opportunity Assessment</b>						
Does Customers need to have drone footages in video production?	41	5	5			<b>4.71</b>
Does drone photo/video footage add value to the video production?	51					<b>5</b>
Does drone photo and video footage make a	47	4				<b>4.92</b>

significant difference on a value of the video?						
Does drone make it easy to have aerial photo/video footage?	50	1				<b>4.98</b>
Does drone make high quality aerial photo/video with a low cost?	25	19	7			<b>4.35</b>
<b>Grand Mean</b>						<b>4.79</b>

Table 3: Drone as an opportunity to enhance filmmakers' activity.

Table 3: describes how drone are creating an opportunities to enhance the filmmakers' activity. On which the filmmakers 83.92% strongly agreed, 11.37% agreed, 4.71% neutral for the opportunities of commercial drones. Drone's photo/video footage add value to the video production is rated with 5. The minimum value is 4.35 for drones are making high quality aerial photo/video with a low cost. The rest of the values are very very close to 5. The grand mean is 4.79. The overall data indicates drones operation is creating opportunities to enhance filmmaker's activities.

<b>Video Producer</b>	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>	<b>Mean</b>
<b>Opportunity Assessment</b>						
Does Customers need to have drone footage in the video production?	15	14	2			<b>4.42</b>
Does drone photo/video footage add value to video production?	30	1				<b>4.97</b>
Does drone photo and video footage make a significant difference on the value of a	26	5				<b>4.83</b>

video?						
Does drone make it easy to have aerial photo/video footages?	28	3				<b>4.90</b>
Does drone make high quality aerial photo/video with low cost?	17	9	5			<b>4.39</b>
<b>Grand Mean</b>						<b>4.70</b>

Table 4: Drone as an opportunity to enhance video producers' activity.

Table 4: describes how drones are creating opportunities to enhance video producers' activity. On which video producers 74.84% strongly agreed, 20.65% agreed, 4.52% neutral for the opportunities of commercial drones. All the variables are rated 4. The highest value is drones are making have aerial photo/video footages easy. The grand mean is 4.7 which is very close to 5. The overall data indicates drones are creating opportunity to enhance video producers' activity.

<b>TV STATIONS</b>	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>	<b>Mean</b>
<b>Opportunity Assessment</b>						
Does Customers need to have drone footage in video production?	12	5				<b>4.71</b>
Does drone photo/video footage add value to video production?	15	2				<b>4.88</b>
Does drone photo and video footage make a significant difference on the value of a video?	14	3				<b>4.82</b>
Does drone make it easy to have aerial photo/video footage?	14	3				<b>4.82</b>

Does drone make high quality aerial photo/video with low cost?	17					<b>5</b>
<b>Grand Mean</b>						<b>4.85</b>

Table 5: Drone as an opportunity to enhance TV stations' activity.

Table 5 illustrates how drones opportunities are enhanced the TV station activities. On which the TV stations 84.71% strongly agreed and 15.29% agreed for the opportunities of commercial drones. The mean of drone are making high quality aerial photo/video with low cost rated 5. Whereas all the means are very close to strongly agree or 5. The grand mean is 4,85 very very close to 5. Those data indicates drones are enhanced the TV stations' activities so greatly.

### **3. Has drone ease the work of law enforcement in Addis Ababa, Ethiopia?**

To assess the role of commercial drones and how it makes easy the law enforcement activities in AA, the collected data from Addis Ababa police and Ethiopian federal police is presented below.

#### **Interviewed Data from Addis Ababa Police:**

Qn. Does police use commercial drones for law enforcement activities in Addis Ababa?

Ans:

AA police do not use commercial drones for law enforcement activities in AA.

Qn.Does police use commercial drones for law aerial surveillance in Addis Ababa?

Ans:

AA police do not use commercial drones for aerial surveillance in AA.

Qn. Does drone ease aerial surveillance in Addis Ababa?

Ans:

Since AA does not use drone for aerial surveillance, it's difficult to decide but; as a new technology it may ease the surveillance activity.

Qn. Does police uses drones to secure outdoor events of large groups of people?

Ans:

AA police do not use commercial drones to secure outdoor events of large groups of people.

### **Interviewed Data from Federal Police**

Qn. Does Police use commercial drones for law enforcement activities in Addis Ababa?

Ans:

AA police do not use commercial drones for law enforcement activities in AA.

Qn. Does police use commercial drones for law aerial surveillance in Addis Ababa?

Ans:

Federal police carried out aerial surveillance in AA for training and during occasions of international meeting.

Qn. Does drone ease aerial surveillance in Addis Ababa?

Ans:

Federal police also uses manned helicopters for aerial surveillance and comparing it with drones; drones are made easy the aerial surveillance activity much easier than manned helicopter.

Qn. Does police uses drones to secure outdoor events of large groups of people?

Ans:

Federal police uses drones to secure outdoor events like concerts, rallies and street run programs if the groups of people are large.

### **4.1.3 Threats of Commercial Drones**

- Does commercial drone operation pose threat to privacy in Addis Ababa?
- Does commercial drone operation pose threat to government activities in AA?

- Does commercial drone operation pose threat to cyber security in AA?

### 1. Does commercial drone operation pose threat to privacy in Addis Ababa?

To assess a threat posed to privacy due to commercial drone operation in Addis Ababa, the questions were raised to Addis Ababa police and federal police. The data collected from Addis Ababa and federal police are presented on the following descriptions.

#### **Interviewed Data from Addis Ababa Police**

Qn. Do commercial drones fly over large groups of people in AA?

Ans:

Of course drones are fly over on large group in Addis Ababa not only during stadiums programs, rallies, events but also drones fly over places where crowded during rush hour like Megenagna and Mexico.

Qn. Is there any threats posed to public privacy by commercial drones operation in Addis Ababa?

Ans:

Having the video production license just drone operators can fly in AA. However without permission and consultation drones fly over on the public and public properties and takes photo/video footages whenever they want.

Qn. Is there any threats posed to personal privacy by commercial drones operation in Addis Ababa?

Ans:

In order to fly over on AA airspace, drone operators need only to have video production license. After that similar to the public privacy, without permission and consultation of individuals they takes photo/video footages

#### **Interviewed Data from Federal Police**

Qn. Do commercial drones fly over large groups of people in AA?

Ans:



Drones fly over on stadiums, rallies, outdoor events in which mostly it's crowded by large groups of people.

Qn. Is there any threats posed to public privacy by commercial drones operation in Addis Ababa?

Ans:

Since drones fly over on large groups of without limitation in AA, public privacy is not considered. Having the video production license drones fly over on the public and public properties to take photo/video footages.

Qn. Is there any threats posed to personal privacy by commercial drones operation in Addis Ababa?

Ans:

This is a similar scenario regarding the private and public privacy. Drones fly over on and took photo/video footages of individuals randomly.

## **2. Does commercial drone operation pose threat to government activities?**

To assess the threats posed to the government activities due to commercial drone operation is the data were collected from ECAA, INSA, federal police and Addis Ababa Police. The collected data is presented in following descriptions respectively.

### **Interviewed Data from ECAA**

Qn. Does Ethiopian civil aviation authority registered commercial drones with unique electronic identification number?

Ans:

Still now ECAA didn't started to register commercial drones with unique electronic identification number; however, registration mark is given to the imported drones.

Qn. Does a commercial drone fly over on Addis Ababa airspace via the flight permission process of Ethiopian civil aviation authority for an altitude of over 120m?

Ans:

Once they set out the clearance commercial drones did not ask any permission for their activities, including for the altitude above 120 meters, but there is an agreement not to fly with above 120 meters.

Qn. Is there any drone accident happened on planes during take-off in Bole Addis Ababa International Airport?

Ans:

Still now there are no accidents happened on planes. During the importing process we strictly inform them no to fly on restricted including the airport.

Qn. Is there any drone accident happened on planes during landing in Bole Addis Ababa International Airport?

Ans:

Still now there are no accidents happened on planes. During the importing process we strictly inform them no to fly on restricted including the airport.

Qn. Is there any drone collision threat happened on planes during take-off in Bole Addis Ababa International Airport?

Ans:

Still now there are no accidents happened on planes. During the importing process we strictly inform them no to fly on restricted including the airport.

Qn. Is there any drone collision threat happened on planes during landing in Bole Addis Ababa International Airport?

Ans:

There is no collision threat created by commercial drones during landing; because during the importing process we strictly inform them no to fly on restricted including the airport.

Qn. Does a commercial drone create air traffic congestion in Addis Ababa nearby Bole international airport?

Ans:

There are no air traffic congestion created by commercial drones nearby Bole international airport; because during the importing process we strictly inform them no to fly on restricted including the airport.

**Interviewed Data from INSA:**

Qn. Is commercial drone operation creating a threat to sensitive facilities like the national palace and government security facilities by flying over it?

Ans:

Drone are flying over where ever they need and there no rules and regulations to manage it. .

In case of the national palace it's geo fenced and drones can fly over by disabling the global positioning system (GPS) mode.

Qn. Is commercial drone operation creating a threat to government security facilities by flying over it?

Ans:

Drone are flying over where ever they need and there no rules and regulations to manage it. The vulnerability is so high to fly on government security facilities with high altitude for the purpose of they need or it might crash on.

Qn. Is commercial drone operation creating a threat to critical infrastructures like (power stations, railways and its power transmission lines) by flying over it?

Ans:

Now a days drone video footages of the city escapes including the light railway is common in the entertainment industry. Because of this drones are flying over on the train, railways and its power transmission lines. This might cause a huge damage if the drone of crashes.

For the case of power station the threat is nearly zero, but if the drone crash on it might create devastated situation. Power stations need to consider drones as a security threat.

**Interviewed Data from Federal Police:**

Qn. Is there any accidents happened (to public & and private property and individuals) in Addis Ababa due to commercial drone operation?

Ans:

Sometimes drones fall over and crash on individuals and properties. But the damage was not high. Drone pilots some times did not choose areas that suit to take off; they might carelessly move on to take off from the palaces like Mexico and Megenagna areas where the area is densely populated during the rush hour.

Qn. Did criminal activities happen in Addis Ababa via drone operation?

Ans:

Due to drone operation there are no criminal activities happened in AA.

Qn. Do drones fly over on sensitive facilities like government buildings (national palace, ministry of defense) by operating commercial drones Addis Ababa?

Ans:

Rarely it's noticed that drones are fly over on nearby sensitive facilities in AA.

Qn. Do drones fly over on protected site like prison and police stations in Addis Ababa?

Ans:

Rarely filmmakers came to prison centres to have drone footages but they did not fly over it just nearby the prison centres.

Qn. Do drones fly over on key infrastructures (trains and its railway power transmission lines, power stations, telecom infrastructures) by operating commercial drones Addis Ababa?

Ans:

Drone fly over on key infrastructures to take photo/video footages, for the purpose video productions

Qn. Do drone used for smuggling (drugs, guns) activities in to Addis Ababa?

Ans:

In there are no evidence to smuggling are carried via commercial drone operation in AA.

#### **Interviewed Data from Addis Ababa Police:**

Qn. Is there any accidents happened (to public & and private property and individuals) in Addis Ababa due to commercial drone operation?

Ans:

Rarely drones fall over events like concerts where large groups of people gathered but the damage is not viable.

Qn. Did criminal activities happen in Addis Ababa via drone operation?

Ans:

No, there is no criminal activities happened in AA.

Qn. Do drones fly over on sensitive facilities like government buildings (national palace, ministry of defense) by operating commercial drones Addis Ababa?

Ans:

No, but drones fly over on nearby sensitive facilities however it's not common to see commercial drones nearby sensitive facilities.

Qn. Do drones fly over on protected site like prison and police stations in Addis Ababa?

Ans:

It's not noticed that drones are fly over on protected site.

Qn. Do drones fly over on key infrastructures (trains and its railway power transmission lines, power stations, telecom infrastructures) by operating commercial drones Addis Ababa?

Ans:

Drone are fly over on key infrastructures for the entertainment and TV stations.

Qn. Do drone used for smuggling (drugs, guns) activities in to Addis Ababa?

Ans:

Yet there is evidence that drones are used for smuggling activities in AA.

### **3. Does commercial drone operation pose threat to cyber security in AA?**

To assess cyber security threat posed in AA due to commercial drone operation, the interviewed data which was collected from INSA is presented as follows.

Qn. Does any of the cyber-attack happened in Addis Ababa on financial institutions carried out by the use of commercial drones?

Ans:

In Addis Ababa financial institutions were attacked by cyber attacks but since there is no evidence whether or not it was by the use of drones, it's hard to say they were facilitated by commercial drones. However the possibility is still there.

Qn. Does anyone carried out non-authorized surveillance activity using commercial drones in Addis Ababa?

Ans:

Commercial drones fly over where ever they need in AA but we think mostly for the entertainment industries. Since there is no evidence it's hard to say non-authorized surveillance.

Qn. Does any a commercial drone deliberately hijacked in AA?

Ans:

There are no reported commercial drones' hijacks in AA, but the possibility is still open.

## **4.2 Data Analysis and Interpretation**

The data analysis and interpretation is divided in to category of opportunity and threats. Under each category, the summary of each research question's data is analyzed and interpreted. The ordinal value for the likert scale data is five (5), each research questions' mean value is evaluated on which; the mean value 1 represents lowest satisfaction whereas 5 represent highest satisfaction for the variable (Bandana C. 2017). Accordingly "1 = very dissatisfied", "2 = dissatisfied", "3 = neutral", "4 = satisfied", and "5 = very satisfied" (Richard L. Daft, Dorothy Marcic, 2016).

### **4.2.1 Opportunity Analysis and Interpretation**

The following are research questions for the opportunity assessment which are going to be answered by the analysis and interpretation.

- Has drone improve the Business practices in Addis Ababa, Ethiopia?
- Does drone enhance the entertainment industries in Addis Ababa?
- Has drone ease the work of law enforcement in Addis Ababa, Ethiopia?

#### **1. Has drone improve the Business practices in Addis Ababa, Ethiopia?**

##### **Entrepreneurs:**

According to the data commercial drones are created much more opportunities for entrepreneurs. The mean data for “does commercial drone photo/video satisfy the need of entertainment industry in AA” is 4.5; the need of marketers satisfied 3.4. Making easy the aerial photo/video footages 3.4; income improvement 3.48; temporary job opportunity creation 4.71; permanent job opportunity creation 4.55; commercial is a profitable business 3.89; its contribution of tax to the government 2.54. The grand mean is 3.94.

The result indicates; commercial drones’ photo/video are satisfying need of the entertainment industry, marketers’ need also satisfied by the opportunity created drone operation; on the other hand drones are making easy the aerial photo/video footages, before the drones involvement it was rare to observe the city escapes of AA; income improvement was also another opportunity created for entrepreneurs; while it created temporary and permanent employment opportunity; commercial drone operation business is a profitable; However its income tax contribution very less and below the neutral level.

The grand mean 3.94 is less than but close to satisfied; this means drone technology’s opportunity’s benefit is close to satisfactory level. The maximum value is temporary job opportunity creation 4.7 which is close to very satisfied level. The minimum is tax contribution

to the government 2.45 which lies in the middle of dissatisfied and neutral. The rest of the results are positioned above neutral. Therefore drones are created the opportunities for entrepreneurs and government also has to gain the benefit through the generated income.

### **Marketers:**

Based on the data collected from marketers, commercial drone photo/video footages increase the demand for video advertisement works is 4.16; an outweigh of an advertisement work by using drone footages is 4.11; temporary job opportunity creation 3.83; permanent job opportunity creation 4.81; commercial is a profitable business 3.64; its contribution of tax to the government 3.81. The grand mean is 4.06.

The result indicates data; the demand of advertisement work that contains drone photo/video footages are increasing, drone footages also outweigh an video advertisement works; commercial drone operation also has created temporary & permanent job opportunity(employment). Commercial drones based business is a profitable business and also it contributes income tax to the government.

The grand mean is 4.06 which are slightly greater than the satisfied level. This indicates commercial drones operation is created an opportunity greater than the satisfied level. Marketers' tax contribution is greater than entrepreneurs. The rest of the variables are lied above the neutral level. So commercial drone operation is created opportunities and improved marketers' activity. Therefore, based on the presented, analyzed, and interpreted data, since entrepreneurs and marketers activities are improved by the use of commercial drones' operation; so it can be concluded that commercial drone operation is improved the business practices in AA.

## **2. Does drone enhance the entertainment industries in Addis Ababa?**

### **Filmmaker:**



The analysis of collected data indicates; for filmmakers, customers need to have drone footages in video production is 4.71; drone footage add value to the video production is scored with 5; drone footage make a significant difference on a value of the video is 4.92; drone is making easy to have aerial photo/video footage is 4.98; while the quality of aerial footages with low cost is 4.35. The grand mean is 4.79.

The result indicates; customers of filmmakers' need to have drone footages in the video production, this customer driven approach is will have a good result for both side of the drone business and entertainment side; drone footages add value to the video production, while drone footage creates a significant difference on the value of the video; drones are making easy to have aerial video footages and it's viable that nowadays we can observe drone footages in local movies; drone are also created high quality aerial photo/video footages with a low cost.

The grand mean is 4.79 which lied in the middle satisfied and very satisfied level, however it's close to very satisfied level. This means commercial drone is enhanced filmmakers' activities, closed to very satisfied level. The highest level is, drone footage add value to the value of production, 5; which lied on the very satisfied level. The rest of the variables lied above satisfied level. So, the opportunities created by operating commercial drones enhanced the activities of filmmakers.

### **Video Producer:**

For video producers, the analysis of the collected data indicates; customers need to have drone footages in video production is 4.42; drone footage add value to the video production is scored with 4.97; drone footage make a significant difference on a value of the video is 4.83; drone is making easy to have aerial photo/video footage is 4.90; while the quality of aerial footages with low cost is 4.39. The grand mean is 4.70.

The results indicates customers of video producers also need to have drone footages in video production; while drone footage add value to the video production; drone footage also make a

significant difference on a value of the video; nowadays drone makes easy to have aerial photo/video footage; whereas aerial drone footages are high quality with low cost.

The grand mean 4.7 lied between satisfied and very satisfied level, however which is slightly very close to very satisfied level. Drone footage add value to the video production is scored with 4.97, which is less vey very slightly less than the very satisfied level. The rest of the variables lied between satisfied and very satisfied. So video producers activity is enhanced by the oppportunity created by commercial drones operation.

### **TV Stations:**

The analyzed data which is collected from TV stations indicate; customers need to have drone footages in video production is 4.71; drone footage add value to the video production is scored with 4.88; drone footage make a significant difference on a value of the video is 4.82; drone is making easy to have aerial photo/video footage is 4.82; while the quality of aerial footages with low cost is 5. The grand mean is 4.85, which is nearly close to strongly agree.

The result indicates, customers of TV stations need to have drone footages in a video production; while drone footage add value to the video production; in addition drone footage make a significant difference on a value of the video; drone is also making easy to have aerial photo/video footages for TV stations; while the quality of aerial footages are high and made with low cost.

For TV stations the grand mean is 4.85 lied between satisfied and very satisfied level, which is very close to satisfied level. The quality of aerial footages with low cost is 5 which is the highest and at the very satisfied level. The rest of the variables lied between satisfied and very satisfied level. So the activities of TV stations are enhanced by commercial drone operation in AA.

Therefore, based on the presented, analyzed, and interpreted data, since filmmakers, video producers and TV station activities are enhanced by the use of commercial drones; so it can be concluded that commercial drone operation is enhanced the entertainment industry in AA.

### **3. Has drone ease the work of law enforcement in Addis Ababa, Ethiopia?**

#### **Addis Ababa Police:**

AA police did not use drones for law enforcement activities.

#### **Ethiopian Federal Police:**

Federal police did not use drone for law enforcement activities. However, they operate drones for surveillance purpose during occasions of international meeting and training. Federal police is trying to be benefited from drone operation and to make the aerial surveillance activity easy via commercial drones.

Therefore, generally; for federal police drones are making easy the law enforcement activities to some extent but not for AA police, because they do not utilized it.

#### **4.2.2 Threat Analysis and Interpretation**

The following are research questions for the threat assessment which are going to be answered by the analysis and interpretation.

- Does commercial drone operation pose threat to privacy in Addis Ababa?
- Does commercial drone operation pose threat to government activities?
- Does commercial drone operation pose threat to cyber security in AA?

#### **1. Does commercial drone operation pose threat to privacy in Addis Ababa?**

##### **Privacy threat:**

The data collected from AA police and federal police has similar notion and it's analyzed as follows. Commercial drones fly over large groups of people in AA not only during stadiums programs, rallies, events but also drones fly over places where crowded during rush hour like

Megenagna and Mexico. Having the video production license just drone operators can fly in AA. However without permission and consultation drones fly over on individuals, the public and private & public properties and takes photo/video footages whenever they want. This is because there is no legal frame work to manage such kinds of scenarios.

Since drones fly over on large groups of without limitation in AA, public privacy is not considered. Having the video production license drones fly over on the public and public properties to take photo/video footages. This is a similar scenario regarding the private and public privacy. Drones fly over on and took photo/video footages of individuals randomly.

Based on the data from AA police and federal police indicates both personal and public privacy are violated, due to commercial drone operation in AA.

## **2. Does commercial drone operation pose threat to government activities?**

### **ECAA:**

Still now ECAA didn't started to register commercial drones with unique electronic identification number; however, registration mark is given to the imported drones. Once they set out the clearance & paid the 200 % import tax; commercial drones did not ask any permission for their activities, including for the altitude above 120 meters.

However, still now there are no accidents happened on manned planes; in any case. Hence importers strictly informed no to fly on restricted areas including the airport with the altitude of above 120 meters.

There is no any drone collision threat happened on planes during take-off and landing in Bole Addis Ababa International Airport.

Still now there are no accidents happened on planes. During the importing process we strictly inform them no to fly on restricted including the airport. There is also no air traffic congestion created by commercial drones nearby Bole international airport.

Even though there were neither congestion nor collision threat happened to the Bole international airport; unique identification number is not applied to commercial drones and operators ignorance for asking a flight permission for an altitude of above 120 meters, heavily increases the threat level. So, it can be concluded that commercial drones operations are posed a threat to the government activities.

#### **INSA:**

Commercial drone operation is creating a threat to sensitive facilities like the national palace and government security facilities by flying over it since in AA, drones are flying over where ever they need and there no rules and regulations to manage it. In case of the national palace it's geofenced but drones can fly over by disabling the global positioning system (GPS) mode.

Drones are flying over where ever they need and there are no rules and regulations to manage it. The vulnerability is so high to fly on government security facilities with high altitude for the purpose of they need or it might crash on.

Now a days drone video footages of the city escapes including the light railway is common in the entertainment industry. Because of this drones are flying over on the train, railways and its power transmission lines. This might cause a huge damage if the drone crashes on. For the case of power station the threat is nearly zero, but if the drone crashes on it might create devastated situation. Power stations need to consider drones as a security threat in AA.

INSA assures commercial drones are a threat to the critical infrastructures, government security, and sensitive facilities. So it's obvious to conclude that drone operation is creating a threat to the government activities.

#### **Ethiopian Federal Police:**

Commercial drone operations are causing accidents to public & private property and individuals in Addis Ababa. Sometimes drones fall over and crash on individuals and properties.

But the damage was not high. Drone pilots some times did not choose areas that suit to take off; they might carelessly move on to take off from the palaces like Mexico and Megenagna areas where the area is densely populated during the rush hour.

However due to commercial drone operation criminal and smuggling activities are not facilitated by drone operation in AA. But rarely it's noticed that drones are fly over on nearby sensitive facilities and protected sites. Drones also fly over on key infrastructures to take photo/video footages, for the purpose video productions.

Therefore drones are caused accidents, drones are crashing; and drones fly over on critical infrastructures and nearby sensitive facilities. So there are threats posed to the government activities by commercial drone operation in AA .

#### **Addis Ababa Police:**

There is accidents happened to public & and private property and individuals in Addis Ababa due to commercial drone operation; rarely drones fall over events like concerts where large groups of people gathered but the damage is not viable.

There is no criminal activities happened in Addis Ababa via drone operation. However drones fly over on nearby sensitive facilities however it's not common to see commercial drones nearby sensitive facilities but not on the protected sites. There are also incidents that drones fly over on key infrastructures (trains and its railway power transmission lines, power stations, telecom infrastructures). But there is no evidence that drones are used for smuggling activities in AA.

AA police noticed while accidents caused by drones, and drones are flying over critical infrastructures and nearby sensitive facilities and protected sites. So there are viable threats posed by drone operations in AA due to commercial drone operation. Therefore, Commercial drones operation is posing threats to the government activities, in AA.

### **3. Does commercial drone operation pose threat to cyber security in AA?**

#### **INSA:**

Even though, in Addis Ababa damages were occurred on financial institutions by cyber attacks, there is no evidence weather or not it was by the use of drones, and it's hard to say they were facilitated by commercial drones. However the possibility is still there.

Commercial drones fly over where ever they need in AA but it's supposed mostly for the entertainment purpose. Since there is no evidence it's hard to say non-authorized surveillance are carried out in AA. There are also no reported commercial drones' hijacks in AA, but the possibility is still open.

INSA's response to the cyber security threat is yet there is no evidence from the past that; there is threat posed to the financial institutions due to commercial drone operations, non-authorized surveillance activity via drones, and hijacked drones in AA. But the threat is not null; Therefore the possibility of threat is still there.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Summary of Findings**

The summary of the findings illustrated in to two categories: the opportunity and threat.

##### **5.1.1 Opportunities of Commercial Drones**

The grand mean of entrepreneurs' and marketers' is 3.94 and 4.06 respectively. Due to the low cost and good quality of aerial photo/video footages; entrepreneurs are satisfying the need for entertainment industry however the need for marketers less satisfied. Even though entrepreneurs have created temporary and permanent job opportunity, the business is not much profitable and their income is not much improved and the tax contribution to the government is much less. Commercial drone operation made tasks easy & improved the business activities.

The grand mean of filmmakers, video producer, and TV station is 4.79, 4.70, and 4.85 .In the entertainment industry filmmakers, video producers, and TV stations are using drone footages to satisfy the need of customers since drone photo/video footages adds a value to the video production and also it makes a significant difference. They are also utilizing the easy way to have high quality aerial photo/video footages with low cost. In the entertainment industry filmmakers are using the opportunity created due to commercial drone operation in an excellent way. Therefore commercial drone operation is enhanced the entertainment industry in AA.

Even though commercial drones do not play a significant role in law enforcement activities in Addis Ababa, for federal police it eases the activities of aerial surveillance. Addis Ababa Police still didn't use commercial drones for any activities in Addis Ababa, In the case of federal police commercial drones' are slightly making the law enforcement activities easy but it's limited to aerial surveillance.



### **5.1.2 Threats of Commercial Drones**

Personal and public privacy is violated due to commercial drone operation in AA. Having the video production license just drone operators can fly in AA. However without permission and consultation drones fly over on individuals, the public, and private & public properties and takes photo/video footages whenever they want. This is because there is no legal frame work to manage such kinds of scenarios.

In AA even though drones do not have unique identification numbers; commercial drone operators don't ask flight permission for an altitude of above One hundred and twenty (120) meters. One hundred and twenty (120) meters is the maximum altitude that is adopted and experienced by early drone rules and regulation formulator nations and recommended by ICAO. Though In Addis Ababa; Bole international airport, commercial drones neither didn't create any air traffic congestion nor any collision threat.

According to INSA, Commercial drone operation posed a threat to government security facilities and critical infrastructures in Addis Ababa. On the other hand, commercial drone operation caused an accident on properties of the public, private organizations, as well as on physical accidents on individuals. INSA, Addis Ababa, and federal police are aware of commercial drone flights over on critical infrastructures.

According to INSA currently, there is no evidence for any cyber security threat to financial institutions, non-authorized surveillance activity due to commercial drone operation and no commercial drone hijack in Addis Ababa.

## 5.2 Conclusions

Based on the assessment of this research; the created opportunities are tremendous and outweighs the threats. The detail conclusion of the assessment of commercial drone opportunities and threats are illustrated below.

### **Opportunities:**

Entrepreneurs are creating and exploiting the opportunities via commercial drone operation. Entrepreneurs are making drone operation to create temporary and permanent employment.

Compared to the filmmakers marketers and entrepreneurs respectively still lagging behind filmmakers in exploiting the benefits of commercial drone operations; however, they are utilized by the potential opportunities of commercial drone benefits.

In the entertainment industry, the main commercial drone footage users are filmmakers, video producers, and TV stations. The entertainment industry is adding their video value with easy aerial drone footages and it's creating a significant quality difference with low cost. Now a day's marketers and filmmakers are utilizing commercial drone footage, due to customer demand. So, drones are creating opportunities and enhanced the entertainment industry.

Federal police are benefiting commercial drones for aerial surveillance and it's making easy their aerial surveillance activities. But AA police are not utilizing drones.

The entertainment industry is using drones much more than the police do. This creates a huge gap between law enforcement bodies and other commercial drone operators. At least police should arm similar technology comparing with society.

## **Threats:**

Personal privacy and public privacy are violated due to commercial drone operation in AA. This is because the legal frame-work to manage privacy violations due to the commercial drone operations in AA is still no implemented.

In order to own and operate commercial drone entrepreneurs, pass through a tough government bureaucracy. The number of commercial drones operated in AA is almost the threefold of the number imported and registered by government, which was the aim to be operated in AA. Commercial drone owners are freely enjoying their activity on Addis Ababa airspace with and only of having their video production license. And also operators do not ask flight permission for an altitude of above one hundred twenty (120) meters. This heavily increases the probability of a threat. However, on Bole international airport, air traffic congestion and collision threat with manned aircraft is almost null.

Even though AA police, federal police and INSA has assured that there are threats to sensitive facilities and critical infrastructures; there are also evidence from videos of social media platforms that drones are fly over nearby the national palace, trains, and its railway power transmission lines.

Commercial drones operation is also causing accidents on properties of the public, private organizations, as well as physical accidents on individuals. Therefore commercial drones are posing a threat to government activities.

Cyber security threat is not posed due to commercial drone operation; However since the technology is dynamic and changing in a fast manner, the performance of drones and capability of a payload are increased dramatically for the past ten years. Therefore the threat is could not be insignificant.

## 5.4 Recommendations

Aerial photography and filming were among the first commercial drone applications which nowadays primarily used in AA. Entrepreneurs have to explore and utilize commercial drone benefits for security facilities, construction, inspection (power line and industries), etc.

In order to minimize the threats and maximize the opportunities retained from commercial drone operations; ECAA should always be active to create the common ground for all commercial drone stakeholders as the technology is always dynamic.

As drones go further in number, it's hard to manage their flights in the airspace, so low cost unique electronic identification system which is connected with central database system has to be introduced.

Further; to create overall nationwide organized drone platforms, all stakeholders especially ECAA, ministry of innovation and technology, INSA, Ethiopian Federal Police, and Addis Ababa police should work in collaboration.

Police should be well aware of drone technology and armed at least the commercial versions.

All commercial drone operators shall abide by the rules and regulations of the airspace and should have flight permission for an altitude of above one hundred twenty meters; and also even though restricted areas might not be geo-fenced, the commercial drone should not fly over it. Because the damage caused by commercial drones on such scenarios is high. Flying over large groups of crowded areas people has to be forbidden unless it is for the benefit of society.

In order to make the drone sector more profitable, the government should encourage entrepreneurs by reducing startup cost like tax, and preparing incubation centers for drone

technology; its platform development further help the nation to own the technology and its impact on national security and economy will be high.

## REFERENCES

- A. Cuadra, C. Whitlock, How Drones Are Controlled. (2014, June 20). Retrieved April 14, 2020, from, <http://www.washingtonpost.com/wp-srv/special/national/drone-crashes/how-drones-work/>.
- Alfred Schutz. (1962) On the methodology of the social sciences, *Probl. Soc. Real.* (1962) 3e47.
- Bandana C. (2017). Service Quality in Higher Education A Study of International Students in India. Retrieved June 20, 2020, from, <http://hdl.handle.net/10603/188396>
- Bharat Rao\*, Ashwin Goutham Gopi, Romana Maione. (2016). The societal impact of commercial drones.
- Bryman, A. & Bell, E. (2011). *Business Research Methods*. 3rd ed. Oxford: Oxford University
- C. Jacques, Led by Agriculture, Market for Commercial Drones Will Reach \$1.7 Billion in 2025, 2014, October 14. Retrieved February 14, 2020, from, <http://www.luxresearchinc.com/news-and-events/press-releases/read/ledagriculture-market-commercial-drones-will-reach-17-billion>.
- Chow, E., Cuadra, A., & Whitlock, C. (2014, June 20). Retrieved May 8, 2020, from [https://www.uavdach.org/News/Missbrauch/2014-06-20Fallen from the skies\\_ drone crashes database - Washington Post.pdf](https://www.uavdach.org/News/Missbrauch/2014-06-20Fallen%20from%20the%20skies_drone%20crashes%20database%20-%20Washington%20Post.pdf).
- Commercial Broadcast in Ethiopia. (November 2013). Retrieved February 20, 2020, <http://www.eba.gov.et/index.php/2013-11-03-08-41-12/2013-11-03-08-40-27>.
- DJI. (February 2020). DJI Helps Fight Coronavirus With Drones. Retrieved February 15, 2020, from, <https://content.dji.com/dji-helps-fight-coronavirus-with-drones/>
- Drone Regulation Under Formulation. (February 03, 2018). Retrieved February 25, 2020 <https://www.thereporterethiopia.com/article/drone-regulation-under-formulation>.
- DRONITECH. (April 2, 2019). Drones are revolutionizing the media industry. Retrieved June 18, 2020, from, <https://www.dronitech.com/drones-are-revolutionizing-the-media-industry/>
- EASA. (2018). Safe operation of drones in Europe: Update on EASA's activities. Retrieved May 14, 2020, from, [https://www.easa.europa.eu/sites/default/files/dfu/217603\\_EASA\\_DRONES\\_LEAFLET %20%28002%29\\_final.pdf](https://www.easa.europa.eu/sites/default/files/dfu/217603_EASA_DRONES_LEAFLET%20%28002%29_final.pdf).

European Drones Outlook Study: Unlocking the value for Europe by SESAR (2016). Retrieved April 02, 2020, from, [https://www.sesarju.eu/sites/default/files/documents/reports/European\\_Drones\\_Outlook\\_Study\\_2016.pdf](https://www.sesarju.eu/sites/default/files/documents/reports/European_Drones_Outlook_Study_2016.pdf) .

Huttunen, M. (2019). Civil unmanned aircraft systems and security: The European approach. *J Transp Secur* 12, 83–101 (2019). <https://doi.org/10.1007/s12198-019-00203-0>.

H. Mackay, G. Gillespie. (1992). Extending the social shaping of technology approach: ideology and appropriation, *Soc. Stud. Sci.* 22 (4) (1992) 685e716.

ICAO. (April 2015). Unmanned Aircraft System (UAS): regulatory framework and challenges. Retrieved June 15, from, <https://www.icao.int/NACC/Documents/Meetings/2015/SARWORKSHOP/SARP06.pdf>.

Incident: LAM B737 at Tete on Jan 5th 2017, radome structural failure. (Jan 05, 2017). Retrieved April 10, 2020, from <http://avherald.com/h?article=4a319157&opt=0>.

Jean Paul Yaacoub, Hassan Noura, Ola Salman,\* and Ali Chehab. (May 08, 2020). Security analysis of drones systems: Attacks, limitations, and recommendations. Retrieved June 15, from, doi: 10.1016/j.iot.2020.100218.

Jeremy Straub.(December 2013).Unmanned aerial systems: Consideration of the use of force for law enforcement applications. Retrieved June 04, 2020, from, <https://doi.org/10.1016/j.techsoc.2013.12.004>.

Jeremy S., (November, 2014). Unmanned aerial systems: Consideration of the use of force for law enforcement applications. Retrieved June 25, from, <https://doi.org/10.1016/j.techsoc.2013.12.004>.

Jessica G. (September 16, 2018). Drone Use in the Entertainment Industry and Beyond. Retrieved June17, 2020, from, <https://thebottomline.as.ucsb.edu/2018/09/drone-use-in-the-entertainment-industry-and-beyond>.

Johnson L.K., Dorn A.W., Webb S., Kreps S., Krieger W., Schwarz E., Shpiro S., Walsh P.F., Wirtz J.J. (May 09, 2017). An ins special forum: intelligence and drones/eyes in the sky for peacekeeping: the emergence of uavs in un operations/the democratic deficit on drones/the german approach to drone warfare/pursuing peace: the strategic limits of drone warfare/seeing but unseen: intelligence drones in israel/drone paramilitary

- operations against suspected global terrorists: us and australian perspectives/the ‘terminator conundrum’ and the future of drone warfare. *Intell. Natl. Secur.* 2017;32(4):411–440. Retrieved June 05, from, <http://dx.doi.org/10.1080/02684527.2017.1303127>.
- J.P. Gee, *An Introduction to Discourse Analysis: Theory and Method*, Routledge, 2014.
- J. Serna, As hobby drone use increases, so do concerns about privacy, security. Retrieved May 14, 2020, from, <http://www.latimes.com/>.
- J.T.K. Ping, A.E. Ling, T.J. Quan, C.Y. Dat, Generic unmanned aerial vehicle (UAV) for civilian application-A feasibility assessment and market survey on civilian application for aerial imaging, in: *Sustainable Utilization and Development in Engineering and Technology (STUDENT)*, 2012 IEEE Conference on, IEEE, 2012, October, pp. 289e294.
- Laurence R. Newcome, (2012). *Unmanned Aviation: a Brief History of Unmanned Aerial Vehicles*. American Institute of Aeronautics and Astronautics, <https://doi.org/10.2514/4.868894>.
- Lord Richard. (September 2017). *Drones and Law Enforcement*. Retrieved April 22, 2020, from, <https://www.questia.com/library/journal/1G1-504460827/drones-and-law-enforcement>
- Mario Arturo, Ruiz Estrada, (March 2020), *The Uses of Drones in Case of Massive Epidemics Contagious Diseases Relief Humanitarian Aid: Wuhan-COVID-19 Crisis*. University of Malaya (UM) - Social Security Research Centre (SSRC). Retrieved April 02, 2020, from, [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3546547](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3546547).
- Michael Peck. (January, 2014), *Predator Drone Sends North Dakota Man to Jail*. Retrieved April 07, 2020, from, <https://www.forbes.com/sites/michaelpeck/2014/01/27/predator-drone-sends-north-dakota-man-to-jail/#7897cb41324c>.
- Michaeli S. B’tselem, 2015. *Crowd Control: Israel’s Use of Crowd Control Weapons in the West Bank*. Retrieved June 11, from, <https://core.ac.uk/download/pdf/85157384.pdf>.
- Maia H.,(2018). *Audible Killings: Capitalist Motivation, Character Construction, and the Effects of Representation in True Crime Podcasts*. Retrieved June 15, from, <https://digitalcommons.conncoll.edu/cgi/viewcontent.cgi?article=1036&context=enghp>.
- M. Lega, A.F. Accardo, Index of risk and safety objectives for civil UAVs, in: *AIAA 2nd “Unmanned Unlimited” Systems, Technologies, and Operations* aerospace, Land, and



- Sea Conference and Workshop & Exhibit, San Diego (CA)USA, 2003, September, pp. 15e18.
- M.J. Boyle, The race for drones, *Orbis* 59 (1) (2015) 76e94.
- M. Lega, A.F. Accardo, Index of risk and safety objectives for civil UAVs, in: AIAA 2nd “Unmanned Unlimited” Systems, Technologies, and Operationsdaerospace, Land, and Sea Conference and Workshop & Exhibit, San Diego (CA)USA, 2003, September, pp. 15e18.
- M.W. Jørgensen, L.J. Phillips. (2002). *Discourse Analysis as Theory and Method*, Sage: Police Drone Infographic. (n.d.). Retrieved June 16, 2020, from, <https://www.dronefly.com/police-drone-infographic>.
- Porter A.A.(2016). Law enforcement’s use of weaponized drones: today and tomorrow. Retrieved June 11, from <https://heinonline.org/HOL/LandingPage?handle=hein.journals/stlulj61&div=16&id=&page=>
- Privacy and Security Issues for the Usage of Civil Drones. (April25, 2014). Retrieved January 14, 2019, from, <http://resources.infosecinstitute.com/privacy-security-issues-usage-civil-drones/>.
- P. Paganini, Privacy and Security Issues for the Usage of Civil DronesInfoSec Resources, 2014, April 25. Retrieved June 18, 2020, from, <http://resources.infosecinstitute.com/privacy-security-issues-usage-civil-drones/>.
- Richard L. Daft, Dorothy Marcic. (2016). *Understanding Management*. Retrieved June 20, from, <https://books.google.com.et/books?id=y884CgAAQBAJ&printsec=frontcover#v=onepage&q&f=false>.
- Rosenfeld A. (January, 2019). Are drivers ready for traffic enforcement drones? *Accid. Anal. Prevent.* 2019;122:199–206. Retrieved June 15, from <https://doi.org/10.1016/j.aap.2018.10.006>
- R.L. Finn, D. Wright, Unmanned aircraft systems: surveillance, ethics and privacy in civil applications, *Comput. Law Secur. Rev.* 28 (2) (2012) 184e194.
- SkyWatch. (2020). Drone Technology in the World of Entertainment. Retrieved June 16, 2020, from <https://www.skywatch.ai/blog/drone-technology-in-the-world-of-entertainment>

- S. O'Brien. (January 2015). Drone Startups Swoop Up Millions. Retrieved April 17, 2020, from, <http://money.cnn.com/2015/01/07/technology/ghostdrone/>.
- Stephen Pritchard. (March 2019). Drones are quickly becoming a cybersecurity nightmare. Retrieved June 14, 2019, from, <https://www.paconsulting.com/newsroom/expert-quotes/threat-post-drones-are-quickly-becoming-a-cybersecurity-nightmare-25-march-2019/>.
- United Rotorcraft. (July 13, 2018). How Drones are Changing the Entertainment Industry. Retrieved June 19, 2020, from, <http://www.unitedrotorcraft.com/newsroom2/2018/07/13/how-drones-are-changing-the-entertainment-industry>
- V. Klochkov, A. Nikitova, A simplified approach to economic efficiency analysis of UAV pipeline surveillance, *Transp. Eng.* 27 (2008) 172e180.
- W.E. Bijker, J. Law, *Shaping Technology/Building Society: Studies in Sociotechnical Change*, MIT Press, 1992.
- WHO. (2020). Coronavirus. Retrieved June 08, 2020, from <https://www.who.int/health-topics/coronavirus>
- World wide Drone Incidents. (n.d.). Retrieved April 10, 2020, from <https://www.dedrone.com/resources/incidents/all>.

## **APPENDIXES**

### **Appendix A**

#### **INTERVIEW**

#### **QUESTIONS**

**St, Mary's University**

**School of Graduate Studies**

**Department of Masters of Business Administration (MBA)**

**Dear Respondent (Ethiopian Civil Aviation Authority)**

This Interview is designed and prepared for the purpose of doing a research entitled with “Assessing Threats and Opportunities of Commercial Drones In case of Addis Ababa” for the partial fulfilment of the requirement for the award of Master’s degree of Business Administration (MBA).

This research is designed with the objective of assessing threats posed and the opportunities created in Addis Ababa. So any phenomena happening related with commercial drones will help for all stakeholders including ECAA, law enforcement bodies (Federal Police and Addis Ababa Police), the film industry, entrepreneurs, marketers and the general public at large.

Therefore; you are kindly requested to answer the questions honestly and your responses will be treated confidential and use for academic purpose only.

I thank you for your support in Advance!

Your genuine response is vital and crucial for the success of the study.

Habtamu Meresa

(Research student, MBA)

Cell phone, 0913430181

Section I: Respondent demographic information

Section II: Assessment questionnaire for threat and opportunities of commercial drones

**Section I: Demographic characteristics of dear respondents**

1. Sex
2. Male\_\_\_\_\_ Female\_\_\_\_\_
3. Your Position at Ethiopian Civil Aviation Authority\_\_\_\_\_
4. Educational Level:  
Diploma\_\_\_\_\_ Degree\_\_\_\_\_ Masters\_\_\_\_\_ PHD\_\_\_\_\_

**Section II: assessment questionnaire for threat and opportunities of commercial drones**

1. Does Ethiopian civil aviation authority registered commercial drones with unique electronic identification number?
1. Does a commercial drone fly over on Addis Ababa airspace via the flight permission process of Ethiopian civil aviation authority for an altitude of over 120m?
2. Is there any drone accident happened on planes during take-off in Bole Addis Ababa International Airport?
3. Is there any drone collision threat happened on planes during take-off in Bole Addis Ababa International Airport?
4. Does a commercial drone create air traffic congestion in Addis Ababa nearby Bole international airport?
5. Is there any drone accident happened on planes during landing in Bole Addis Ababa International Airport?
6. Is there any drone collision threat happened on planes during landing in Bole Addis Ababa International Airport?

**Dear Respondent (Ethiopian Federal Police/Addis Ababa Police)**

Section I: Respondent demographic information

Section II: assessment questionnaire for threat and opportunities of commercial drones

**Section I: Demographic characteristics of dear respondents**

1. Sex

Male \_\_\_\_\_ Female \_\_\_\_\_

2. Your title and position at Ethiopian Federal Police Authority

\_\_\_\_\_

3. Educational Level

Diploma \_\_\_\_\_ Degree \_\_\_\_\_ Masters \_\_\_\_\_ PHD \_\_\_\_\_

**Section II: assessment questionnaire for opportunities of commercial drones**

1. Does Police use commercial drones for law enforcement activities in Addis Ababa?
2. Does a drone ease the law enforcement activities in Addis Ababa?
3. Does police use commercial drones for law aerial surveillance in Addis Ababa?
4. Does a drone ease the aerial surveillance activity?
5. Does police uses drones to secure outdoor events of large groups of people?

**Section II: assessment questionnaire for threat of commercial drones**

1. Do commercial drones fly over large groups of people in AA?
2. Is there any threats posed to public privacy by commercial drones operation in Addis Ababa?
3. Is there any threats posed to personal privacy by commercial drones operation in Addis Ababa?
4. Is there any accidents happened (to public & and private property and individuals) in Addis Ababa due to commercial drone operation?
5. Did criminal activities happen in Addis Ababa via drone operation?

6. Is there threats posed to personal privacy by operating commercial drones Addis Ababa?
7. Do drones fly over on sensitive facilities like government buildings (national palace, ministry of defense) by operating commercial drones Addis Ababa?
8. Do drones fly over on protected site like prison and police stations in Addis Ababa?
9. Do drones fly over on key infrastructures (trains and its railway power transmission lines, power stations, telecom infrastructures) by operating commercial drones Addis Ababa?
10. Do drone used for smuggling (drugs, guns) activities in to Addis Ababa?

## **Dear Respondent (INSA)**

Section I: Respondent demographic information

Section II: Assessment questionnaire for threat and opportunities of commercial drones

### **Section I: Demographic characteristics of dear respondents**

1. Sex

Male\_\_\_\_\_ Female\_\_\_\_\_

2. Your title and position at INSA

\_\_\_\_\_

3. Educational Level

Diploma\_\_\_\_\_ Degree\_\_\_\_\_ Masters\_\_\_\_\_ PHD\_\_\_\_\_

### **Section II: Assessment questionnaire for threat of commercial drones**

#### **Cyber security threat:**

1. Does any of the cyber-attack happened in Addis Ababa on financial institutions carried out by the use of commercial drones?
2. Does anyone carried out non-authorized surveillance activity using commercial drones in Addis Ababa?
3. Does any a commercial drone deliberately hijacked in AA?

#### **Threat to security facilities and critical infrastructures**

1. Is commercial drone operation creating a threat to government security facilities in Addis Ababa?
2. Is commercial drone operation creating a threat to critical infrastructures like (power stations, railways and its power transmission lines) by flying over it?
3. Is commercial drone operation creating a threat to sensitive facilities like the national palace and government security facilities by flying over it?

## Appendix B

### WRITTEN QUESTIONNAIRE

St, Mary's University

School of Graduate Studies

Department of Masters of Business Administration (MBA)

#### RESEARCH TITLE: ASSESSING THREATS AND OPPORTUNITIES OF COMMERCIAL DRONES IN CASE OF ADDIS ABABA

Dear Sir/ Madam, (Entrepreneurs)

I am student of St. Mary's University, School of Graduate Studies and I conduct this research as partial fulfilment of my Master's Degree in MBA (Masters of Business Administration) program. The main objective of this research is only for academic purpose which aims to assess the "Threats and Opportunities of Commercial Drones In case of Addis Ababa". You are kindly requested to answer the questionnaire honestly; on which your participation for this research is highly appreciated and your privacy will be kept anonymous.

Thank you for your time and consideration.

General Instruction

- Do not write your name in any part of the questionnaire.
- Your genuine response is vital and crucial for the success of the study.

Habtamu Meresa  
(Research student, MBA)  
Cell phone, 0913430181

Section I: Respondent demographic information

Section II: assessment questionnaire for opportunities of commercial drones.

**Section**

#### **I: Demographic characteristics of dear respondents**

1. Sex

a. Male \_\_\_\_\_ Female \_\_\_\_\_

2. Age group



[Below 20\_\_\_\_], [20 - 25\_\_\_\_], [25 - 30\_\_\_\_], [30 - 35\_\_\_\_], [35 - 40\_\_\_\_], [40 - 45\_\_\_\_], [45 – 50\_\_\_\_], [Greater than 50]

3. Educational Level

High School\_\_\_\_ Diploma\_\_\_\_ Degree\_\_\_\_ Masters\_\_\_\_ PHD\_\_\_\_

**Section II: Assessment questionnaire for threat and opportunities of commercial drones**

<b>Entrepreneurs</b>	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
<b>Opportunity Assessment</b>					
Does commercial drone photo/video footages satisfy the need of entertainment industry in Addis Ababa?					
Does commercial drone photo/video footages satisfy the need of marketers/Advertisers in Addis Ababa?					
Does commercial drone eases aerial photo/video footages in Addis Ababa?					
Does a commercial drone operation have improved your income?					
Does a commercial drones operation have created temporary job opportunity?					
Does a commercial drone have created permanent employment opportunity?					
Does a commercial drone operation is a profitable business?					
Does a commercial drone operation pay/contribute income tax to the government?					

Table B1: Five scale Likert written questionnaire for entrepreneurs

**Dear Sir/ Madam, (Marketers)**

Section I: Respondent demographic information

Section II: assessment questionnaire for opportunities of commercial drones.

**Section I: Demographic characteristics of dear respondents**

1. Sex

a. Male\_\_\_\_\_ Female\_\_\_\_\_

2. Age group

[Below 20\_\_\_\_], [20 - 25\_\_\_\_], [25 - 30\_\_\_\_], [30 - 35\_\_\_\_], [35 - 40\_\_\_\_], [40 - 45\_\_\_\_], [45 – 50\_\_\_\_], [Greater than 50]

3. Educational Level

High School\_\_\_\_\_ Diploma\_\_\_\_\_ Degree\_\_\_\_\_ Masters\_\_\_\_\_ PHD\_\_\_\_\_

**Section II: assessment questionnaire for threat and opportunities of commercial drones**

<b>Marketers</b>	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
<b>Opportunity Assessment</b>					
Does commercial drones photo/video footages increase demand of video advertisement works?					
Does commercial drones photo/video footages outweigh an advertisement video work from competitors?					
Does a commercial drone operation have created temporary job opportunity?					
Does a commercial drone have created permanent employment opportunity?					
Does a commercial drone operation is a profitable business?					
Does a commercial drone operation pay/contribute income tax (from salary) to the government?					

Table B2: Five scale Likert written questionnaire for marketers

**Dear Sir/ Madam, (Tv Stations/ video producers/ Film makers)**

Section I: Respondent demographic information

Section II: assessment questionnaire for opportunities of commercial drones.

**Section I: Demographic characteristics of dear respondents**

1. Sex

a. Male\_\_\_\_\_ Female\_\_\_\_\_

2. Your title and position at your organization

\_\_\_\_\_

3. Educational Level

Diploma\_\_\_\_\_ Degree\_\_\_\_\_ Masters\_\_\_\_\_ PHD\_\_\_\_\_

**Section II: assessment questionnaire for threat and opportunities of commercial drones**

1. Primarily for what purpose are you using commercial drones for (you can select one or more options):

- a. Movie
- b. Documentary
- c. Music video
- d. Outdoor events (weddings, concerts, street great runs, rallies, religious holidays)
- e. Stadium Programs (soccer, public and religious holidays and programs)
- f. Any other\_\_\_\_\_

<b>TV/filmmakers/video producers</b>	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
<b>Opportunity Assessment</b>					
Does Customers need to have drone footages in the video production?					
Does drone photo/video footages add value to the video production?					
Does drone photo and video footage makes a significant difference on a value of a video?					
Does drone make easy to have aerial photo/video footages?					
Does drone make high quality aerial photo/video with low cost?					

Table B3: Five scale Likert written questionnaire for TV/film makers/video produces