# THE EFFICACY OF CRIME MAPPING TECHNOLOGIES IN LAW ENFORCEMENT IN UGANDA:

# A CASE OF SECURITY CAMERAS IN WAKISO DISTRICT

# BY

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# A DISSERTATION SUBMITTEDTO THE SCHOOL OF SOCIAL SCIENCE FOR THE PARTIAL FULFILLMENT OF THE

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# DEGREE OFMASTER’S IN SECURITY

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# JANUARY 2022

# DECLARATION

I**, Joseph Musa Brown,** solemnly declare to the best of my knowledge that this research dissertation is my own original work and has not been published or presented to any other university or higher institution of learning for academic purposes.

Signature: …………………………………… …………. Date: …………………………………

**Joseph Musa Brown**

# APPROVAL

This dissertation titled, **“*THE EFFICACY OF CRIME MAPPING TECHNOLOGIES IN LAW ENFORCEMENT IN UGANDA: A CASE OF SECURITY CAMERAS IN WAKISO DISTRICT “***has been developed under my supervision and is ready for submission for the award of a Degree of Master’s in Security and Strategic Studies of Nkumba University

Signed: …………………………………………. Date: …………………………………..

**Dr. Anne Abaho**

**SUPERVISOR**

# DEDICATION

I dedicate this research report with joy and love to my son, Joseph Moses Brown my Supervisor, Roger Lewis, and my siblings all the well-wishers including those who will enjoy reading this report.

# ACKNOWLEDGEMENT

I am sincerely grateful to the Almighty God for his unconditional love, knowledge and care throughout my academic life.

To my parents, Mr Joseph Musa Brown and Hawa Brown for bringing me into this life and raising me before you departed, may the Almighty Lord bless you wherever you are.

To my course mates

I greatly extend my thanks to my supervisor Dr. Anne Abaho for the support, encouragement, and guidance throughout the research process.

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# ABBREVIATIONS

AR: Annual Report

AUCCS: African Union Convention on Cyber Security

CCCM: Community-Centric Crime Mapping

CCMT: Computerized crime mapping technology

CCTV: Closed-Circuit Television

CJ: Chief Justice

CMRC: Crime Mapping Research Centre

CP: Constitution Project

CRU: Central Region of Uganda

CS: Comparative Statistics

CSS: Chicago School of Sociologists

EMP: Emergency Medical Personnel

FCSA: Framework for Cyber Security in Africa

GIS: Geographical Information Systems

GIS: Geo-Information Systems

HSSM: Huawei’s Safe-Cities model

IACA: International Association of Crime Analysts

ICT: Information and Communications Technology

IGP: Inspector General of Police

IP: Internet Protocol

KMASA: Kampala Metropolitan Area Security Arrangement

KMP: Kampala Metropolitan Police

LMP: London Metropolitan Police

LPR: License Plate Recognition

NIJ: National Institute of Justice

NITA: National Information Technology Authority

NSOG: National Security Organization Group

OCOPS: Office of Community Oriented Policing Services

PCBC: Police Chief of Berkeley California

PDP: Personal Data Protection

# SCWD: Security Cameras in Wakiso District

STCAMS: Spatio-Temporal Crime Analysis and Mapping System

TAC: Temporal Analysis of Crime

TCRIS: Traffic Case Records Information System

TCRIS: Traffic Case Records Information System

TDUP: Traffic Department of the Uganda Police

UCBSC: University of California Berkeley School of Criminology

URA: Uganda Revenue Authority

WNP: WorldNet project

WSJNY: Wall Street Journal of New York

# OPERATIONAL TERMS

**Computerized crime mapping technology:** According to Maltz et al., (2000), computerized crime mapping technology enables law enforcement agencies to analyze and correlate data sources to create a detailed snapshot of crime incidents and related factors within a community or other geo- graphical area. Crime-related data then can be compared and analyzed with other external data sources.

**Crime mapping:** According to Leong et al., (2013), crime mapping is the process through which crime analysts and researchers use location information about crime events to detect spatial patterns in criminal activity. Early crime mapping efforts typically involved placing physical markers, such as pins, on maps to designate the locations where crimes occurred. Crime mapping is used by analysts in law enforcement agencies to map, visualize, and analyze crime incident patterns. It is a key component of crime analysis and the CompStat policing strategy. Mapping crime, using Geographic Information Systems (GIS), allows crime analysts to identify crime hot spots, along with other trends and patterns.

**Geographic information system:** According to Holdstock (2017), a geographic information system (GIS) is a system that creates, manages, analyzes, and maps all types of data. GIS connects data to a map, integrating location data (where things are) with all types of descriptive information (what things are like there). This provides a foundation for mapping and analysis that is used in science and almost every industry. GIS helps users understand patterns, relationships, and geographic context. The benefits include improved communication and efficiency as well as better management and decision making.

# ABSTRACT

The study was about the efficacy of crime mapping technologies particularly Security Cameras on law enforcement in Wakiso District. The study objectives were; to establish ways in which the CCTV camera system enables law enforcement agencies to obtain information on criminal incidents in Wakiso district, to examine the relevance of CCTV Camera system in storage and retrieval of information on crime incidents to enable law enforcement agencies track and prosecute criminals in Wakiso district and to examine the challenges facing the CCTV Camera system operation in providing evidence to prosecute criminality in Wakiso district.

The researcher obtained data from 118 respondents through a cross sectional design. The Close Circuit Television camera system is used for 24/7 surveillance, and in the process, any criminal act like theft, Murder, kidnap and so on that take place within their range of capture, is captured and relayed to the control centre. The Close Circuit Television camera systems is serving the purpose for which they were installed, but the limitations with their surveillance structures and extent makes it hard for them to capture all incidents police would naturally be very interested into compile information on criminality. The police has few personnel to run the camera centre, and as such the existing ones are overloaded with work. According to URN, 2021, one officer at the police CCTV ICT centre noted that it is not easy to be seated in one place with your eyes glued on a monitor for twelve hours. The security Closed Circuit Television Camera-CCTV operators were concerned about the long working hours they are subjected to which affects their ability to closely monitor all events happening around, particularly in Wakiso and Kampala. Cameras should avoid or mask inappropriate views of private areas, such as yards and second-story windows. Law enforcement agencies more so police should also document and publicize policies governing how surveillance cameras can be used and what the disciplinary consequences are for misuse, and this should be done where officers should be thoroughly trained on these policies and held accountable for abiding by them, using the CCTV camera system for public surveillance can be a cost-effective way to deter, document, and reduce crime. The detection function, through the recording of events and all types of behaviour, enables the detection of specific offenses and immediate response of authorized agencies. Public interest and safety along with surveillance cameras are here to stay.

The study recommends that the CCTV surveillance systems should become more easily integrated with monitoring devices, alarm systems and access control devices in order to help security personnel to identify and interrupt security breaches as they are occurring or even before they take place, the CCTV system operators should inform the work place or public place that everyone is watched for example an audio warning can be issued to let the intruder know they are being monitored and recorded, and if the premises are still at risk, the operators can update the police and the CCTv technology should be connected to the smart phone so that the security officers and owners are linked to monitor CCTV where the CCTV monitoring software allows authorised users to receive notifications on their smartphones whenever certain incidents occur including movement within a defined area if motion detectors or smart video analytics have been included in the installation.

# CHAPTER ONE

# BACKGROUND TO THE STUDY

# 1.0 Introduction

# This chapter contains the background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, justification of the study, scope of the study, significance of the study and conceptual framework.

# 1.1 Background to the study

# The study was about the efficacy of crime mapping technologies on law enforcement in Uganda, particularly Security Cameras in Wakiso District. The study is vital for there is need to establish the ways in which government authorities like law enforcement and the judiciary ought to build evidence on the occurrence of crime and reprimand the perpetrators.

# 1.1.1 Historical perspective

Modern-day crime analysis can be traced back to UK in 19thcentury when modern policing began with pioneer practitioner and major scholar of police studies, Sir Robert Peel of London Metropolitan Police (Boba, 2005; Gwinn et al., 2008). Crime analysis is, however, credited to August Vollmer, Police Chief of Berkeley California in the USA who became the founding professor at the University of California Berkeley School of Criminology in the early 20thcentury, inspiring other important early criminology studies conducted by the Chicago School of Sociologists. Crime analysts all over the world now play a central role in crime prevention and control (International Association of Crime Analysts, 2013).

Brantingham and Brantingham (1981) wrote that one of the most important aspects of a crime is the location, because any other descriptive information linked to the location of a crime event can hint at possible criminals, assist in designing countermeasures for prevention, help in the assessment of crime management programmes, and provide insight into environmental factors related to criminality. The use of crime mapping technology thus became important and as such, with time it crept in before becoming prominent in USA, Europe, Australia, Asia, Latin America and lately Africa.

Several commentators have argued that we are in the beginning stages of a second technological revolution, which will once again dramatically change police organization and administration (Chan, 2001; Stroshine, 2005; Harris, 2007).

A recent review of the use of information technologies by law enforcement agencies highlighted the role of the Federal government in funding these new technology innovations. Between 1995 and 2002, Goff and McEwen (2008) noted that the Office of Community Oriented Policing Services (COPS) program gave grants that helped more than 4,500 law enforcement agencies acquire and implement CCTV technology in support of efficient police operations.

Computerized mapping of crime-related data started in the military but today the police are often using tools such as CCTV cameras and GIS to map and analyse crime (Dağlar and Argun, 2016); Chainey and Ratcliffe (2005) and the Home Office (2008), from 2004 onwards, police organizations in developed world such as West Midlands, West Yorkshire, Surrey, Sussex, Devon and Cornwall, and the London Metropolitan Police in the UK have openly distributed crime data using web-based mapping of crime-related data tools. Innovative crime-mapping tools are now available and include Comparative Statistics (CompStat) and Crime Statistics (CrimeStat) programs in the USA (Levine, 2006), Police Network (PolNet) in Turkey (Yalcinkaya, 2007) and the Seed Finder algorithm in UK (Wang et al, 2013). In addition, there are several custom-made GIS software applications for Temporal Analysis of Crime (Block, 1995; Brown, 1998), Automated Tactical Analysis of Crime (Bair, 2000; Buetow et al., 2003; Levine, 2010; Anselin et al., 2006; Cheetham, 2010; Kulldorff, 2010 and Treglia, 2017).

CCTV surveillance systems are constantly being upgraded to include new software technology features. In several cities (e.g., Boston, Newark), the addition of gunshot location technology allows rapid deployment of emergency medical personnel, and police, to the locations where gunshots are identified (Mazerolle, et.al., 1998). The security agencies currently use software applications that are available with restricted access mainly for criminological research (Rich and Shively, 2004). All these programs are tailored versions of GIS technology whose invention dates to 1960s although it gained popularity in law enforcement during 1990s when computer processing speed and storage capacity expanded rapidly (Harries, 1999). These GIS programs are computer applications that help to capture, store, manage and analyse crime data (Murphy, 1995). GIS tools assist in presenting crime information in a visual form either as pin-push or density maps, linking geographic information such as estates and streets with descriptive information such as burglary and homicide incidents.

According to Norris (2015), in Africa, countries such as South Africa, Egypt, Nigeria were among the first to adopt the use of crime mapping technology in the 1960’s and 1970’s through to the 1980’s, more so in the resource rich areas such as the gold enclave of Witwatersrand, the Nile Delta regions, and Niger Delta. Murry et al., (2014) writes that in Uganda, these technologies are quite recent, and as Ssemwogerere (2012) noted, the vital installations of government such as the Airport, Inland Ports, Ministries, security installations, businesses and private homes of the affluent have, however, been using the technologies for more than two decades; in this case police and other security agencies had been relying on Geographical Information System (GIS) and other analytical tools, later Spatio-Temporal Crime Analysis and Mapping System (STCAMS) was developed to improve reconnaissance.

According to Kamusiime (2019- the police had managed to install Hi-tech CCTV cameras for the KMP area at a stand of 68%. The work had been carried out as part of the police investments in the CCTV provision across the country to better map crime and respond in a timely and appropriately manner. Kamusiime (quoting Enanga, 2019), the security forces actively use the CCTV system for gathering information, supporting patrols within the Kampala Metropolitan Police (KMP) area, directing investigations, tackling anti-social and criminal behaviour, which range from nuisance to assaults and wounding, and other offences such as burglary, robbery, and murder. The recordings show the whole incident from the point the offender begin to commit an offence to the end. Kamusiime (2019) adds that the effect of CCTV cameras is enhanced when installed alongside other complementary measures, like police patrols, community vigilance, environmental designs, thus raising its credibility as a threat to offenders. The CCTV operators are constantly monitoring the areas under surveillance and passing information to the police command centre, about incidents which require police response.

**1.1.2 Theoretical perspective**

The study was guided by the Crime Pattern Theory

Created by Brantingham and Brantingham, this theory is influenced by several different theories, including Routine Activities, Rational Choice and environmental principles relating to crime. It proposes that criminal acts are most likely to occur in areas where the awareness space of an offender intersects with perceived suitable targets. Most criminals do not choose their crime sites randomly, but rather their criminal site choices are spatially structured (Brantingham & Brantingham, 1993). Brantingham & Brantingham (1993).

Some important Crime Pattern Theory concepts are nodes that are main geographic points in a person’s life. Example: home, work, school, and girlfriend’s home, paths: The main arteries of travel between Nodes. Essentially how people travel between their main nodes, the main travel routes. It is assumed that people are very ritualistic in their travels, edges where people engage in their activities.

According to Cornish and Clarke (1986) argues that a potential offender consciously evaluates the expected costs and rewards of crime versus alternative behaviours and, thus, provides the theoretical foundation for the situational crime prevention measures. Environmental criminology advocated by Brantingham and Brantingham (1981) has an unequivocal focus on place as ascertained by crime geographers from being marginalized to a major source of knowledge and innovations for criminological fields (LeBeau and Leitner 2011). Crime mapping technologies have turned crime mapping to a powerful decision-making tool for law enforcement agencies (increasingly so for crime analysis and law enforcement) (Wang 2005). The National Institute of Justice (NIJ) has been instrumental in promoting the use of Crime mapping technologies such as CCTV and spatial analysis in crime research (Wilson 2007). The efforts are exemplified in funding the development and installation of CCTV cameras. There is need to build collaborations in security agencies to undertake the use of CCTV in addressing crime in any community, and for Wakiso District, the criminologists agree that the rational choice theory is vital in supporting the study on the efficacy of crime mapping technologies on law enforcement in Uganda, particularly on Security Cameras in Wakiso District.

# 1.1.3 Conceptual perspective

As Cynthia et al., (1999) noted, crime mapping is a very important tool in managing and controlling crime in an area. By analysing the spatial and temporal data provided by cameras and location, spatial maps, investigators can understand the crime patterns and trend. Further Weisburd and McEwen (1998) pointed out, it also helps in resource allocation and in geographic profiling of criminals and suspicious locations. Therefore, crime mapping technology enables law enforcement agencies to analyze and correlate data sources to create a detailed snapshot of crime incidents and related factors within a community or other geographical area. Crime-related data then can be compared and analyzed with other external data sources for appropriate security action.

According to LaVigne and Wartell (2008), as a first step in understanding law enforcement agencies’ knowledge of crime mapping, the use of Closed-Circuit Television (CCTV) cameras are well coordinated at a central police or crime intelligence centre which is then referred to as Crime Mapping Research Center (CMRC) where the acquired crime and geographical, spatial information is analysed for appropriate action and intervention.

In policing, computerised crime mapping technology has considerable influence on effective and efficient law enforcement (Colvin and Goh, 2005). Institutions such as police and the army, like all other social service organizations, are expected to utilize state-of-the-art technologies to carry out investigations, protect lives and property, and respond to crises (Johnston, 2007). Use of computerized crime mapping technology applications provides support to police work in many ways, such as analysing data using tools such as Geographical Information Systems (GIS) and recording uniform crime reports in computer databases (Adderly and Musgrove, 2001; Pelfrey, 2001).

Computerized crime mapping technology tools such as Geo-Information Systems can thus improve the effectiveness of police duties when integrated into policing operations that are designed to take advantage of readily available data (Garicano and Heaton, 2007). Ultimately, if police officers accept and optimally use computerised crime mapping technology tools, they can improve their performance and add great value to their service delivery in terms of crime prevention and control (Gottschalk and Holgersson, 2006).

Bainomugisha (2013) publication on, “Community-Centric Crime Mapping for a Safer Society in Uganda”, revealed that computerized crime mapping allows law enforcement agencies in Uganda more so Kampala Metropolitan areas such as Wakiso, Kampala and Mukono to plot crime-related data against a digitized map of a community, and or the city. Crime-related data then can be compared and analyzed with other external data sources. The various crime control departments use the computerized mapping report to plan for eradicating crime. Bainomugisha, adds that crime incident data can be geo-coded (assigning an x and y coordinate to an address so it can be placed on a map) by using either street centrelines (every address within a block is encoded) or parcels (each piece of land that can be bought or sold is encoded).

# 1.1.4 Contextual perspective

The Xinhua (2018) agency report on Ugandan police started installation of security cameras to curb crime, pointed out that CCTVs are thus becoming a very common feature in the private sector and are increasingly being used to survey and monitor shopping malls, banks, car parks, schools and colleges, entertainment places and tourist attractions with collaborations from the private sector who have installed them at their premises. Much as the footage from privately owned CCTVs may vary in terms of quality and volume, it is still useful for pre-incident monitoring and post-incident analysis. There are also plans to harness footage from the private CCTV cameras and link them to the police CCTV monitoring system, after the successful completion of phase one.

According to Kazibwe (2021), Kampala Metropolitan districts of Wakiso, Kampala and Mukonohave a total of 3233 cameras on 1248 sites, but for security reasons, the numbers are not adequately broken down; but with this number and the geographical extent, this is quite good coverage. The security has improved mainly because of the technical interventions, the security services had got infiltrated by bad elements like criminals and corrupt people. Even now they are there but things are now much easier because of cameras and other technical interventions (Museveni Yoweri Kaguta quoted in Nile Post, 2020), and he cited the Nagirinya incident in which a social worker was kidnapped together with her driver and later killed, saying that the CCTV cameras played a crucial role in the arrest of the suspects. According to Museveni (quoted in Nile Post, 2020), the criminals in the past used the loophole of under investment in technical interventions in security to terrorise the country but noted this is no longer possible with the use of the CCTV camera system in place.

Currently, CCTV camera system with the capability of alerting police when inordinate numbers of individuals cluster at one location and when crime happens have been installed in Wakiso District under the Kampala Metropolitan Area Security arrangement. In addition, software has been availed utilizing the identification data base and facial recognition software that allow the police to identify individuals under video surveillance (Biryabarema, 2020). On the other hand, Daoud (2011) pointed out that emerging issues in policing such as cybercrime, terrorism and other transnational organized crimes have increased due to the inability by the CCTV cameras to identify the perpetrators even when they continue to operate.

Though it has enabled police to detect and follow up on criminal activities in the district, they are challenged by the low levels of professional proficiency of the operators in police and armed forces.

The Police’s ICT directorate has revealed that in the past two months, they have used CCTV cameras to track and recover at least 600 vehicles involved in various crimes around the country (Kazibwe, 2021), using the automatic number plate recognition, facial recognition CCTV cameras and intelligent video system, they have been able to recover vehicles, most of which had been hidden by drivers after committing crimes, nabbed several robbers, petty thieves and closer follow-up on criminal activities have been enhanced.

Masaba (2019) noted that modern closed-circuit television cameras (CCTV) with facial recognition devices are to be installed in all municipalities, towns, selected Police stations and border entry points to fight crime totalling up to 2,319 surveillance cameras. These CCTV cameras, with the capacity to monitor a radius of 2km. The purpose of the use of the CCTV is to monitor public places, where they are installed to assist in the prevention and detection of crime.

While Enanga (quoted by Masaba, 2019) states that the objectives of installing the CCTV cameras are: To help reduce crime: The CCTV system would help in gathering information, supporting patrols within the KMP area, directing investigations, tackling anti-social and criminal behaviour, which range from nuisance to assaults and wounding, and other offences such as burglary, robbery, and murder. The recordings show the whole incident from the point the offender began to commit an offence to the end. On roads, they were meant to read number plates to reduce traffic-related cases. The cameras were also meant to track defaulters of traffic express penalty scheme tickets. Traffic Police have been finding it hard to track express penalty scheme ticket defaulters, for example in 2017, the Police imposed traffic fines worth sh17.7b fines but only sh2.2b was paid and most of the defaulting vehicles could not be traced in time. With the new CCTV camera technology, express penalty defaulters’ vehicle licence plates are entered into the system, and they were to be tracked automatically, and officers on the road would be informed to carry out arrests.

Masaba (2019) added that the cameras were to be mounted at 107 Police stations in municipalities and at the border points of Busia, Malaba, Katuna, Bunagana and Nimule with the support of the National Information Technology Authority, Uganda (NITA-U) backbone infrastructure to enable them track movement of cargo, cargo operations during clearance and transit as well as tracking cargo handling related crime fast enough and stealthily. Enanga (quoted by Masaba, 2019) stated that districts such as Kisoro, Mityana, Mubende, Kamuli and Rukungiri, which are not supported by the backbone infrastructure, will have stand-alone networks to power the surveillance cameras. The cameras are aimed at tightening the noose on criminals and those who thought they would use crime to discredit government. The purpose of using CCTV cameras is to monitor public places, where they are installed to assist in the prevention and detection of crime. They would further help improve the understanding of how CCTV cameras can be used to control crime in public places.

Further Enanga (cited in Masaba, 2019) noted that the Government intends to build a technological eco-system that would include security cameras installed around strategic locations and highways. These would be beefed up with facial recognition and apparent number plate recognition capabilities. They would relay back to a fully-fledged data centre that will also contain DNA and picture-based databases to authenticate individuals. To harness footages from the private CCTV cameras and link them to the police CCTV monitoring system, after the successful completion of the project; the current study will therefore examine the efficacy of crime mapping technologies on law enforcement in Uganda, particularly on Security Cameras in Wakiso District.

# 1.2Problem statement

Installation of the CCTV surveillance systems in Kampala Metropolitan Area started in 2019for better crime surveillance in the area, in this case Wakiso district (Nzito, 2020). Nzito (quoting Enanga, 2020), stated that they have not been able to cover the whole area, and this has also not deterred criminals from involving in murders, burglary, thefts, rape, and various other cases which require urgent attention. Before the current CCTV system was installed, Masaba (2019) noted that police had recorded 4,497 homicides in 2018, nearly double the number of five years ago in 2013, there were many cases of kidnap for ransom which had risen to 202 cases by 2018, an eightfold jump from 2017 because of the non-existence of remote sensing instruments to records and film the crimes. But even with the installation of the CCTV surveillance system, few cases of crime in Wakiso district has been successfully followed (Masaba, quoted Enanga, 2019).

Even with advanced technology like facial recognition, the CCTV security cameras has not been able to adequately provide evidence for use by police to reprimand criminals, and there have been a lot of doubts (Biryabarema, 2020) that police have the capacity to develop the footages and images to identify and track criminals, , and further several gruesome acts like murders such as that of Naggirinya, Kitayimbwa, Magara Susan (Kazibwe, 2020), the 29th September 2021 murder of a 3 year-old child in Nangabo Sub-county, the CCTV footage of of the panga wielding criminals who were captured by the CCTV in Kibwa Nabweru (Kalinaki, 2021), the reported bomb incidents in Komamboga, - have not been addressed well by the CCTV camera system as no footages have emerged. Much as the Ugandan government has ensured that Wakiso District is well covered under the CCTV camera system, various crimes have happened and gone un reprimanded as the system is said to be not so accurate at recording and relaying images of incidents, thus making it hard for police to carry out its role of law enforcement. The current study examined the efficacy of crime mapping technologies on law enforcement in Uganda, particularly on Security Cameras in Wakiso District.

# 1.3 Purpose of the study

The purpose of the study was to examine the efficacy of crime mapping technologies particularly Security Cameras on law enforcement in Wakiso District.

# 1.4 Study objectives

# The following study objectives guided the study:

1. To establish ways in which the CCTV camera system enables law enforcement agencies to obtain information on criminal incidents in Wakiso district
2. To examine the relevance of CCTV Camera system in storage and retrieval of information on crime incidents to enable law enforcement agencies track and prosecute criminals in Wakiso district
3. To examine the challenges faced in using the existing CCTV Camera system to produce adducible incriminating evidence to prosecute criminality in Wakiso district

**1.5 Research questions**

# The following research questions guided the study:

1. What are the ways in which the CCTV camera system enables law enforcement agencies to obtain information on criminal incidents in Wakiso district??
2. What is the relevance of CCTV Camera system in storage and retrieval of information on crime incidents to enable law enforcement agencies track and prosecute criminals in Wakiso district?
3. What are the challenges faced in using the existing CCTV Camera system to produce adducible incriminating evidence to prosecute criminality in Wakiso district?

# 1.6 Justification of the study

A review of crime prevention technology by Welsh and Farrington (2007) revealed that technological advances over the years have had a profound influence on the way we think about crime and the efforts that are taken to prevent it, including the vigorous integration of CCTV cameras under remote sensing security activities to reprimand and reduce crime in the community. Marx (2007) noted that advocates of crime prevention through situational crime control and/or environmental design manipulations such as the current CCTV system in Uganda, and particularly Wakiso district is vital for crime surveillance and offering the timely response required for crime response activities. The study is necessitated because CCTVs are becoming a very common feature in Wakiso district as the security forces enhance their capabilities to reprimand crime in the most populous district of Uganda. The security in public places, shopping malls, banks, car parks, schools and colleges, entertainment places and tourist attraction centers need the CCTV surveillance system as these are high concentrations of people and hot spots for crime which should be monitored. With such bulk of need, it is justified to undertake the study on the efficacy of crime mapping technologies particularly Security Cameras on law enforcement in Wakiso District.

# 1.6 Scope of the study

It consists of the geographical scope, content scope and time scope

# 1.6.1 Geographical scope

Wakiso District is located in the Central Region of Uganda that partly encircles Kampala, Uganda's capital city, further bordering with Nakaseke District and Luweero District to the north, Mukono District to the east, Kalangala District in Lake Victoria to the south, Mpigi District to the southwest and Mityana District to the northwest (Uganda District Map, 2020). Wakiso, where the district headquarters are located, lies approximately 20 kilometres (12 mi), by road, northwest of Kampala, the capital of Uganda and the largest city in the country (Road Distance between Kampala and Wakiso with Map, Globefeed.com., 2014). The coordinates of the district are: 00 24N, 32 29E., the district is largely semi-urban with over two sub districts, 11 town councils and 12 sub-counties which are also between peri-urban and semi-rural in nature. The district is highly populated with 1,997,418 persons occupying its vast 1,906.7 km2 (736.2 sq mi) of land.

# 1.6.2 Content scope

The hard technology crime prevention innovations that have known effects on crime is the closed-circuit television cameras (Hertz and Simon, 2011). Prior to this study, several inclusive studies had been conducted on the use of CCTV cameras to monitor and reprimand crime, but none has been carried out extensively on the efficacy of CCTV cameras in filming and recording crime incidents from start to end. The current study examines the ways in which the CCTV camera system enables law enforcement agencies to carry out general reconnaissance and identification of crime incidents, the effectiveness of CCTV camera system in enabling law enforcement agencies detect and arrest criminals and the relevance of CCTV Camera system in storage and retrieval of information on crime incidents to enable law enforcement agencies track and prosecute criminals in Wakiso district.

# 1.6.3 Time Scope

The study on the efficacy of crime mapping technologies particularly Security Cameras on law enforcement in Wakiso District was accomplished in January 2022, and it focused on a period of five years from 2016 to 2021, when there has been a huge installation and use of CCTV camera system by security to map and respond to crime in Uganda generally and Wakiso District in particular.

# 1.7 Significance of the study

The findings of the study will be of utmost importance to various stakeholders in the following ways:

1. The findings of the study will enable the leadership of the security forces in government and the private security managers to know the best way to make use of the available and install more CCTV cameras to beef up security and blow-up possible terror activities before they happen.
2. The study will act as a basis for the Ministry of Defence and veteran Affairs, Security and Internal Affairs to revise their policy on security services by making CCTV cameras central in their security reconnaissance missions in the country.
3. The study findings strengthen the body of knowledge on the theory about security management using the CCTV camera system.
4. The findings of the study can be used as a basis for further research in the fields of security management wherever it can be implemented.
5. When accomplished, the researcher will be able to obtain the academic award of the Master’s Degree of Nkumba University.

# 1.8 Ethical considerations

For any research to be valid and objective in nature, it has to take into consideration the ethical aspects while carrying it. Under this study confidentiality was observed and kept by the researcher for all information given by the respondents. The researcher was honest in his work by avoiding any form of falsification, misrepresentation, plagiarism, and any other form of academic malpractice that could hinder the dependability of the data collected. The researcher reported the actual findings without omission and adding personal information to distort the information. Participation in the research was voluntary, based on consent to avoid collection of wrong data and other inconveniences to the researcher.

The researcher was non-discriminative in nature when selecting samples. This was implemented by avoiding bias in selecting respondents according to their sex, tribes and even culture. Thus, the researcher gave all the people equal chances of being chosen.

# 1.9Limitations and delimitations of the study

There might be the problem of unavailability of some respondents. They were not readily available to provide information needed for the study because of some responsibilities that could have taken them out of their offices or work premises. The researcher used secondary documents to obtain additional data and make appropriate contact.

The available respondents might hesitate to give information thinking they are being tricked to see if they can release the information and that information could be taken for personal gain, even though there was an introductory letter from the University which was addressed to the responsible authorities. The researcher requested the authorities in the area of study for permission to collect data and it was granted though verbally as they did not commit in writing their consent in any way.

Some respondents did not return the questionnaires in time, and some refused to take part in the study. The researcher talked to those and explained the purpose of the study and obtained data from them as much as he could after obtaining their verbal consent to participate.

# 1.10 Organization of the study

The study was organized in five chapters followed by references and appendices.

Chapter one: This chapter contains the background to the study, purpose of the study, objectives of the study, research questions, scope of the study, significance of the study, ethical considerations, anticipated limitations and delimitations of the study and arrangement of the study. Chapter two: This chapter presents the literature survey, theoretical review, literature review (empirical studies) which are in line with the subthemes of the study and the conceptual framework. Chapter three: This chapter presents the methodology which includes procedures and methods that will be used in conducting the study. Chapter four: This chapter contains the presentation, analysis, and interpretation of findings Chapter five: This chapter presents the summary, conclusions, and recommendations of the study.

# CHAPTER TWO

# LITERATURE REVIEW

# 2.0 Introduction

This chapter focuses on the review of related literature on the efficacy of crime mapping technologies on law enforcement. The chapter comprises the theoretical and literature review thematically structured in line with the study objectives. The literature review consists of materials obtained from published research, textbooks, journals, magazines, and any internet sources which are relevant and provide a thorough background to this study.

# 2.1 Literature survey

This section focuses on the review of studies related to crime mapping and law enforcement in Uganda. The studies enabled the researcher to identify the gaps which the study has closed.

Mubaraka et al., (2013) carried out a study on the development of Traffic Case Records Information System (TCRIS) that would ease storage and retrieval of traffic cases in the Traffic Department of the Uganda Police. The method used to manage traffic cases is manual; information collected daily is written on paper and stored in files for reference, thus making the captured cases susceptible to loss, easy access by unauthorized people and destruction. The researcher set out to study the current system, analyze the needs and then improve on the system by designing and developing a Traffic Case Records Information System. The study discovered that the system developed captures the defaulters’ bio data, traffic offence committed and the charge for the traffic offence. The TCRMS makes the use of the camera that captures the photo of the defaulter and the biometric gadget that captures the defaulter’s thumb print for police reference. All these are centrally stored in the database but are sharable with migrations department, Bank of Uganda (BoU) and Uganda Revenue Authority (URA) which government departments work closely with police regarding such offences. Different programming languages were used during the development of the system including Visual Basic for the front end and SQL Server2005 for the back end. The system is thus user friendly in the way it inserts, retrieves, and updates user information.

Wamwa (2012) carried out a study on the current system of registering crimes and criminals in Uganda Police Force. Emphasis was particularly put on the performance bottlenecks in terms of data security as far as existing processes involved in crime reporting are concerned.

These were authentication, integrity, confidentiality, identification, non-repudiation, availability, and risk management. It was adduced that confidentiality mechanisms in Uganda Police do not protect transactions against unauthorized reading, copying, or disclosure. Also, integrity mechanisms do not provide transaction accuracy and assurance that the transactions have not been altered or deleted. The study yielded a hierarchical attack tree model for data security attributes. The purpose of this model was to represent the division of each primary threat into sub-attacks, either all or some of them being necessary to materialize the primary threat. The sub-attacks were then divided further, until the state where it does not make sense to divide the resulting attacks anymore, was reached.

Vulnerabilities were assessed using a probabilistic approach and it came out that the probability of the current system being vulnerable to attacks was more than the probability of the new system being vulnerable to attacks from different sources. The new system being referred to here is the system that was designed from my study. This was justifiable to conclude that the new system is more secure and hence an improved one. This is yet another positive contribution of this research. In the new system, there is a security feature of printing audit trail logs at the end of every day. These can then be signed by the Systems Administrator and kept with the Inspector General of Police and the Chief Justice. In the event that complaints arise about particular cases, the printouts of the kept audit trail logs can be produced and if a particular date’s records on the kept print-out and the system’s fresh print-out do not match, then this means at one time, those records were altered. The feature was not there in the old system and its presence in the new system enhances non-repudiation.

A study by Ssemwogerere (2007) focused on improving crime analysis and mapping in Uganda Police Force using Geographical information system (GIS) and other analytical tools. To achieve the aim of the study, Spatio-temporal crime Analysis and Mapping System (STCAMS) was developed. The analysis of the existing information system in the Uganda Police Force showed that the current system was manual and not effective. It lacked comprehensive crime analysis with a spatial component in the form of a map. In addition, socio-demographic data were missing. The Spatio-temporal Crime Analysis and Mapping System (STCAMS) which included various components of spatio-temporal crime analysis and mapping was therefore developed to solve the above problems.

The new system was implemented using PHP/HTML, MySQL Server, ArcView GIS, Arc Explorer, and it was tested and validated to determine if it fulfilled the requirements of the system. The GIS was used to tie crime data to location and view crime situation of an area on a map. Police commanders can use the developed prototype software to pinpoint the problem areas and allocate appropriate resources to effectively control crime. With the use of GIS, crime analysis in police was improved to combine crime, location, socio-demographic and temporal data in order to identify crime trends and patterns, victims, and perpetuators of crime, for a better control. A number of recommendations were made for proper implementation of the new system (STCAMS). The communication channel as stipulated in the Standing Orders needs to be revised to allow for the direct access to information thereby reducing the bureaucracy which in turn improves efficiency in crime analysis. The computers should be networked and security measures for data accessibility defined. Lastly, the new system must be continuously maintained and updated.

Since none of the studies focused on the efficacy of crime mapping technologies on law enforcement, the current study will close these gaps by focusing on the efficacy of crime mapping technologies on law enforcement in Wakiso District through subthemes such as the ways in which the CCTV camera system enables law enforcement agencies to obtain information on criminal incidents, the relevance of CCTV Camera system in storage and retrieval of information on crime incidents to enable law enforcement agencies track and prosecute criminals and the challenges facing the CCTV Camera system operation in providing evidence to prosecute criminality in Wakiso district.

# 2.2 Theoretical review

The Crime Pattern Theory as advanced by Brantingham & Brantingham (1993) includes routine surveillance activities, rational choice and environmental principles relating to crime proposes that criminal acts are most likely to occur in areas where the awareness space of an offender intersects with perceived suitable targets. Most criminals do not choose their crime sites randomly, but rather their criminal site choices are spatially structured. Brantingham & Brantingham (1993) see that crimes are patterned; decisions to commit crimes are patterned and the process of committing a crime is patterned. Some important Crime Pattern Theory concepts are nodes that are main geographic points in a person’s life.

Examples include home, work, school, and girlfriend’s home, paths: The main arteries of travel between nodes. Essentially how people travel between their main nodes, the main travel routes. It is assumed that people are very ritualistic in their travels, edges, the boundaries of areas where people engage in their activities.

Also the rational choice theory, according to Cornish and Clarke (1986) argues that a potential offender consciously evaluates the expected costs and rewards of crime versus alternative behaviours and, thus, provides the theoretical foundation for the situational crime prevention measures. Environmental criminology advocated by Brantingham and Brantingham (1981) has an unequivocal focus on place as ascertained by crime geographers from being marginalized to a major source of knowledge and innovations for criminological fields (LeBeau and Leitner 2011). Crime mapping technologies have turned crime mapping to a powerful decision-making tool for law enforcement agencies (increasingly so for crime analysis and law enforcement) (Wang 2005a).

The National Institute of Justice (NIJ) has been instrumental in promoting the use of Crime mapping technologies such as CCTV and spatial analysis in crime research (Wilson 2007). The efforts are exemplified in funding the development and installation of CCTV cameras. There is need to build collaborations in security agencies to undertake the use of CCTV in addressing crime in any community, and for Wakiso District, the criminologists agree that the rational choice theory is vital in supporting the study on the efficacy of crime mapping technologies on law enforcement in Uganda, particularly in Security Cameras in Wakiso District, but several research gaps exist which need to filled by the study in areas of CCTV camera system and the ability of law enforcement agencies to obtain information on criminal incidents, including the relevance of CCTV Camera system in storage and retrieval of information on crime incidents as well as the challenges faced in using the existing CCTV Camera system to produce adducible incriminating evidence to prosecute criminality.

**2.3****The ways in which the CCTV camera system enables law enforcement agencies to obtain information on criminal incidents**

The review of literature on the ways in which the CCTV camera system enables law enforcement agencies to obtain information on criminal incidents focuses on the following subthemes; CCTV systems being used in detecting several criminal incidents, CCTV cameras are employed for safety of the cities/towns, capability to monitor \citizens, enhance cyber security to fight cyber-crime, enabling effective public safety interventions to curb crime and improve the liveability and economic well-being of their communities, use of eavesdropping for local and overseas surveillance, remote sensing to identify report and follow up criminality , watch over and carry-on video surveillance duties on the streets and offering physical security.

# 2.3.1 CCTV systems and detection of criminal incidents

According to Heba (2014), in the last two decades ago, CCTV systems have been used to play a significant role in detecting several criminal incidents and enable security organs to respond. The

CCTV technology has evolved exponentially to intelligent systems that can identify abnormal events or behaviour like observe probable terror activities and behaviour (LaVigne, Nancy G., Samantha S. Lowry, Joshua A. Markman, and Allison M. Dwyer. 2011). The CCTV camera system is employed for public surveillance purposes for overt, semi-covert and covert operations. Overt cameras are intentionally designed to be visible to the public and for the most part, one can easily detect what is being recorded by the direction of the camera. Semi-covert cameras have become increasingly more common (Cameron, Aundreia, ElkeKolodinski, Heather May, and Nicholas Williams, 2008), and record unknown as they are very vital for crime awareness and detection as well as prevention efforts. The offenders are unable to determine whether they are being recorded and may therefore refrain from criminal activity due to fear of apprehension, while covert cameras are hidden for security reasons and used primarily for observation rather than to achieve a deterrent effect.

# 2.3.2 CCTV cameras and increased safety

Governments are ramping up camera coverage in cities to stop shadow maps of crime hotspots from emerging and are using bigdata driven AI like computer vision to cut crime (Cao Zhihui, 2017). Using the Huawei’s Safe-Cities model, the Huawei’s Safe-Cities model provides a template, and it is important to recognize that these governance and surveillance systems are being installed at the request of African governments. The adoption of surveillance products in Africa is closely linked to Huawei’s Safe-Cities projects. The Safe Cities concept makes use of a range of interconnected tracking devices, video cameras, software, and cloud storage systems to tap public and private platforms in a more cohesive manner to enhance public goals such as policing, managing traffic, and streamlining administrative services. Access to this web of systems ostensibly increases the visibility of police officers who can then agilely track and respond to crime in real time (Steven Feldstein, 2019).

**2.3.3 Capability to monitor citizens**

African countries in conjunction with Beijing, have championed the use of ICT technologies as an instrument to strengthen its local ability to monitor their citizens. For example, what the Ethiopian government termed the WorldNet project digitally connects ministers in Addis Ababa with the country’s 950 district administrations (woredas), nine regions, and two city administrations (Felix Horne, 2014) where the government can surveil all the major concentrations of people from Addis-Ababa and its regional centres. This suggests that the implementation of surveillance technologies is vulnerable to being abused. This vulnerability is compounded by Ethiopia’s lack of a comprehensive legal instrument to regulate privacy and data protection measures.

**2.3.4 Enhance cyber security to fight cyber crime**

According to Wycoff (2004), promoting cyber stability and increasing awareness of cyber security governance in Africa helps support the establishment of enforcement mechanisms and the development of institutional capacities to detect and fight cyber-crime like cyber fraud. International actors can also work with local African civil society organizations to strengthen checks and balances and address concerns over privacy. By supporting digital rights initiatives, international actors can empower and scale the work of local organizations. African citizens are facing a digital inflection point, and as Karen and Isel-van Zyl (2020) pointed out, there is an urgent need to understand and strengthen the means of protecting digital rights as part of the broader array of civil liberties and political rights. To advance these goals, training, best practices, advisory panels, and conferences that include digital advocacy groups, policymakers, security professionals, and citizens can accelerate the learning curve on these issues and find policy solutions that ensure freedom while paying critical attention to security demands.

**2.3.5** **Improvement in liveability and economic wellbeing**

According to Skogan (2006), among the latest wave of public safety tools is the use of public surveillance systems, often referred to as Closed-Circuit Television (CCTV). While public surveillance systems are widely employed in the business sector to improve security, until recently the use of cameras to monitor public spaces has been much less common in the United States, in part, due to concerns about privacy and civil liberties (Skogan Wesley, 2006).

Community policing, which embodies a combination of proactive crime prevention and community engagement with more traditional policing functions, may benefit from this technology because public surveillance can enhance problem solving strategies, aid in arrests and investigations, and ultimately increase offenders’ perceptions that they will be both caught and prosecuted. Public surveillance systems might also yield a secondary impact, serving to increase legitimate users’ perceptions of safety and thus their presence in public areas, which in turn may increase guardianship, improve police-community partnerships, and reduce crime.

Municipalities across the country are in a constant search for effective public safety interventions that will curb crime and improve the liveability and economic well-being of their communities. This is particularly true among law enforcement agencies that embrace a community policing philosophy, which has become a key component of policing efforts in most mid- and large-sized law enforcement agencies across the United States (Skogan Wesley, 2004). While many believe that the adoption of community policing has led to more efficient and effective policing strategies, (Fridell, Lorie and Mary Ann Wycoff, 2004), law enforcement agencies continue to grapple with limited resources and are therefore interested in employing new, cost-effective tools that can enhance their community policing efforts.

**2.3.6 Use of eavesdropping for local and overseas surveillance**

Eavesdropping is another surveillance technique that allows governments to access calls, texts, and the locations of phones around the world. This technique, most closely linked to the Bulgarian-based surveillance firm Circles, an affiliate of the National Security Organization Group, which developed the infamous Pegasus software, provides spyware technology to countries to exploit faults in telecom systems.

Several governments in African countries, such as Botswana, Equatorial Guinea, Kenya, Morocco, Nigeria, Zambia, and Zimbabwe, are reportedly using these systems to connect to their local telecommunications companies’ infrastructure to conduct surveillance.

**2.3.7** **Identification, reporting and follow-ups on criminality**

Bagala (2021) wrote that with the CCTV cameras, remote sensing is possible, and watching on a screen mile away from the scene as people converge for a demonstration or strike, setting off the alarm, ensuring quick dispatch of patrols and reaching the scene shortly after is impressive.

But in Uganda, rising cases where gangs riding on boda-boda rob unsuspecting victims in full glare of CCTV cameras have raised concerns about the effectiveness of the government project for example in July 2021, CCTV cameras captured a gang riding on boda-bodas attacking a man of Asian origin, who was also riding a motorcycle, and beat him up before robbing him of Shs5m and two mobile phones on Mawanda Road in Kampala, and according to police, they first treated the incident as an accident, before they called the area police, but the criminals executed the crime very fast sped off, so police was not able to get them immediately.

Also, a week earlier in July, a gang of four hit Chief Magistrate Gladys Kamasanyu with a blunt object before making off with her bag containing unspecified items at Greenhill Academy Kibuli on Mbogo Road in Kampala City around midday, but the suspects were yet to be arrested despite being captured on the police CCTV cameras. And further incidents like in March, four thugs attacked Kannankutty Krisnamaham and robbed from him €100,000 near Kitgum House junction on Jinja Road in broad daylight, the incident was captured by the police CCTV cameras, but police had not yet managed to get the suspects. This puts the CCTV camera project into disrepute since on opposition they are seen to work well, but on criminal gangs they take long to be useful.

# 2.3.8 Watch over and carry-on video surveillance duties on the streets

Muhawe (2020) wrote that CCTV cameras were commissioned to watch over and carry-on video surveillance duties on the streets of Kampala and other parts of the country. The thinking was that assassins and other criminals are in great trouble. The installation of the cameras came off as a knee-jerk reaction to the high crime rate and specifically assassinations of high-profile Ugandans.

The assassinations did not only target high ranking security officers, but also clerics and political leaders in Kampala and the surrounding districts, and even the civilian population has not been spared. Whereas the adoption of advanced technology as a solution to the insecurity in the country is a commendable one, the government needs to beware of a more security threat that is posed by the installation of CCTV cameras. This call is buttressed by vivid cyber-attacks that have been experienced by the more technologically advanced nations.

There are notorious examples that exhibit the short comings in the CCTV surveillance schemes that have exposed the vulnerability of the CCTV cameras as a mode of ensuring a secure and safe environment without crime for example days before US President Donald Trump’s inauguration, hackers infected storage devices on Washington, D.C. police video surveillance cameras with ransomware. This left 123 cameras in public spaces inoperable. In Japan, hackers disabled more than 60 Canon security cameras at businesses and waterways in cities across the country and the country was left on a standstill for a while. Hackers have often accessed traffic controlling cameras and caused havoc in cities around the world.

# 2.3.9 Offering physical security

Kamusiime (2019) pointed out that it is generally agreed that video surveillance in form of Internet Protocol (IP) cameras have long served as the workhorse of physical security, exposing, and even deterring criminal activity. Internet Protocol cameras offer better resolution and a wider field of vision than traditional analogy models, and they feature analytic and remote monitoring capabilities. However, the ever-changing technology has allowed hackers to turn the tables on these dependable devices and making surveillance cameras another piece of equipment that needs protection over and above the threat they intend to avert.

Muhawe (2020) added that the weaknesses in the Uganda CCTV cameras security approach are two-fold. These are a lack of the right cyber infrastructure coupled with the imbedded weaknesses in the technology itself. The President should consider that this security solution has to be supported by advanced ICT infrastructure and robust cyber security which the government has neglected. The infrastructural challenges of internet connectivity and power shading experienced by developing countries like Uganda are areas that will blur the results expected of this new security tool.

CCTV cameras need more secure packet layers in order to yield the desired results a situation which is still lacking in Uganda’s CCTV security system. Uninterrupted power supply, which is a rare commodity in Uganda, is another missing link that is likely to affect this new revered security linchpin.

Porter (in International Fire Security Exhibition and Conference, 2019), since 2014, with the growth of facial recognition, drones, body-worn cameras, analytics and much more. Modern systems now have “phenomenal capabilities”, though these have created understandable misgivings about the risk for privacy and potential abuse such capabilities create. Porter (2019) therefore noted that the Home Office and surveillance industry must ensure only hardware and software compliant with relevant standards, such as Secure by Default, is installed in public and private spaces alike.

In summary, the purpose of the use of the CCTV is to monitor public places, where they are installed to assist in the prevention and detection of crime. The completion of phase I, of this innovative project, will mark a significant point in what is a complex and intricate project (Kamusiime, 2019). The program works have been huge, and we are grateful to the CCTV project team for all their hard work. The CCTV system is also used for gathering information, supporting patrols within the KMP area, directing investigations, tackling anti-social and criminal behaviour, which range from nuisance to assaults and wounding, and other offences such as burglary, robbery, and murder. The recordings show the whole incident from the point the offender began to commit an offence to the end. The public should also note that the effect of CCTV cameras is enhanced when installed alongside other complementary measures, like police patrols, community vigilance, environmental designs, thus raising its credibility as a threat to offenders. The study needs to be expounded on the ways in which the CCTV camera system enables law enforcement agencies to obtain information on criminal incidents because CCTV operators are constantly monitoring the areas under surveillance and passing information to the Police Command Centre, about incidents which require police response.

**2.4The relevance of CCTV Camera system in storage and retrieval of information on crime incidents to enable law enforcement agencies track and prosecute criminals**

This section of the literature review is about the relevance of CCTV Camera system in storage and retrieval of information on crime incidents to enable law enforcement agencies track and prosecute criminals. It focuses on the following sub-themes; effective utilization of video cameras in surveillance of a particular area, alarm notification, psychological preparation of the population, monitoring and eradication of crimes, video retrieval, Video footages as evidence in court, video analytics, license plate recognition, facial recognition, artificial intelligence-enabled solutions, edge technology and real-time video streaming, analytics-based security approach, obtaining forensic samples, promoting international and national cyber security policies and biometrics and automation.

# 2.4.1 Effective utilization of video cameras in surveillance of a particular area

Closed-circuit television utilizes video cameras in surveillance of a particular area using a limited number of surveillance monitors. Almost all video cameras fit in the usage as the CCTV cameras, although the ones used must have high definition for accuracy in monitoring mainly in banks, supermarkets, casinos, airports, military institutions, and convenience stores. In most cases, the cameras function in deterring crime from occurrence and minimizing the levels in places where it cannot stop completely. According to Jewitt (2007), in many parts of America, Europe, and Asia, CCTV surveillance proved one of the best ways of crime prevention as the criminal cases decreased proportionately as more of the cameras came into existence. However, the comfort from their use lasted no long as the people soon went back to the old ways. Old crimes started to resurface thus a good number of people began to lose faith in the cameras. This paper evaluates how effectively CCTV can help deal with the criminal cases with the goal of determining the relevance and benefits of their application and use.

**2.4.2 CCTV camera systems and alarm notification**

Alarm notification is the best way that the CCTVs can function in prevention and reduction of crime. According to Guha (2002), in most of the stores where the surveillance security applies, the commodities or area covered deems specific and clear. The case withstanding, the security personnel can protect the main item or area of focus by connecting it to alarm notification in case of criminal moves.

In this kind of protection, the activities and movements in a particular area must fit into a program from which deviation alerts the alarm. Items made of glass prove the best to secure using the automatic alarm connection because the breaking attempts fit into many alarm programs easily. Any attempt made to break the glass trickles the alarm hence the whole security detail gets the signal and action can follow faster. Using the automatic alarm notification prevents the crimes from occurring by short intervals, although the protection cannot miss the attention of the security due to its attention demand and command.

# 2.4.3 Psychological preparation of the population

The psychological effect of the presence of surveillance serves as the greatest step in crime reduction and prevention. CCTV protection serves to remind the people of their security measures that they would otherwise forget easily. Psychologically, people understand that a place under surveillance may deem insecure if the security did not exist. In such cases, people walking, working, or operating in the protected areas take more measures to protect their property thus the CCTV psychologically prevents crime by influencing the potential victims. The potential criminals can also experience the psychological effect not to commit crime in places, which appear secured (Baum, 1997 p. 23). Robbery on moving trains in Brazil deemed so rampant before the trains started using the CCTVs because the criminals felt no pressure in executing the illegal activities towards the passengers. Immediately the CCTVs came to force, the cases disappeared. The criminals understand that any evidence beyond doubt of their activities may lead them to court (Harris et el, 1998 p. 160). Due to experiences, the criminals also understand that the CCTVs maximally provide any evidence of crime in the areas targeted. Psychologically, the criminals fear executing their activities as the authorities can easily catch them. CCTVs thus affect the criminals psychologically to stop their activities.

Gips (2006) noted that when the number of people in a particular place increases, the criminal activities decrease, as there are more witnesses in case any crime would occur. More so, targeting particular people when the crowd deems large cannot happen easily thus the CCTV presence only can deter crime. The CCTVs receive unlimited praise for their proven prowess in crime prevention and protection although they do not function to maximum prevention. Deterring crime using the CCTVs may deem tricky due to several factors. First, the criminals could easily change their target.

The cost of making sure that all the avenues for crime seal using surveillance cameras deems too high to undertake, and when a particular area attracts attention as prone to crime, security will likely beef up in the area and the next step likely falls to the CCTVs (Devine, 2006 p. 29).

# 2.4.4 Monitoring and eradication of crimes

According to Guha (2002), most of the people wonder about those who commit intentional crimes publicly. Some people know the repercussions of the activities they engage in, especially the criminal activities yet they still go ahead and do them. The CCTVs provide evidence that the people committed the crimes but do not deter them from the same. In fact, the people may get motivation to do more damage because they know that they get into the trap anyway. In this regard, as much as the surveillance creates a feeling of security in a particular area, some crimes go beyond the mere ability of surveillance thus the security agents cannot fall back and resign to the CCTVs. In advanced cases especially with the alarm-programmed CCTVs, some activities do not deem criminal to the CCTVs apart from the programmed crimes. People can thus commit unique mistakes and crimes and still get away with them because the crimes do not show in the CCTV cameras (Wilner, 2005). CCTV helps in monitoring and not the actual eradication of crimes.

# 2.4.5 Video Retrieval for evidence and security decision making

According to Nestel (2006), investigators employ a variety of methods to learn whether a camera was located near the scene of a crime being investigated. In some cities, incident reporting forms include a box that the responding officer can check to indicate that a camera was in the general vicinity of the crime scene. In other jurisdictions, police departments maintain a centralized list of all camera locations, whereby an investigator needs only to reference the list to determine whether a camera could be potentially helpful; in some cases, computerized mapping is employed for this purpose. Many investigators, however, indicate that they know where most of the cameras are in their jurisdictions from previous experience, based on an intimate knowledge of the neighbourhood in their area.

The locations of existing cameras in a city can be invaluable because investigators must often request video footage quickly after receiving the facts of the case. As pointed out by Skogan (2006), camera hard drives typically have enough memory to record on a continuous loop for 24 to 72 hours depending on the model of the camera and size of the hard drive before overwriting the previously recorded footage. Thus, an investigator may lose critical investigative information if he or she is not able to act quickly. For several cities, however, the process is streamlined so that an investigator can either access images directly, allowing for immediate review, or submit requests to a technician and receive the recording from one or more cameras in as little as one hour.

According to Hampapur et al., (2005; 2015), while investigators are always hopeful that a camera recorded the crime of interest in its entirety with perfect clarity, useful information can often be obtained from surveillance footage even when the recording captured only parts of the event, or the resolution is poor. With a stationary camera, if it happens to be pointed in the direction of a crime, it may be able to capture it more fully. With these cameras, however, events not within its immediate views are not captured (HampapurArun et al., 2005). Panning cameras, on the other hand, can survey larger areas, but their drawback is that during passive (non-monitored) surveillance, they may pan away from a crime in-progress. Even with seemingly incomplete video recordings, investigators can piece together information to identify the perpetrators, victims, and witnesses to a crime. This has been particularly useful for investigators combating a culture of “no snitching.” Armed with proof that a particular person was in fact present at a crime scene, investigators have found it easier to persuade a witness to speak with them.

In addition, cameras enable investigators to recreate the sequence of events leading to, during, and following the incident. In some cases, camera footage has revealed that an individual who appears to be the obvious victim was the aggressor. Recorded video has also been useful in identifying evidence that might not otherwise have been recovered through traditional investigations, such as license plate numbers of vehicles used by individuals at the scene of the crime or the location of weapons discarded by perpetrators after commission of the crime (Hampapur, Arun, Lisa Brown, Jonathan Connell, 2005).

Once video is retrieved, it becomes evidence in a case and is subject to all the reporting and chain-of-custody requirements that are applicable to other pieces of evidence. In order to protect the rights of those who are documented on camera and the admissibility of the footage in court, proper storage policies surrounding where and for how long the recorded video should be kept becomes an important legal concern. There is no set standard for the period of time that video footage should be retained once it is downloaded from cameras.

However, the CCTV Code of Practice, which is guided by the United Kingdom’s Data Protection Act, advises that “images should not be retained for longer than is necessary” (Information Commissioner’s Office 2008: 14) and should be guided by the purposes for which the footage was recorded. This advice is echoed by The Constitution Project, which prescribes that “recorded footage lacking evidentiary or other documented value should be destroyed as a matter of course after a specified time.

Any decision to retain footage past the time period allotted in the policy should be specifically documented for subsequent review and audit” (Constitution Project: 26). For example, if footage was explicitly captured while developing a case against a known group of organized criminals, prudence suggests that the footage is retained throughout the period of prosecution and case disposition, if not beyond that period. However, retaining footage of everyday activities with no explicit law enforcement or criminal justice purpose increases the risk that the footage will be misused and that individual privacy rights will be violated. This underscores the importance of ensuring that footage is both stored and destroyed securely (Phillips, P. J., W. T. Scruggs, A. J. O’Toole, P. J. Flynn et al., 2007, 2011).

# 2.4.6 Video footages as evidence in court

According to Braga (2006), video footage can be powerful evidence in court, but it cannot take the place of witness testimony. Attorneys who have used video in courts report that jurors view footage as an unbiased account of the events in question. This perceived reliability can be an asset or a hurdle for attorneys. Footage alone typically does not include audio and could have a poor image quality and presents a completely objective view of what transpired. Nonetheless, most attorneys recommend using any available footage, as the lack of expected footage can be more of a handicap than poor footage (King, Jennifer, Deirdre Mulligan, and Steven Raphael, 2008). Braga (2006) adds that when presenting video footage, a police officer is often required to authenticate and explain events as they unfold. Video footage can also be used to confirm or refute the testimony of individuals at the scene of the incident. Even small details about the scene, timeline, or actions surrounding the incident can be used to create reasonable doubt or bolster witness credibility.

# 2.4.7 Video Analytics

Marcus Nieto (1997, 2021) writes that a video analysis system provides defensible numbers and allows the police to better allocate resources for public law and order situations. These analyses can be done in real-time or be based on archived video. This helps proper utilization of resources and helps prevent mass agitation. CCTV video surveillance systems can passively record and play back video at certain intervals, be actively monitored by security personnel, or use a combination of these methods. Law enforcement personnel actively monitor most municipally operated systems, although volunteers and private security are also involved in some projects.

Video analytics, especially when coupled with surveillance cameras, can potentially support a variety of law enforcement activities. Among them are tracking of movement in areas restricted by police; detecting moved objects, which may indicate a theft has taken place, or the converse; detecting the addition of an object, which could be an abandoned object containing an explosive or other device; and identifying a shooting based on the muzzle-flash emitted by a firearm. Such a technology may enhance both passive and active monitoring activities (National Institute of Justice, 2003). Even among jurisdictions that engage in active monitoring, there are countless hours of activity that go unmonitored, and in passive monitoring jurisdictions, even more footage goes unwatched.

A 2015 budget paper for the ministry of internal affairs said there were about 5,500 detectives, Twine (2015) states that police must turn to civilian experts if they need DNA analysts, toxicologists, or fibre experts, and he hoped CCTV footage was the answer, letting investigators know who has committed the crime, how did he commit it, which route did he take, and which tools did he have. Though some current and former law enforcement officials are sceptical that hi-tech aids such as CCTV or new forensic tools such as planned DNA and fingerprint databases will influence crime where Uganda's police are poorly paid and have little investigative training (Herbert Karugaba, 2019). Uganda's Human Rights Awareness and Promotion Forum (2016) with their CCTV running in May 2016 when robbers killed a guard and stole computers, they gave the video to police, but police had never done anything. Jjuuko (quoted by Biryabarema, 2019) noted that if there's no political will to investigate or prosecute crime, nothing will change, so it is all nonsense, CCTV, or no CCTV.

# 2.4.8 License plate recognition

A License Plate Recognition (LPR) system does exactly what the name suggests: it is able to scan license plates on vehicles, even those moving at high speeds and check the plates against state and federal databases to determine if the car was reported stolen or if the driver has any tickets or outstanding warrants. Though there are a variety of vendors selling various models, most LPR systems employ one or more cameras mounted on or in a police vehicle. For those models utilizing multiple cameras, the preferred placement is on the light bar across the roof of the car. These cameras link to the police cruiser’s computer and display images on the computer’s screen. If more than one camera is being utilized, a split-screen display is used to show two vehicles at a time (Brandon C. Welsh and David P. Farrington, 2009, 2012).

According to Agustina&Clavell (2011), the cameras often have more than one mode, such as regular color capture as well as infrared (for use at night); some have other settings such as multiple pictures using varying shutter speeds and anti-glare features to combat the weather and other elements that may inhibit the system’s ability to read and process the license plate. These systems can scan in excess of 3,000 plates in a given patrol shift, whereas the average officer checking manually may only be able to process 100–200 license plates per shift. While the license plate images are being displayed on the screen, they are simultaneously being compared against databases to which the system has access (Agustina&Clavell, 2011; Webster, Töpfer, Klauser, &Raab, 2011). For example, the images could be run through a database containing all locally stolen vehicles, vehicles wanted because of their use in the commission of a crime, vehicles with warrants issued for the owner of the vehicle, and any other state or federal databases that the system has access to as well.

# 2.4.9 Facial recognition

In a publication by Woodward et al., (2003), as with license plate recognition systems, the power of facial recognition systems rests with an underlying database from which a unit scanning an image in real-time can compare it to in order to relay important information to law enforcement. Facial recognition technology captures images continuously and transmits those images to a computer using a pre-programmed algorithm that matches the image to a face in the database (Woodward, J., C. Horn, J. Gatune, and A. Thomas, 2003). The camera’s software is programmed to identify eyes, nose, mouth, and or ears, due to their relatively stable distance away from each other, and these combined data points are flagged as an image of a face.

After this process, the face a set of landmarks at given distances away from each other is scanned into a database containing facial images of known criminals.

According to Phillips et al., (2007), currently, however, facial recognition could only be instituted if all images were taken in a controlled setting, with ideal lighting and a full facial image of the subject. This limitation, combined with the challenges of developing a robust database of facial images of known suspects, may render the technology inappropriate for adoption at this time. In the future, however, partnering facial recognition systems with a city’s public surveillance cameras seems logical. The cameras could be integrated with software enabling facial scanning while the camera is recording in both active and passive modes (Litch, M., M. Calhoon, P. Scharf, et al., 2006). Given the potential for merging these technologies within a single unit, facial recognition technology holds promise for providing added value to both proactive and reactive crime surveillance. Incorporating video analytics into existing infrastructure is the clear solution, as the technology enables legacy assets, such as analog CCTV cameras, to become more than just after the fact evidence gathering tools and instead be used to help enhance real-time responses to unfolding incidents (Long Kenny, 2021).

# 2.4.10 Artificial Intelligence-Enabled Solutions

D’Souza (2019) states that artificial intelligence-enabled solutions are trained using vast datasets of images and video footage, to better understand people, objects and vehicles that are captured on film, and they continue ‘learning’ and improving, while in use. The system’s algorithms analyze and prioritize input from video data to decide which inputs are of value, automatically classifying the footage and notifying security personnel accordingly. This reduces response times by notifying CCTV operators of an incident, as it happens, meaning law enforcement and security personnel can react faster and intervene in an ongoing situation.

D’Souza (2019) further reveals that a key consideration should be choosing a technology that can operate at the edge and deliver real-time video streaming, even at the lowest bandwidths, so it isn’t limited to use in areas with good connectivity, which would exclude most remote areas. Quality really does matter and technology that can operate over low bandwidths is crucial for allowing operators to zoom in on areas of interest, such as a car number plate or face, and retrieve full-resolution images that can make a real difference in ongoing investigations.

# 2.4.11 Analytics-based security approach

Introducing an analytics-based security approach would also help curtail the rising cost of tackling crime. Introducing an analytics-based security approach would also help curtail the rising cost of tackling crime. Research conducted by the UK’s Labour Party, 2020 recently found that the annual cost of crime reached a staggering £100 billion. While statistics show that crime rates in general have been stable over recent years, experts point to the increase in specific types of violent crime, such as knife crime which rose by over 20% during 2020.

From https://www.telegraph.co.uk/news/2018/11/06, the use of biometrics in crime solving is not new. Be it fingerprint, face, DNA, scars or tattoos, biometric data is the safest, most accurate way to identify an individual. Once combined with automation technology and artificial intelligence that process multiple biometrics automatically, the required verification and identification steps can be done much faster and with the same precision, but also with ease. As the global leader in biometrics, augmented identity in a connected world in which the security of identity has become essential, especially when it comes to financial transactions, has over 40 years’ experience in working alongside the world’s leading law enforcement agencies.

In summary, the study gap identified is about the relevance of CCTV Camera system in storage and retrieval of information on crime incidents to enable law enforcement agencies track and prosecute criminals through effective utilization of video cameras in surveillance of a particular area, alarm notification, psychological preparation of the population, monitoring and eradication of crimes, video retrieval and so on. The study aimed at ensuring that the gaps is filled which was adequately done.

**2.5 The challenges faced in using the existing CCTV Camera system to produce adducible operation in providing incriminating evidence to prosecute criminality**

This section focuses on the challenges facing the CCTV Camera system operation in providing evidence to prosecute criminality under the following subthemes: lack of capacity in terms of expert personnel, there are no checks and balances, expensive to afford and sustain, hacking is common, inadequate power infrastructures to run the CCTV system, breach of private security systems, lack of independence in the CCTV system and security officers misuse the footages.

**2.5.1 Lack of capacity in terms of expert personnel**

According to Aubrey (2020), many African countries lack the capacity in terms of expert personnel to facilitate the development and implementation of cyber security policy and regulatory frameworks. A common regulatory approach offers a collection of tools, policies, and guidelines that can enable local actors to protect their cyber environments more quickly. The absence of a clear regulatory framework leaves many African countries vulnerable to misuse of surveillance technologies. Tapping available training content and programs consistent with domestic realities can support digital rights advocates and other stakeholders with essential facts and frameworks to engage constructively with the demands of digital rights and security concerns.

**2.5.2 There are no checks and balances**

The spread of surveillance technology in Africa without adequate checks and balances is reshaping the governance landscape while potentially enabling another tool of repression. In 2019, Kampala police procured $126 million worth of closed-circuit television camera (CCTV) surveillance technology from Chinese telecommunications giant Huawei to help control the city’s growing crime problem. Opposition and civil society leaders contend that the surveillance cameras, which rely on facial recognition technology, will be used instead to track, and target government critics.

This concern appears justified as an independent investigation has found that Ugandan intelligence officials are using the technology to crack the encrypted communications of popular singer and opposition leader Bobi Wine (Bulelani, 2020). Similar concerns have emerged across the continent as over a dozen African countries have deployed surveillance devices in recent years. These countries represent a range of political systems, and the intended purposes of the surveillance systems vary. Nonetheless, these technologies present challenges to democratic norms and practices. Specifically, activists and digital rights organizations have raised concerns over privacy.

The introduction of these technologies without institutional checks and balances renders citizens more vulnerable to political surveillance and suppression. The growing accessibility of monitoring products in Africa has been made possible by the sales of foreign technology supported by soft loans, primarily from China. In addition to Huawei and other Chinese firms, which have built roughly 70 percent of the 4G network infrastructure on the continent, private cyber security and surveillance firms from Israel, the United Kingdom, Germany, and Italy, among others, have also been active in Africa.

# 2.5.3 Expensive to afford and sustain

For Duguid (2006), unless there is a crime reported in the area, it is unlikely that anyone would spend precious resources reviewing this footage. By using video analytics, however, the review process could be automated and would require human intervention for only those items in which the user defined parameters resulted in an incident being flagged. In this manner, crimes that may have gone unreported as well as other activity of interest to law enforcement would become known to police whereas without video analysis, that information would not be discarded. Except for license plate recognition systems, very few jurisdictions in the United States currently have video analytic systems integrated with other law enforcement technologies that they might use.

# 2.5.4 Hacking is common

Bulelani (2020) adds that remote-control hacking is another form of surveillance technology that is spreading across the continent. These surveillance systems enable governments to access files on targeted laptops. They also log keystrokes and passwords as a means to turn on webcams and microphones. The growing accessibility of monitoring products in Africa has been made possible by the sales of foreign technology supported by soft loans, primarily from China.

# 2.5.5 Inadequate power infrastructures to run the CCTV system

Without being a pessimist, unless the government addresses the infrastructural challenges by providing dedicated infrastructure for the CCTV cameras in form of uninterrupted power supply and high-speed internet, the installation of CCTV cameras will not be an assurance of the safest, secure and on the go solution for averting crime in Kampala. From a technological research point, it has been established that as countries opt for advanced Internet Protocol cameras, they expose themselves to hackers who, often, can easily gain access to system networks, changing or stealing data and rendering cameras useless. From a professional standpoint, the internet protocols used in our CCTVs are an easy go for potential attacks. Each internet protocol camera is a unique, connected device with its own passwords and security settings. Poorly configured devices with design flaws or faulty firmware, combined with a “set it and forget it” mindset, can give hackers easy access to manipulate video footage.

Muhawe (2020) adds that this would potentially compromise other critical systems housed on the same network which is the case with Uganda. The vigilance that the powers that behave exhibited in installing the CCTV cameras should be replicated in ensuring advanced cyber infrastructure and a deliberate approach to avert cyber-attacks, and in that way, the Ugandan government will maximise the desired goal of a safe city, a safe Uganda.

# 2.5.6 Breach of private security systems

Biryabarema (2019) wrote that a forest of slender white poles topped with dark, unblinking eyes is quietly sprouting on the rubbish-strewn, potholed street corners of the Ugandan capital. The development came because of the directive by the Ugandan president to have security cameras installed to curb crime in Uganda. On the contrary though, Biryabarema, 2019 brought out the concern of the opposition leaders who stated that law enforcement agencies are too corrupt and overburdened to use the footage to identify criminals. They worry police may use the cameras, which have facial recognition technology, to target demonstrators in violent clampdowns as an election approached in 2021. Tuninawe (quoted in Biryabarema, 2019) noted that the CCTV project is just a tool to track opposition, hunt them and persecute them, because facial recognition technology has become increasingly pervasive around the world, raising concerns about potential abuses. Huawei technicians have already helped intelligence officials in Uganda and at least one other African country spy on their political opponents (Wall Street Journal, 2019), and in Uganda, they helped crack the encrypted communications of popular musician turned politician Bobi Wine which enabled police to stop his concerts, arrested him and dozens of supporters. Furthermore, in Zambia, Huawei employees helped the government access the phones and Facebook pages of bloggers critical of the president so they could be tracked and arrested. So, this breach could play to the advantage of the government security agencies more so police to terrorize and selectively prosecute those in opposition in Uganda.

According to the Wall Street Journal of New York, 2019, in Africa, Huawei has sold CCTV systems to countries such as Kenya, Egypt and Zambia where activists have raised similar concerns over privacy and effectiveness. In Europe, France, Germany, and Serbia have small projects with Huawei's initiative. And the US government has restricted trade with Huawei and four other Chinese firms, accusing them of espionage and stealing intellectual property. It is also lobbying to persuade US allies to keep Huawei out of next generation 5G telecommunications infrastructure, citing concerns the company could spy on customers.

# 2.5.7 Lack of independence in the CCTV system

Lack of independence in the CCTV system gives a huge loophole to the criminals in case the gang may come when organized. Guthrie (2001) infers that most of the criminals understand that the CCTVs function with electric power and that it takes them time to readjust after the lights go off. Consequently, an organized group of people with criminal intentions can easily undertake criminal activities and go unnoticed if they tamper with the power line first. The transfer of the video signals from the high-definition cameras to the monitor screens occurs through signals sent through straight transmissions. Due to advances in technology, the criminals can easily hack into the signals and tamper with them to facilitate their criminal activities (Duguid, 2006 p. 69).

# 2.5.8 Security officers misuse the footages

Poor pay and living conditions encourage corruption, and Ugandans frequently swap stories of police who demand bribes, meaning some crimes go unreported. At police stations, evidence moulders while cases await trial (Mike Chibita quoted in Biryabarema, 2019), exhibits disappear or decay, witnesses disappear or forgotten. Expensive tools also do little to address underlying causes of crime, such as high unemployment or disputes over land. Four out of every 10 young Ugandans are out of work. Of those with jobs, about 80% work in low-paid informal jobs, so cameras are an expensive election ploy, so if someone is determined to kill or steal, a camera would be a small obstacle. In addition, Tugume (cited in Biryabarema, 2019) noted that this is a waste of money by politicians to create a false perception that government is acting on crime.

In summary, using public surveillance systems with CCTV cameras for crime control and prevention is designed to guide law enforcement agencies, and their partners in implementing and employing public surveillance systems in a manner that will have the greatest impact on public safety. It details the various aspects of a system that are integral in yielding a cost-beneficial impact on crime, including budgetary considerations, camera types and locations, how best to monitor cameras, and the role that video footage plays in investigations and prosecutions. The study was able to fill the gap on the challenges faced in using the existing CCTV Camera system to produce adducible operation in providing incriminating evidence to prosecute criminality.

# 2.6 Conceptual framework

**Independent variable Dependent variable**

**Crime mapping technologies (CCTV Security Cameras)**

* General reconnaissance and recording crime incidents
* Detecting particular crime
* Storage and retrieval of information on crime incidents

**Law enforcement**

* Identifying and leading to arrest of criminals
* Gathering Information for security decision making for safety of society
* Availing evidence which can be adduced in courts of law against criminals

**Moderating variables**

* The prevailing laws, rules and regulations
* Community-security agency liaison
* Computer management and proficiency of knowledge and skills and system effectiveness

***Source: Based on the model developed by Wamwa, Jackson Samuel (2012), and modified by the Researcher, 2021***

# 2.7 Conclusion

Khosravi and Gholamalinejad (2020) pointed out that many countries now employ public video surveillance as a primary tool to monitor population movements and to prevent crime and terrorism, both in the private and public sectors. The police can identify criminals recorded with cameras. Through surveillance cameras, the police can both prevent crimes from happening and can quickly solve criminal cases with material evidence. Surveillance cameras protect against property theft, and vandalism. It is very difficult to get away with stealing something if there are cameras filming you. Surveillance cameras will catch the thief before, or during the process of committing the crime. If no one is aware of the crime until after it has been committed, the surveillance footage is always a crucial piece of evidence during a police investigation. Surveillance cameras have and will provide a solution to many crimes (Agustina&Clavell, 2011; Webster, Töpfer, Klauser, &Raab, 2011).

At the face of it, CCTV appears as one of the most effective ways to prevent occurrence of crimes. People with plans to undertake criminal activities cannot go ahead because they can appear on the monitoring screens and face trial. Evidence deems circumstantial and accurate when the CCTVs function in security (HosseinKhosravi and HosseinGholamalinejad, 2020). Crimes can also reduce due to the feeling of security among the people that eradicates fear thus CCTVs yield more results that are positive. However, the CCTV security can yield enormous setbacks especially where they do not have sufficient monitoring. Consequently, the CCTVs show the best protection and security beef although they should not function to replace but rather to supplement the existing security systems.

According to Webster et al., (2011), criminals are less likely to commit crimes in the area if they know they are going to be being filmed the whole time. Unscrupulous activities like shoplifting hardly seem worth it when pitted against the possibility of going to jail. Having cameras in public places make people feel safe since if people know that there are cameras around them, they will most likely not do anything stupid. People feel safer in the knowledge that a potential mugger or attacker will be put-off by the presence of a camera. Cameras, through video analytics, now can zoom in to reveal someone’s identity which can be beneficial to crime prevention when used in the correct way.

# CHAPTER THREE

# METHODOLOGY

# 3.1 Introduction

# This chapter covers the research design, the study population, the sample size, sampling techniques, methods of data collection, procedure of data collection, data management and analysis, reliability, and validity of the research instruments as well as data processing and analysis among others.

# 3.2 Research approach

Both quantitative and qualitative research approaches were used in this study.

**3.2.1 Qualitative approach**

According to Tola (2021), qualitative research is expressed in words to understand concepts, thoughts, or experiences. This type of research enables you to gather in-depth insights on topics that are not well understood using methods such as interviews with open-ended questions, observations described in words, and literature reviews that explore concepts and theories. Qualitative data collection plays an important role in monitoring and evaluation as it helps you investigate deeper into a particular problem and gain a human perspective on it. Qualitative data provides in depth information on the more intangible factors which in this case is the efficacy of crime mapping technologies and law enforcement like experiences, opinions, motivations, behaviours or descriptions of a process, event, or a particular context relevant to the study. Also, qualitative approach uses people’s stories, experiences, and feelings to measure change, therefore the qualitative approach is more open, informal, and unstructured or semi-structured and it provides more flexibility in how data is collected.

**3.2.2 Quantitative approach**

According to Streefkerk (2021), the quantitative approach uses numbers and statistics to quantify change and is often expressed in the form of digits, units, ratios, percentages, proportions and so on. This approach is more structured, straightforward, and formal. Quantitative data is used to quantify attitudes, behaviours, and other defined variables on the efficacy of crime mapping technologies on law enforcement in Uganda, more so Security Cameras in Wakiso District. Quantitative data uses measurable data to formulate facts and uncover patterns in research. Examples of qualitative data collection methods include focus groups, observation, written records, and individual interviews. Quantitative research presents data in a numerical format, enabling researchers to evaluate and understand this data through statistical analysis.

The quantitative approach will use the structured closed-ended interview with definite answers based on the Likert Scale, closed ended surveys and questionnaires, hypotheses that state an expected relationship between the efficacy of crime mapping technologies on law enforcement with correlation research, causal-comparative and statistical data review from research studies and other sources of statistical data.

# 3.3 Research design

The research was carried out following a cross-sectional survey design. According to Hulley et al., (2001), cross-sectional study design is a type of observational study design. Cross-sectional designs were used for population-based surveys and to assess the prevalence of diseases in clinic-based samples. These studies can usually be conducted relatively faster and are inexpensive. In a cross-sectional study, the researcher measured the outcome and the exposures in the study participants at the same time. The participants in a cross-sectional study were selected based on the inclusion and exclusion criteria set for the study. Once the participants had been selected for the study, the researcher followed the study to assess the exposure and the outcomes related to the efficacy of crime mapping technologies on law enforcement in Uganda, particularly with Security Cameras in Wakiso District. The study of the association between the efficacy of crime mapping technologies and law enforcement. It was also possible that the researcher would recruit the study participants and examine the outcomes in this population as well as estimating the prevalence of the outcome in those surveyed. The cross-sectional survey research design was chosen because it put into consideration constraints of cost, created quickly, administered easily and it helped the researcher to collect information on wide range of issues that include personal facts, attitudes, past behaviours, and opinions.

The researcher used the cross-sectional survey to collect data to make inferences about a population of interest at one point in time. Cross-sectional survey design was further used to collect data through snapshots of the populations about which the data is gathered.

# 3.4 Target and study population

According to Osikhotsali (2021), a population is a distinct group of individuals, whether that group comprises a nation or a group of people with a common characteristic. Osikhotsali (2021), wrote that a research population is generally a large collection of individuals or objects that is the focus of a scientific query. A research population is also known as a well-defined collection of individuals or objects known to have similar characteristics.

**3.4.1 Study Population**

According to Neuman (2000), study population is a subset of the target population from which the sample is selected, and usually operationalised by the sample frame; hence it may be appropriate to say that sample frame is an operationalized form of study population. For example, the study is going to conduct a survey of security officers (particularly the police officers in Wakiso District), local leaders (in Wakiso District), Boda Boda Cyclists (in Wakiso District) and the entire community in Wakiso District. It is from this category of people that the researcher obtained the sample for this study. Since the area and the population is so big to be explored, the researcher selected Police Officers including DPCs (03 that is 01 for Entebbe Sub District, 01 Kasangati Sub-District and 01 for Wakiso District as a whole), O/Cs (about 123 from the Town councils and Sub-Counties as well as Municipalities- info@wakiso.go.ug), CID officers (123, info@wakiso.go.ug), police officers and special police constables (number not ascertained for security reasons, but 40 were chosen), the Local leaders (27 including district Chaiperson, Municipality, Town Councils and Sub-Counties’ leaders), Boda-Boda cyclists (no official numbers available, but the study chose 33) and the community ( numbering over 2,499 million according to UBOS, 2021, but the study chose 53). From this study population, the researcher was able to obtain the sample using the Krajie and Morgan table of 1970 for each category of the population. The target population for this study was 153 from who the sample was obtained.

**3.4.2 Target Population**

According to Barnsbee (2018), before research can begin the target population must be identified and agreed upon. The target population is the entire population or group that a researcher is interested in researching and analyzing. The target population for the research is the entire set of units for which the survey data are to be used to make inferences. Thus, the target population defines those units for which the findings on the efficacy of crime mapping technologies on law enforcement are meant to generalize. For this research, the target population is well defined and constitutes the Police Officers including DPCs (03 that is 01 for Entebbe Sub District, 01 Kasangati Sub-District and 01 for Wakiso District as a whole), O/Cs (about 123 from the Town councils and Sub-Counties as well as Municipalities- info@wakiso.go.ug), CID officers (123, info@wakiso.go.ug), police officers and special police constables (number not ascertained for security reasons, but 40 were chosen), the Local leaders (27 including district Chaiperson, Municipality, Town Councils and Sub-Counties’ leaders), Boda-Boda cyclists (no official numbers available, but the study chose 33) and the community ( numbering over 2,499 million according to UBOS, 2021, but the study chose 53).

# Table 3.1 Distribution of the study population

|  |  |
| --- | --- |
| **Category of the population** | **Target population** |
| Police officers (eg DPCs, O/Cs, CID officers, police officers and special police constables) Selected) | 40 |
| Local leaders (Selected) | 27 |
| Boda-Boda cyclists (Selected) | 33 |
| Traders (Selected) | 53 |
| Community members (Selected) | 30 |
| **Total** | **153** |

**Source: primary data, 2021**

# 3.5 Sampling

According to Tuovila (2020), sampling is a process used in statistical analysis in which a predetermined number of observations are taken from a larger population. Thus, Sampling is a technique of selecting individual members or a subset of the population to make statistical inferences from them and estimate characteristics of the whole population. The methodology used to sample from a larger population depends on the type of analysis being performed, but it may include simple random sampling or systematic sampling.

# 3.5.1 Sampling methods

According to Tuovila (2020), sampling in research is of two types which are probability sampling and non-probability sampling. Probability sampling: Probability sampling is a sampling technique where a researcher sets a selection of a few criteria and chooses members of a population randomly. All the members have an equal opportunity to be a part of the sample with this selection parameter.

Non-probability sampling: In non-probability sampling, the researcher chooses members for research at random. This sampling method is not a fixed or predefined selection process which makes it difficult for all elements of a population to have equal opportunities to be included in a sample.

# 3.5.2 Sampling techniques

The researcher used the simple random and purposive sampling techniques. With the simple random sampling, Amin (2005) noted that is a sample obtained from the population in such a way that potential respondents of the same category have equal chances of being selected at the same level for example police officers, Boda-Boda cyclists, special police constables, traders, and the Community members. While judgmental or purposive sampling as Amin (2005) also noted, the researcher applied judgmental or purposive sampling about which respondents to choose and pick only those who best meet the purpose of the study. In this study, purposive sampling was applied to local leaders, DPCs, CID officers and O/Cs who are believed to have privileged information required in this study.

# 3.5.3 Sample size determination

Kibuacha (2021) noted that sample size is a research term used for defining the number of individuals included in a research study to represent a population. The sample size references the total number of respondents included in a study, and the number is broken down into sub-groups such as Police officers (eg DPCs, O/Cs, CID officers, police officers and special police constables), local leaders, Boda-Boda cyclists and community members. Determining the appropriate sample size is one of the most important factors in statistical analysis.

The sample for this study is chosen using the Krejcie and Morgan Table (Appendix 1: Table for Determining Sample Size for a Finite Population).

# Table 3.3 Distribution of the study population and sample size are drawn from Krejcie and Morgan Table

|  |  |  |
| --- | --- | --- |
| **Category of respondents** | **Study population** | **Sample size** |
| Police officers (e.g., DPCs, O/Cs, CID officers, police officers and special police constables) Selected) | 40 | 36 |
| Local leaders (Selected) | 27 | 24 |
| Boda-Boda cyclists (Selected) | 33 | 28 |
| Community members | 53 | 48 |
| **Total** | **153** | **136** |

**Source: primary data, 2018**

The sample for this study comprised 136 respondents

**3.6 Research data**

Mesly (2015 and 2016) defines data as a set of values of qualitative or quantitative variables. Data is facts or figures from which conclusions can be drawn. Before one can present and interpret information, there has to be a process of gathering and sorting data. Just as trees are the raw material from which paper is produced, so too, can data be viewed as the raw material from which information is obtained. Data as a general concept refers to the fact that some existing information or knowledge is represented or coded in some form suitable for better usage or processing. Data is collected and analyzed; data only becomes information suitable for making decision in some fashion. Gathering data can be accomplished through a primary source (researcher is the first person to obtain the data) or a secondary source (the researcher obtains the data that has already been collected by other sources, such as data disseminated in a journal).

**3.7 Data Collection**

As Rueda (2016), data collection is defined as the procedure of collecting, measuring, and analyzing accurate insights for research using standard validated techniques. A researcher can evaluate their hypothesis on the basis of collected data. In most cases, data collection is the primary and most important step for research, irrespective of the field of research. The approach of data collection is different for different fields of study, depending on the required information. The most critical objective of data collection is ensuring that information-rich and reliable data is collected for statistical analysis so that data-driven decisions can be made for research. Data collection tools refer to the devices/instruments used to collect data, such as a paper questionnaire or computer-assisted interviewing system. Case Studies, Checklists, Interviews, Observation sometimes, and Surveys or Questionnaires are all tools used to collect data.

**3.7.1 Primary data**

According to Douglas (2015), primary data is a type of data that is collected by researchers directly from main sources through interviews, surveys, experiments and so on. Primary data are usually collected from the source where the data originally originates from and are regarded as the best kind of data in research. Primary data is one which is collected for the first time by the researcher while secondary data is the data already collected or produced by others.

**3.7.2 Secondary data**

According to Langkos (2014), secondary data is the data that have been already collected by and readily available from other sources. Such data are cheaper and more quickly obtainable than the primary data and may be available when primary data cannot be obtained at all. Secondary data is the data that has already been collected through primary sources and made readily available for researchers to use for their own research. A researcher may have collected the data for a particular project then made it available to be used by another researcher.

**3.8 Data collection procedure**

Mesly (2015) noted that data collection procedure involves the systematic process of gathering quantitative and qualitative information on specific variables with the aim of evaluating outcomes actionable insights. Good data collection requires a clear process to ensure the data you collect is clean, consistent, and reliable. This study follows a randomized response technique which Claes Wohlin (2003) states that allows researchers to obtain sensitive information while guaranteeing privacy to respondents. This method encourages greater cooperation from respondents and reduces their motivation to falsely report their attitudes. The researcher will obtain a letter of introduction to go to the field from the Dean of the School of Social Sciences of Nkumba University which will be handed over to the authorities at the selected schools seeking permission to be allowed to carry out the study in that organization.

**3.9 Data collection methods**

According to Claes Wohlin (2003), data collection is a process of collecting information from all the relevant sources to find answers to the research problem, test the hypothesis and evaluate the outcomes. Data collection methods can be divided into two categories: secondary methods of data collection and primary methods of data collection.

**3.9.1 Secondary data collection methods**

According to Mesly (2015), secondary data is a type of data that has already been published in books, newspapers, magazines, journals, online portals and so on. There is an abundance of data available in these sources about your research area in business studies, almost regardless of the nature of the research area. The secondary data sources enabled the researcher to strengthen the primary data by giving related and valid explanations of the efficacy of crime mapping technologies on law enforcement in Uganda, particularly with Security Cameras in Wakiso District from these various online and library. The researcher was able to create extensive meaning to the reader. Therefore, application of appropriate set of criteria to select secondary data to be used in the study plays an important role in terms of increasing the levels of research validity and reliability. These criteria include but not limited to date of publication, credential of the author, reliability of the source, quality of discussions, depth of analyses, the extent of contribution of the text to the development of the research area and so on.

**3.9.2 Primary data collection methods**

According to Ajayi (2017), primary data collection methods include those methods which are used to obtain first-hand data gathered by the researcher himself Primary data sources include surveys, observations, experiments, questionnaire, and personal interview and so on. Primary data collection methods can be divided into two groups: quantitative and qualitative. Quantitative data collection methods were used include questionnaires with closed-ended questions for this short period of time. The qualitative research method to be used in this study include interviews, questionnaires with open-ended questions, focus groups, observation, game or role-playing and case studies were applied.

# 3.10 Data collection instruments

Several instruments were used for data collection, and these include self-administered questionnaire and interview guide

# 3.10.1 Self-administered questionnaire

The researcher used the questionnaire tool for collecting data that was be constructed with open-ended and close-ended questions as showed in Appendix I. According to Lavrakas (2008), a questionnaire is a research instrument that consists of a set of questions or other types of prompts that aims to collect information from a respondent. A research questionnaire is typically a mix of close-ended questions and open-ended questions. These instruments include either written or oral questions and comprise an interview-style format. The researcher used the questionnaire on all categories of respondents because it helps to collect large amounts of information from a large number of people in a short period of time, and it was relatively cost effective, quick, and easily quantifiable by the researcher to analyze the data and to compare the findings for clarity. Structured or closed questions are meant to save the respondents’ time and get definite answers and unstructured or open-ended questions are meant to ensure that respondents’ feelings are not disregarded, and further explanations are made. The questionnaires were delivered in person. Questionnaires were distributed after the initial communication with the respondents to seek consent. The respondents were given a maximum of one week to answer the questionnaires after which the questionnaires were collected for analysis. No public postal service or email services were used to distribute questionnaires. The questionnaire helped to gather qualitative data which was vital to strengthen and give vivid evidence to the study, but they made the study to delay as they were not easy for the respondents to fill without being guided.

# 3.10.2 Interviewed guide

The researcher set questions as shown in Appendix II to guide the oral or mouth to mouth interactions between the researcher and the respondents. The data collected by this instrument were more correct compared to the other tools that were used for data collection. The tool was good to use since the researcher asked the respondents to give more information that were necessary for the study, thus yielding more informative data from the field.

# 3.11Validity and Reliability of Instruments

# 3.11.1 Validity

Validity can be defined as the degree to which a test measures what it is supposed to measure. There are three basic approaches to the validity of tests and measures as shown by Rosenberg &Yates (2007). These are content validity, construct validity, and criterion-related validity. In this study, content validity is what was emphasized. This approach measures the degree to which the test items represent the domain or universe of the trait or property being measured.

In order to establish the content validity of a measuring instrument, the researcher must identify the overall content to be represented. Items must then be randomly chosen from this content that was accurately representing the information in all areas. By using this method, the researcher was able to obtain a group of items which is representative of the content of the trait or property to be measured thus it enabled the researcher to test how the data collection tools can be useful to obtain data by consulting experts in research.

# 3.11.2 Reliability

Peterson (1982) defines reliability as the extent to which measures are free from errors, thus the greater the reliability of an instrument, the less likely the errors of measurement to occur. More than one data collection instrument was used in order to eliminate the weaknesses inherent in each instrument. The reliability of a research instrument concerns the extent to which the instrument yields the same results on repeated trials. The researcher set questions in the data collection tools which were tested twice to enable her to get logical sequence of data.

# 3.12 Data processing and analysis

# 3.12.1 Data processing

After data has been collected, it needs to be presented in a way that communicates the information and enables conclusions to be drawn (Merriam, Sharan B., 2009). Data was collected from both primary and secondary sources, processed, analyzed and presented. The data collected was edited; coded and quantitative ones were tabulated into frequency tables while the qualitative ones were accumulated under specific themes.

# 3.12.2 Data analysis

## The researcher used qualitative and quantitative data analysis techniques for qualitative data, the analysis was carried out through using exploratory and descriptive methods while quantitative data, this was analyzed through descriptive statistics mainly percentages.

# CHAPTER FOUR

# PRESENTATION AND DISCUSSION OF FINDINGS

# 4.0 Introduction

This chapter is about presentation and discussion of findings on the efficacy of crime mapping technologies particularly Security Cameras on law enforcement in Wakiso District. The researcher obtained data from 118 respondents directly and indirectly as this is a sensitive area of study. The data obtained is on respondents’ personal variables, ways in which the CCTV camera system enables law enforcement agencies to obtain information on criminal incidents, the relevance of CCTV Camera system in storage and retrieval of information on crime incidents to enable law enforcement agencies track and prosecute criminals and the challenges facing the CCTV Camera system operation in providing evidence to prosecute criminality in Wakiso district.

# 4.1 Respondents’ bio-data

Questions about the basic data about the person completing the survey are given common name particulars which are usually placed at the beginning of the questionnaire. Although additional questions seem redundant or irritating to respondents, they play a fundamental role in the advanced analysis of test results because it is the particulars that allows the use of data on respondents to carry out an even more accurate and advanced analysis of the collected data. In this case, there is focus on the gender or sex of respondents, the age range of respondents, and respondents’ level of education and so on as displayed in this section;

# Table 4.1: Gender/sex of respondents

|  |  |  |  |
| --- | --- | --- | --- |
| **Statement** | **Distribution of responses** | | |
| **Category** | **Frequency** | **Percentage** |
| Gender/sex of respondents | Male | 72 | 61.0 |
| Female | 46 | 39.0 |
| **Total** |  | **118** | **100.0** |

**Source: Field data, 2021**

Regarding the gender/sex of respondents, it was discovered that 61.0% of the respondents were males, and 39.0% were females. This shows that most respondents who were available and willing to participate in the study were males, but also the females were a considerable number. This illustrates that both male and female took part in the study by providing data for this study, significant in ensuring that the study can be accomplished.

# Table 4.2: Age range of respondents

|  |  |  |  |
| --- | --- | --- | --- |
| **Statement** | **Distribution of responses** | | |
| **Category** | **Frequency** | **Percentage** |
| Age range of respondents | 15-30 years | 37 | 31.4 |
| 31-45 years | 49 | 41.5 |
| 46-60 years | 20 | 16.9 |
| 61 years and above | 12 | 10.2 |
| **Total** |  | **118** | **100.0** |

**Source: Field data, 2021**

Regarding the age range of respondents, 31.4% of the respondents were aged 15-30 years, 41.5% were aged 31-45 years, 16.9% were aged 46-60 years and 10.2% were aged 61 years and above. Though most respondents were aged 15 and 60 years, all the respondents’ availed data for this study which supported the presentation, analysis and discussions of findings in this study.

# Table 4.3: Respondents’ level of education

|  |  |  |  |
| --- | --- | --- | --- |
| **Statement** | **Distribution of responses** | | |
| **Category** | **Frequency** | **Percentage** |
| Respondents level of education | No education at all | 03 | 2.5 |
| Primary | 16 | 13.6 |
| Secondary | 75 | 63.6 |
| Tertiary | 24 | 20.3 |
| **Total** |  | **118** | **100.0** |

**Source: Field data, 2021**

Regarding the respondents’ level of education, 2.5% of the respondents had no formal education at all, 13.6% had primary education, 63.6% had secondary and 20.3% had tertiary education. Most respondents had secondary and tertiary education with at least completion of ordinary and advanced level as well as Certificate, Diploma, and Bachelors’ degree, and even with this level of education, the respondents availed data for the study.

# Table 4.4: The position you occupy

|  |  |  |  |
| --- | --- | --- | --- |
| **Statement** | **Distribution of responses** | | |
| **Category** | **Frequency** | **Percentage** |
| **The position you occupy** | **Police officer** | 08 | 6.8 |
| **Local leaders** | 06 | 5.1 |
| **Boda-Boda cyclists** | 63 | 53.4 |
| **Traders** | 21 | 17.8 |
| **ICT professional** | 04 | 3.4 |
| **Community members** | 16 | 13.6 |
| **Total** |  | **118** | **100.0** |

**Source: Field data, 2021**

Regarding the position one occupies, 6.8% of the respondents were police officers, 5.1% were local leaders, 53.4% were Boda-Boda cyclist, 17.8% were traders, 3.4% were ICT professionals and 13.6% were community members. The respondents were at different levels in, so the information they provided rhymed well with their rank and file but was all so vital in supporting the study.

**4.2. The ways in which the CCTV camera system enables law enforcement agencies to obtain information on criminal incidents in Wakiso district**

The study findings on the ways in which the CCTV camera system enables law enforcement agencies to obtain information on criminal incidents in Wakiso district are presented, analysed and interpreted in this section;

**4.2.1 The period you have seen CCTV cameras in your area**

The findings on the period you have seen CCTV cameras in your area are presented in table 4.5;

# Table 4.5: The period you have seen CCTV cameras in your area

|  |  |  |  |
| --- | --- | --- | --- |
| **Statement** | **Distribution of responses** | | |
| **Category** | **Frequency** | **Percentage** |
| The period you have seen CCTV cameras in your area | 1-4 years | 110 | 93.2 |
| 5-9 years | 06 | 5.1 |
| 10-14 years | 02 | 1.7 |
| 15 years and more | - | - |
| **Total** |  | **118** | **100.0** |

**Source: Field data, 2021**

Regarding the period you have seen the CCTV Cameras in the area where one stays or works from, 93.2% of the respondents had seen them for 1 to 4 years, 5.1% had seen the CCTV Cameras in the area where one stays or works for a period of 5 to 9 years more so at vital installations like supermarkets, streets and so on and 1.7% had seen it for 10 to 14 years still at vital installations like near statehouse, supermarkets, government installations like Airport , Ministries and so on. So, the respondents had good knowledge at their different levels and period of exposure to the CCTV camera system.

**4.2.2 The period you have known and worked in the CCTV camera system**

The findings on the period you have known and worked in the CCTV camera system are presented in table 4.6;

# Table 4.6: The period you have known and worked in the CCTV camera system

|  |  |  |  |
| --- | --- | --- | --- |
| **Statement** | **Distribution of responses** | | |
| **Category** | **Frequency** | **Percentage** |
| The period you have known and worked in the CCTV camera system | 1-4 years | 110 | 93.2 |
| 5-9 years | 06 | 5.1 |
| 10-14 years | 02 | 1.7 |
| 15 years and more | - | - |
| **Total** |  | **118** | **100.0** |

**Source: Field data, 2021**

Regarding the period you have known and worked in the CCTV camera system, 93.2% of the respondents had known and worked in the CCTV camera system for 1 to 4 years directly benefiting from their services and supporting their installations by talking good about them and supporting such initiatives, 5.1% had known and worked in the CCTV camera system for a period of 5 to 9 years more so at vital installations like supermarkets, streets and so on because they could retrieve information in form of videos, 1.7% had known and worked in the CCTV camera system for 10 to 14 years still at vital installations like near statehouse, supermarkets, government installations like Airport, Ministries and so on through supporting their installations and marketing the idea to the community as well as using them to obtain records of information. So, the respondents had good knowledge at their different levels and period of exposure to the CCTV camera system.

# 4.2.3 The Close Circuit Television camera system are used to obtain criminal incidents

The findings of the study on whether the Close Circuit Television camera systems are used to detect criminal incidents are presented in table 4.7;

# Table 4.7: The Close Circuit Television camera system are used to detect criminal incidents

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 97 | 82.2 |
| Not Sure | 21 | 17.8 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The findings of the study on whether the Close Circuit Television camera system is used to detect criminal incidents reveal that 82.2% of the respondents agreed and 17.8% were not sure, with 82.2% in an agreement, it implies that the cameras are used for 24/7 surveillance, and in the process, any criminal act like theft, Murder, kidnap and so on that take place within their range of capture, is captured and relayed to the control centre for example the 2020 February murder of Naggiriinya and Kitayimbwa had the murder suspects captured at Bweyogerere driving her car which offered a good lead to the reprimand of such cases. This is in line with Heba (2014) who states that the CCTV systems have in the last two decades been used to play a significant role in detecting several criminal incidents and enable security organs to respond accordingly. As the researcher observed and found out, CCTV technology has developed so fast to intelligent systems that can enable the police to identify abnormal events or behaviour like observe probable terror activities and behaviour.

# 4.2.4 Close Circuit Television camera system are employed for safety of the cities/towns

The findings of the study on whether with remote sensing capabilities, Close Circuit Television camera system is employed for safety of the cities/towns are presented in table 4.8;

# Table 4.8: Close Circuit Television camera system are employed for safety of the cities/towns

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 39 | 33.1 |
| Not Sure | 54 | 45.8 |
| Disagree | 25 | 21.2 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

Close Circuit Television Camera system are used as remote sensing instruments that can detect from the distance either seen or not to guarantee safety of the people in the community. Findings reveal that 33.1% of the respondents agreed, 45.8% were not sure and 21.2% disagreed. With 33.1% in agreement and 45.8% being unsure, it implies that the extent of coverage of the camera system is limited, and as such they do not capture a wide range of incidents which occur out of their range of capture more in the rural areas where few have been installed. For 21.2% noted that the coverage and distribution of the cameras does not cover the entire district therefore, many incidents go unreported and uncaptured so the Close Circuit Television camera system worked only guarantee the safety of people if at least all towns, estates, traffic arteries, grounds of pyrographic importance and others like industrial centres are well covered under this smart city security arrangement. This is illustrates that the authorities acknowledge the need for safe cities, and Zhihui (2017) accepts that using the Safe-Cities model for example the Huawei’s Safe-Cities model provides a template for detecting and reprimanding crime. From the study, also it is important to recognize that these governance and surveillance systems are being installed at the request of government to enable security function well.

# 4.2.5 The Close Circuit Television camera system monitors peoples movements

The study findings on whether the Close Circuit Television camera system is used to monitor the movements and operations of the general community or people are presented in table 4.9;

# Table 4.9: The Close Circuit Television camera system is used to monitor the movements and operations of the general community or people

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 59 | 50.0 |
| Not Sure | 23 | 19.5 |
| Disagree | 36 | 30.5 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

Findings reveal that the Close Circuit Television camera system is used to monitor the mobility and operations of the general community or the people, since 50.0% agreed, 19.5% were not sure, and 30.5% of disagreed. With 50.0% in agreement, it means that the cameras enable police to detect and monitor how the people move and operate, and in case of any occurrence of a security incident police can collate the movements of criminals and how they operate. For 19.5% were not sure if the Close Circuit Television system has this capability because they believe that despite the presence of cameras, failure to have professionals to use them, rendered them less useful and 30.5% noted that several incidents could occur, but police follow up largely on those with political and grave implications. As Horne (2014) opine, the government has to observe the major concentrations of people from the control centre, and though the overall facts are that the Close Circuit Television camera system is vital for monitoring the movements and operations of the general community or people, and in these situation even criminal acts are detected and followed up for successful reprimand.

# 4.2.6 Close Circuit Television camera system enhances cyber security

The study findings on whether Close Circuit Television camera system is used to enhance cyber security to fight cyber-crime are presented in table 4.10;

# Table 4.10: Close Circuit Television camera system enhances cyber security

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 25 | 21.2 |
| Not Sure | 49 | 41.5 |
| Disagree | 44 | 37.3 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

Cyber-crime ranges from minor cyber breaches to extended high technical sophisticated ones; the findings of the study revealed that 21.2% of the respondents agreed that the Close Circuit Television camera system supports the enhancement of cyber security to fight cyber-crime, 41.5% were not sure and 37.3% disagreed with few accepting and 41.5% being unsure, it means that the current Close Circuit Television system can hardly be used to detect hackers, while 37.3% noted that tool to detect cyber-crime because they cannot help much into the sophisticated would of cyber hacking to cyber terrorism which require better technology and operators that are rare under the current system. Though the society has limited knowledge of cyber crime, Wycoff (2004) noted that promoting cyber stability and increasing awareness of cyber security governance helps support the establishment of enforcement mechanisms and the development of institutional capacities to detect and fight cyber-crime like cyber fraud. For those who are aware, they see it a s a vital undertaking to detect and prevent fraud in Wakiso District.

**4.2.7 Close Circuit Television camera system enables effective public safety interventions**

The study findings on whether the Close Circuit Television camera system is in place to enable effective public safety interventions to curb crime and improve the liveability and economic well-being of the communities are presented in table 4.11;

# Table 4.11: Close Circuit Television camera system enables effective public safety interventions

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 52 | 44.1 |
| Not Sure | 33 | 28.0 |
| Disagree | 33 | 28.0 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The study findings on whether the existing Close Circuit Television camera system is in place to enable effective public safety intervention on to curb crimes and improve the liveability and economic well-being of the community revealed that 44.1% of the respondents agreed, 28.0% were not sure and 28.0% disagreed with 44.1% in agreement, it indicates that the existing Close Circuit Television camera system somewhat scares off criminals, and where it is detected, the public and her sister security agencies can know the exact location and respond in time and appropriately, through as disagreed by 28.0% the dumping of a baby of 3 years’ body the dumping Magara in Kitiko, the murder of travellers on Entebbe express and so on, are all cases which have gone unresolved even with the presence of the Close Circuit Television system.

# 4.2.8 The Close Circuit Television camera system is used for monitoring foreigners’ activities in the area

The findings on whether the Close Circuit Television camera system is used for monitoring foreigners’ activities in the area are presented in table 4.12;

# Table 4.12: The Close Circuit Television camera system is used for monitoring foreigners’ activities in the area

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 18 | 15.3 |
| Not Sure | 75 | 63.6 |
| Disagree | 25 | 21.2 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

Foreign activities involve those activities that are strange to the community such as burglary, terrorism and so on. Findings show that 15.3% of the respondents agreed that the Close Circuit Television camera system captures and monitors the foreign activities, 63.6% were not sure and 21.2% disagreed. As seen from the findings, majority of the respondents (63.6%) were not sure, 15.3% agreed and for 21.2% disagreed because the system is not in place only to detect foreign activities but to capture all incidents, and the onuses on the security agents to determine what is criminal or not. They do not operate with artificial intelligence to scan and detect what is criminal and what is not.

# 4.2.9 Close Circuit Television camera system is used to identify, report and follow up criminality

The findings of the study on whether Close Circuit Television camera system is used to identify, report and follow up criminality are presented in table 4.13;

# Table 4.13: Close Circuit Television camera system is used to identify, report and follow up criminality

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 81 | 68.6 |
| Not Sure | 28 | 23.7 |
| Disagree | 9 | 7.6 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The Close Circuit Television camera as little noted, it offers an overall capture of livelihood and community activities regardless of whether they are criminal or not. Findings show that 68.6% of the respondents agreed, 23.7% were not sure and 7.6% disagreed with 68.6% in agreement it means the security information and communications Technology operators are able to transmit suspicions bites or videos for security analysis in which criminality is identified, reported and followed up, though 23.7% were not sure and 7.6% disagreed. But the system has brought some un doubtable degree of success in following up on criminality in the district.

# 4.2.10 The Close Circuit Television camera system and video surveillance

The findings of the study on whether the Close Circuit Television camera system is used to watch over and carry-on video surveillance duties on the streets and urban areas are presented in table 4.14;

# Table 4.14: The Close Circuit Television camera system and video surveillance

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 67 | 56.8 |
| Not Sure | 31 | 26.3 |
| Disagree | 20 | 16.9 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

In urbanized areas, Close Circuit Television camera system is used to watch over and carryon video surveillance duties on the streets and urban areas, so findings revealed that 56.8% of the respondents agreed, 26.3% were not sure and 16.9% disagreed. With 56.8% in agreement, it means that the cameras have the eagle eye to detect and store or relay all what happens which provides the platform for the security officers to make the appropriate decision on regarding follow up and stopping criminal activities in the areas where they are established and those without them, but where collaboration with individual households can be established to have footages shared about criminal incidents for example the murder of Mulindwa, a boda-boda cyclist in 2020 was well captured on a private Close Circuit Television camera which was shared with police and the assailants were apprehended, prosecuted and sentenced to imprisonment.

# 4.2.11 Close Circuit Television camera system offers physical security

# The study findings on whether the Close Circuit Television camera system offers physical security in homes and in public places are presented in table 4.15;

# Table 4.15: Close Circuit Television camera system offers physical security

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 58 | 49.2 |
| Not Sure | 39 | 33.1 |
| Disagree | 21 | 17.8 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The findings on the study revealed that 49.2% of the respondents agreed that the existence of the Close Circuit Television camera places, more so for those homes near the installed cameras, while 33.1% were not sure and 17.8% disagreed. This means that with 49.2% in agreement and 33.1% being unsure, the Close Circuit Television camera system have enabled the security agencies to reprimand criminals like in 2019, the army used the camera’s in Kyengera to get information about a runaway vehicle from Entebbe that had criminals who wanted to disappear with army / SFC attires and machinery, while in 2020 a young man who plucked off the side mirrors and door lockers from an SUV Toyota Land Cruiser Pad was taped well by a Close Circuit Television camera on a domestic wall. This shows that the Close Circuit Television system on both private and public installation have been useful in providing information on criminality.

# 4.2.8 The CCTV camera system as an early warning system in fighting crime

According to the study, a respondent noted that,

*“the existing CCTV camera system is for the protection it serves to remind the people of their security measures that they would otherwise forget easily, and as such it serves as an early warning system in such cases, people walking, working, or operating in the protected areas take more measures to protect their property thus the CCTV psychologically prevents crime by influencing the potential victims”.*

R1

As Bennett & Gelsthorpe (2010) pointed out that the common goal of CCTV camera systems is the prevention of crime and disorder through deterrence. Facts are also made that CCTV camera system provides public reassurance and therefore reduces fear of crime, which may, in turn, increase the use of public spaces like townships such as Kasenge-Kikajjo, Nansana, Wakiso, Kakiri, Kajjansi, Kawuku and so on. The CCTV camera system is an eye that does not only see day and night but actually record what happens so that even if one came back afterwards, they can roll back and see, sequentialise events. For the use of alarms, they can warn people including those in security about suspicious activities and appropriate responses registered or done.

# 4.2.9 CCTV camera systems enables the police ICT personnel in police to identify criminals

The findings of the study reveal that, *‘the cameras are powered by a feed that transmits images and videos through cables to a specific server created by the National Information Technology Authority Uganda. National Information Technology Authority is providing high speed connectivity for the CCTV camera system network over the national data transmission backbone infrastructure in Wakiso District’.* As obtained from the Information and Communication Technology, Baryamwisaki (2020), the cameras aid investigation and enhance surveillance in areas around Wakiso District where more crime cases have been recorded over the years. The real time footage is accessible to different police units because once one appears anywhere where the cameras are, the police are able to correlate with the database when it gives an alarm then one is able to know that this person is at this place.

*“now the facial recognition technology which is borne by the CCTV camera system putting them at places which are unique like local government installations, the police stations, business centres, and those are the areas”*

R2

Thus the findings show that for specific areas like automatic number plate recognition cameras are on highways that pass through Wakiso District specifically at exits of various shopping centres, strategic security points and other vital installations,

# 4.2.10 The CCTV camera systems and police investigation about the type of crime

# committed

Furthermore, the CCTV camera system is enhanced when installing alongside other complementary measures, like police patrols, community vigilance, environmental designs, thus raising its credibility as a threat to offenders. Enanga (2021) opine that the CCTV camera operators are constantly monitoring the areas under surveillance and passing information to the police command center, about incidents which require police response, and response takes place. One respondent noted that the popularity and use of Closed-Circuit Television (CCTV) camera has grown rapidly since the technology was first introduced on public scale in Wakiso District. And as discovered at 5 points namely Kasenge, Nabbingo-Kyengera, Bulenga, Kajjansi and Mutundwe-Kabojja-Kinaawa for example have been so crucial points to detect and address crime which has been well done.

# 4.2.11 CCTV camera systems and police ICT department documentation of crime

The findings of the study revealed that,

*“the CCTV camera system in place helps the police to monitor according to the nearby police station in charge of the specific area where the CCTV is mounted. The CCTV cameras are categorized into the Fixed and the Pan Tilt Zoom cameras and have featured including automatic number plate recognition, facial recognition, night vision and Global Positioning System among others”.*

R3

Shepherd and Matthews (2010) noted that CCTV may deter potential offenders who perceive an increased risk of detection, and it may direct security personnel to locations where precursors to offending have been detected, which may head off their translation into crime and reduce the severity of harm. The presence of CCTV may induce people to take elementary precautions for fear that they will be shared by being shown on CCTV camera system.

**4.3 The relevance of CCTV Camera system in storage and retrieval of information on crime incidents to enable law enforcement agencies track and prosecute criminals in Wakiso district**

The study findings on the relevance of CCTV Camera system in storage and retrieval of information on crime incidents to enable law enforcement agencies track and prosecute criminals in Wakiso district are presented, and interpreted in this section below;

**4.3.1 There is effective utilization of the existing Close Circuit Television Camera system (video cameras) in surveillance of a particular area**

The study findings on whether there is effective utilization of the existing Close Circuit Television Camera system (video cameras) in surveillance of a particular area where they are installed and used to monitor are presented in table 4.16;

**Table 4.16: There is effective utilization of the existing Close Circuit Television Camera system (video cameras) in surveillance of a particular area**

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 39 | 33.1 |
| Not Sure | 28 | 23.7 |
| Disagree | 51 | 43.2 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

On whether there is effective utilization of existing Close Circuit Television camera system (video cameras) in surveillance of a particular area where they are installed and used to monitor discovered that 33.1% of respondents agreed, 23.7% were not sure and 43.2% disagreed. With majority, that is 43.2% in disagreement it means that the Close Circuit Television camera systems is serving the purpose for which they were installed, but the limitations with their surveillance structures and extent makes it head for them to capture all incidents police would naturally be very interested into compile information on criminality. In accordance with this, Jewitt (2007) noted that in many parts of America, Europe, and Asia, CCTV surveillance proved one of the best ways of crime prevention as the criminal cases decreased proportionately as more of the cameras came into, and much as it is still at the basic level, the existence of Close Circuit Television Camera system (video cameras) can support surveillance of a particular area where they are installed and used to monitor.

**4.3.2 Close Circuit Television Camera system and alarm notification to police officers**

The findings on whether the Close Circuit Television Camera system’s alarm notification provides notifications to the police officers are presented in table 4.17;

# Table 4.17: Close Circuit Television Camera system and alarm notification to police officers

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 35 | 29.7 |
| Not Sure | 68 | 57.6 |
| Disagree | 15 | 12.7 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

On whether the Close Circuit Television camera system’s alarm notifications provides notifications to the police officers the findings revealed that 29.7% of the respondents agreed, 57.6% were not sure and 12.7% disagreed. With 57.6% beings unsure, and 29.7% in agreement, it literary means that at the central system control centre (Nateete police). Wherever cameras capture and unusual incidents, alarm notifications alert the officers who can then create a footage, isolate and analyze in order to respond, though many respondents could not detail how, and the police officers identified contacted) could not divulge into detailed, but confirmed they are alerted.

# 4.3.3 The Close Circuit Television Camera system offers a line confident line of psychological preparation of the population

The study findings on whether the Close Circuit Television Camera system offers a line confident line of psychological preparation of the population as they get to know that crime is being tracked and managed are presented in table 4.18;

# Table 4.18: The Close Circuit Television Camera system offers a line confident line of psychological preparation of the population

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 73 | 61.9 |
| Not Sure | 29 | 24.6 |
| Disagree | 16 | 13.6 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

On whether the Close Circuit Television camera system offers a confident line of psychological preparation of the population as they get to know that crime is being tracked and managed, findings reveal that 61.9% of the respondents agreed, 24.6% were not sure and 13.6% disagreed. With 61.9% in agreement, it means that both the security officers and local people feel that with the existing Close Circuit Television system crime in urban areas, alongside major wads and in many motal areas in Wakiso district can be reprimanded because many areas are under 24/7 surveillance; Baum (1997) had noted that the CCTV protection serves to remind the people of their security measures that they would otherwise forget easily. Psychologically, people understand that a place under surveillance may deem insecure if the security did not exist. In such cases, people walking, working, or operating in the protected areas take more measures to protect their property thus the CCTV psychologically prevents crime by influencing the potential victims. The potential criminals can also experience the psychological effect not to commit crime in places, which appear secured. But for many petty criminals and criminals gangs have relented on their operations though 13.6% noted that there are many incidents that go unreported for example the September incident in Nangabo where a 9 year old child was killed supposedly for ritual sacrifice. But on the grander scale, they are a vital back up security apparatus that is highly appreciated.

# 4.3.4 The Close Circuit Television Camera system and monitoring and eradication of crimes

The findings on whether the Close Circuit Television Camera system is vital in monitoring and eradication of crimes through availing vivid evidence are presented in table 4.19;

# Table 4.19: The Close Circuit Television Camera system and monitoring and eradication of crimes

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 87 | 73.7 |
| Not Sure | 11 | 9.3 |
| Disagree | 20 | 16.9 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

On whether the camera system is vital in monitoring and eradicating crime through availing vivid evidence 73.7% of the respondents agreed, 9.3% were not sure and 16.9% disagreed. With 73.7% in agreement, the Close Circuit Television camera system is crucial monitoring every situation in their range. Wilner (2005) noted that in advanced cases especially with the alarm-programmed CCTVs, people can thus commit unique mistakes and crimes and still get away with them because the crimes do not show in the CCTV cameras. The CCTV camera system helps in monitoring and not the actual eradication of crimes. And this can enable police and security forces to collate, collaborate pieces of information from different shots or videos to create a scenery and track crime, but 16.9% believed that crime has not been eradicated, but has been reduced as some criminals fear to act in areas where the Close Circuit Television is in use, as almost 65% percent of Wakiso is covered.

# 4.3.5 The Close Circuit Television Camera system enables the retrieval of video evidence to track and reprimand criminals

The findings on whether the Close Circuit Television Camera system enables the retrieval of video evidence to track and reprimand criminals are shown in table 4.20;

# Table 4.20: The Close Circuit Television Camera system enables the retrieval of video evidence to track and reprimand criminals

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 44 | 37.3 |
| Not Sure | 33 | 28.0 |
| Disagree | 41 | 34.7 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The study findings on whether Close Circuit Television Camera system enables the retrieval of video evidence to track and reprimand criminals revealed that 37.3% of the respondents agreed, 28.0% were not sure and 34.7% disagreed. With 37.3% in agreement, it means that the Close Circuit Television camera system is amounted with recorders, or the control centre has recorders where the captured images are stored for retrieval and security decision making in the areas which are affected for example the theft of property captured on the Close Circuit Television camera system aided the police to follow up and arrest the perpetrators in Wakimese in 2020. As pointed out by Skogan (2006), camera hard drives typically have enough memory to record on a continuous loop for 24 to 72 hours depending on the model of the camera and size of the hard drive before overwriting the previously recorded footage, but the current CCTVF system in the district has been agreed upon as being vital in this case.

# 4.3.6 The Close Circuit Television Camera system avails video footages as evidence

The study findings on whether the Close Circuit Television Camera system avails video footages as evidence in court against criminal suspects are presented in table 4.21;

# Table 4.21: The Close Circuit Television Camera system avails video footages as evidence

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 87 | 73.7 |
| Not Sure | 23 | 19.5 |
| Disagree | 8 | 6.8 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The findings of the study on whether the Close Circuit Television Camera system avails video footages as evidence in court against criminal suspects reveal that 73.7% of the respondents agreed, 19.5% were not sure and 6.8% disagreed. With 73.7% in agreement, it indicates that the police have chance now to reprimand with quite better source of evidence. In the same vein, Braga (2006) pointed out that video footage can be powerful evidence in court. In many cases judges view footage as an unbiased account of the events in question for example in the case of the murder of Naggirinya in 2020, the police was able to build its file with detailed evidence of photographs/images and videos on suspects as they had been able to retrieve it from the Close Circuit Television camera control system.

# 4.3.7 The Close Circuit Television Camera system and video analytics in reconstructing crime incidents

The study findings on whether the Close Circuit Television Camera system enables credible video analytics in reconstructing crime incidents are presented in table 4.22;

# Table 4.22: The Close Circuit Television Camera system and video analytics in reconstructing crime incidents

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 93 | 78.8 |
| Not Sure | 8 | 6.8 |
| Disagree | 17 | 14.4 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

Regarding the findings of the study on whether the Close Circuit Television Camera system enables credible video analytics in reconstructing crime incidents, 78.8% of the respondents agreed, 6.8% were not sure and 14.4% disagreed. But with 78.8% in agreement, it implies that the captured videos are developed into footages; and as Nieto (2021) writes that a video analysis system provides defensible numbers and allows the police to better prosecute criminality. CCTV video surveillance systems can passively record and play back video at certain intervals, the footages can then be used to critically follow-on incidents and produce them when needed to reconstruct crime scenes and incidents for better follow-up on the certain crime or crimes.

# 4.3.8 The Close Circuit Television Camera system is vital in license plate recognition so that vehicles used by criminals can be well tracked

The study findings on whether the Close Circuit Television Camera system is vital in license plate recognition so that vehicles used by criminals can be well tracked are presented in table 4.23;

# Table 4.23: The Close Circuit Television Camera system is vital in license plate recognition so that vehicles used by criminals can be well tracked

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 84 | 71.2 |
| Not Sure | 27 | 22.9 |
| Disagree | 7 | 5.9 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The findings of the study on whether Close Circuit Television Camera system is vital in license plate recognition so that vehicles used by criminals can be well tracked revealed that 71.2% of the respondents agreed, 22.9% were not sure and 5.9% disagreed. With 71.2% in disagreement, it indicates that the existing Close Circuit Television Camera system can ably recognize license plate at most stations, and this is what has partly enabled the police to track down all the assailants, thieves, burglars, highway robbers and so on. Much as 22.9% were not sure and 5.9% disagreed that in some cases the cameras have not been able to adequately recognize vehicle plates, but in most cases, it is not only the vehicle plates but even motorcycle plates which have made it quite possible for locomotives used by criminals to be tracked.

# 4.3.9 The CCTV Camera system is used to obtain facial recognition of suspects

The study findings on whether the CCTV Camera system is used to obtain facial recognition of suspects in crime are presented in table 4.24;

# Table 4.24: The CCTV Camera system is used to obtain facial recognition of suspects

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 32 | 77.1 |
| Not Sure | 56 | 20.3 |
| Disagree | 30 | 2.6 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The findings of the study on whether the CCTV Camera system in place The CCTV Camera system is used to obtain facial recognition of suspects in crime revealed that 77.1% of the respondents agreed, 20.3% were not sure and 2.6% disagreed. With 77.1% in agreement, it means that the CCTV Camera system in place The CCTV Camera system is used to obtain facial recognition of suspects in crime which is why most criminals who have carried out their criminality where these cameras can reach have been easily recognized and some nabbed by the security forces. Woodward et al., (2003), the CCTV camera have the power of facial recognition systems because of the powerful underlying database from which a unit scanning an image in real-time can compare it to in order to relay important information to law enforcement. According to the study, facial recognition technology captures images continuously and transmits those images to a computer using a pre-programmed algorithm that matches the image to a face in the database

# 4.3.10 CCTV Camera system and artificial intelligence-enabled solutions

Findings on whether with CCTV Camera system, artificial intelligence-enabled solutions are at the disposal of police to establish security breaches logically are presented in table 4.25;

# Table 4.25: CCTV Camera system and artificial intelligence-enabled solutions

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 38 | 32.2 |
| Not Sure | 50 | 42.4 |
| Disagree | 30 | 25.4 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

From the study, it was revealed that with CCTV Camera system, artificial intelligence-enabled solutions are at the disposal of police to establish security breaches logically as agreed by 32.2% of the respondents, while 42.4% were not sure and 25.4% disagreed. Those who accepted (agreed) noted that without artificial intelligence, then logical follow up on criminality would be impossible; and while 42.4% were not sure, 25.4% disagreed because they did not know about artificial intelligence since it is a technical term, but at all respondents believed the CCTV camera system exists and is used to reprimand crime. D’Souza (2019) states that artificial intelligence-enabled solutions are obtained using images and video footages to better understand people, objects and vehicles that are captured on film of the camera, which seems yet to become common in the area.

# 4.3.11 CCTV Camera system and edge technology for real-time video streaming of events

The study findings on whether the CCTV Camera system offers edge technology for real-time video streaming of events as they happen including crime incidents within their range of observation are presented in table 4.26;

# Table 4.26: CCTV Camera system and edge technology for real-time video streaming of events

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 46 | 39.0 |
| Not Sure | 55 | 46.6 |
| Disagree | 17 | 14.4 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

On whether the CCTV Camera system offers edge technology for real-time video streaming of events as they happen including crime incidents within their range of observation, findings show that 39.0% agreed, 46.6% were not sure and 14.4% disagreed. With 39.0% in agreement, it means that there is some degree of use of edge computing, though 46.6% were not sure and 14.4% disagreed because they believed police cannot keep individual data safe and only need to address criminality. Edge computing is a distributed information technology architecture in which client data is processed at the periphery of the network, as close to the originating source as possible, so with the existing CCTV Camera system, this is only possible for a short time. These CCTV Camera systems are awash in an ocean of data, and huge amounts of data is routinely collected operating in real time from remote locations and inhospitable operating environments almost anywhere in the district of Wakiso as long as the camera can pick there.

# 4.3.12 The ways CCTV Camera system help in addressing crime and criminality in your area

The existing CCTV camera system built on the Smart City model is meant to be used effectively by police and other security organs to carry out monitoring of public areas to detect incidents and to co-ordinate police responses, and another respondent revealed that the installed CCTV system is also used as an aid for enforcing exclusion orders, recording events for use as evidence and to inform investigations in crime. One respondent noted that,

*“the security forces in Uganda, more so police for law and order now employ public video surveillance as a primary tool to monitor population movements and to prevent crime and terrorism, both in the private and public sectors”*

R4.

This explains why the public mounted CCTV system can also share information from private CCTV domestic systems. Thus, the CCTV camera system video surveillance plays a vital role in improving safety and security, as well as the myriad other functions.

One ICT professional noted that,

*“this CCTV system by its integrated Artificial Intelligence and analytics software is now affording operators real time access to information they can analyse and address crime. Now there are several cases where various local councils in Wakiso, the police and other law enforcement and security management professionals in those agencies rely heavily on video surveillance as a tool to fight crime and prevent terrorism”*

R5

It was discovered that the use of CCTV camera system encompasses everything from public surveillance, also seeks support from private business operated cameras. The study revealed that through deep learning and Artificial Intelligence is becoming more prevalent, as cameras are able to more accurately gather data and make predictions based on integrated analytical software manufacturers have developed in Uganda, particularly Wakiso District.

# 4.3.13 The importance of the analytics-based security approach to security management in the area

The respondents from ICT and conscious environment revealed that security analytics as a proactive security approach uses big data analytics and machine learning to gather, categorize and analyze data collected from CCTV camera system network devices to detect advanced threats like the terror attacks at Lungala. The ICT professional from Police noted that,

*“the security analytics approach also supports cyber-security with data collection, data aggregation and analysis tools for threat detection and security monitoring for example to track and follow-up on all detected and suspected criminals”*

R6

From another ICT expert,

*“there is analysis of network traffic to detect patterns indicating potential attacks, monitors the user behaviour including potentially suspicious activity, detect potential threats, detect data exfiltration, monitor employees, detect insider threats, identifies compromised accounts, identifies improper user account usage such as shared accounts, investigates malicious activity, demonstrate compliance during information audits and investigate cyber-security incidents as the police continues to build capacity in neutralising crime”.*

R7

This security analytics tools provide the security agencies monitoring Wakiso with security incident and anomaly detection and response, support regulatory compliance, boost enhanced forensics capabilities relying on the CCTV camera system tools like Wildfire from Palo Alto Networks which detects and prevents zero-day malware using a combination of malware sandboxing, signature-based detection and malware blocking, the sumo logic which is cloud-nativemachine data analytics service that enables police to monitor, troubleshoot and resolve operational issues, as well as security threats to their cloud or hybrid.

# 4.3.14 The ways in which CCTV Camera system provide video evidence which can help the police to obtain forensic samples at crime incidents

Most major cities throughout the world have now installed an extensive array of CCTV cameras that are linked to control rooms which are equipped with video monitors in order to monitor the designated public spaces with a view to discouraging criminal offending and improving perceptions of safety in these areas. The technology in this field, both hardware and software, has advanced exponentially in recent years with vehicle license plate recognition and facial recognition capability having become the industry standard. Furthermore, the cutting-edge CCTV systems that are currently been rolled out in countries such as India and the United Kingdom have notably incorporated thermal imaging and aspects of artificial intelligence in an effort to predict certain types of criminal offending (such as robbery and sexual assault) before they take place.

# 4.4 The challenges facing the CCTV Camera system operation in providing evidence to prosecute criminality in Wakiso district

The study findings on the challenges facing the CCTV Camera system operation in providing evidence to prosecute criminality in Wakiso district are presented, analysed and interpreted in this section below;

# 4.4.1 The police has low capacity in terms of trained personnel to handle this technology to the best use in addressing crime

The study findings on whether the police has low capacity in terms of trained personnel to handle this technology to the best use in addressing crime are presented in table 4.27;

# Table 4.27: The police has low capacity in terms of trained personnel to handle this technology to the best use in addressing crime

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 71 | 60.2 |
| Not Sure | 19 | 16.1 |
| Disagree | 28 | 23.7 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The findings of the study on whether police has low capacity in terms of trained personnel to handle this technology to the best use in addressing crime revealed that 60.2% of the respondents agreed, 16.1% were not sure and 23.7% disagreed. With 60.2% in agreement, for example because of having less numbers than they should have, in the Independent of June 18th, 2021, they quoted police CCTV operators complaining about long working hours. These security Closed Circuit Television Camera-CCTV operators were concerned about the long working hours they are subjected to which affects their ability to closely monitor all events happening around, particularly in Wakiso and Kampala. The CCTV operators work for more than 12 hours a day and are expected to stay glued on the screens, taking a keen interest in the developments and peculiarities around the city. For example, even when two warnings had been issued to them by Information and Communications Technology and Criminal Investigations Directorate directors prior to the shooting of former army commander, Gen Katumba Wamala before 1st June on the edges of Wakiso District, the fatigued and demoralized officers could not get on top of their game. But the monitoring rooms need full-time attendance so that the real-time intelligence provided by these cameras is put to effective use. The full-time vigilance of the CCTV monitoring team enables them to send signals to motorized patrollers for a timely response. But CCTV operators stated that they would be more efficient on the job if their working hours are reduced and that they should be given special gear to protect them from lights produced by the monitors saying that excessively watching these monitors is likely to affect their eyesight.

# 4.4.2 The police lacks adequate ICT staff to handle the operations of the CCTV system centre where video analysis takes place

The study findings on whether the police lack adequate ICT staff to handle the operations of the CCTV system centre where video analysis takes place are presented in table 4.28;

# Table 4.28: The police lack adequate ICT staff to handle the operations of the CCTV system centre where video analysis takes place

|  |  |  |  |
| --- | --- | --- | --- |
|  | | Frequency | Percent |
| Valid | Agree | 62 | 52.5 |
| Not Sure | 36 | 30.5 |
| Disagree | 20 | 17.0 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The findings of the study on whether the police lack adequate ICT staff to handle the operations of the CCTV system centre where video analysis takes place show that 52.5% of the respondents agreed, 30.5% were not sure and 17.0% disagreed. With 52.5% in agreement, it means that the police has few personnel to run the camera centre, and as such the existing ones are overloaded with work. According to URN, 2021, one officer at the police CCTV ICT centre noted that it is not easy to be seated in one place with your eyes glued on a monitor for twelve hours. The security camera operators said they would wish to be given accommodation just like their colleagues attached to National CCTV Command Centre at Naguru, so that they can respond to emergencies in the event that anything happens when they are already out of the station.

# 4.4.3 The police lacks checks and balances on those managing the information centre where video analysis is done

The findings of the study on whether the police lack checks and balances on those managing the information centre where video analysis is done are presented in table 4.29;

# Table 4.29: The police lacks checks and balances on those managing the information centre where video analysis is done

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 41 | 34.7 |
| Not Sure | 39 | 33.1 |
| Disagree | 38 | 32.2 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The study findings on whether the police lack checks and balances on those managing the information centre where video analysis is done revealed that 34.7% of the respondents agreed, 33.1% were not sure and 32.2% disagreed; and for 34.7% in agreement, it means that though on a small scale, but police is not having strong internal checks and balances to safeguard all the information well from being pirated for ill use. For 33.1% were not sure and for 32.2% who disagreed, did so probably because they did not believe that police can be reckless with information and that there are tight controls on information flow. But what has often come out is that police have been known to misuse the information through corrupt means.

# 4.4.4 The CCTV system and its accessories are so expensive for the police to manage those which can cover the entire district

The study findings on whether the CCTV system and its accessories are so expensive for the police to manage those which can cover the entire district are presented in table 2.30;

# Table 2.30: The CCTV system and its accessories are so expensive for the police to manage those which can cover the entire district

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 61 | 51.7 |
| Not Sure | 37 | 31.4 |
| Disagree | 20 | 16.9 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The findings of the study on whether the CCTV system and its accessories are so expensive for the police to manage those which can cover the entire district revealed that 51.7% of the respondents agreed, 31.4% were not sure and 16.9% disagreed. Thus with 51.7% in agreement, it means that the screen monitors, cameras, installations, cyber cables are so expensive.

# 4.4.5 Hacking is common because the system is vulnerable to artificial intelligence and space technology

The study findings on whether hacking is common because the system is vulnerable to artificial intelligence and space technology are presented in table 2.30;

# Table 2.31: Hacking is common because the system is vulnerable to artificial intelligence and space technology

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 56 | 47.5 |
| Not Sure | 43 | 36.4 |
| Disagree | 19 | 16.1 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The findings of the study on whether hacking is common because the system is vulnerable to artificial intelligence and space technology revealed that 47.5% of the respondents agreed, 36.4% were not sure and 16.1% disagreed, which means that the system can be well hacked as was reported in March 2021 when hackers jammed the flow of information in the police websites and emails, rendering even the CCTV camera system vulnerable in this case.

# 4.4.6 The district experiences inadequate power to constantly run the system, so vital real information is missed whenever power is off

The study findings on whether the district experiences inadequate power to constantly run the system, so vital real information is missed whenever power is off are presented in table 2.32;

# Table 2.32: The district experiences inadequate power to constantly run the system, so vital real information is missed whenever power is off

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 43 | 36.4 |
| Not Sure | 50 | 42.4 |
| Disagree | 25 | 21.2 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The findings of the study on whether the district experiences inadequate power to constantly run the system, so vital real information is missed whenever power is off, 36.4% agreed, 42.4% were not sure and 21.2% disagreed. For the 36.4% who agreed believed that the CCTV system relies on Hydro-Electric power or solar power, though for 21.2% noted that they the CCTV systems do not require supply of Hydro power which is often unreliable but use solar power and batteries; but often also need Hydro which when not available their transmission capacity is quite slow.

# 4.4.7 The public CCTV system is threatening to breach private security systems

The study findings on whether the public CCTV system is threatening to breach private security systems are presented in table 2.33;

# Table 2.33: The public CCTV system is threatening to breach private security systems

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 95 | 80.5 |
| Not Sure | 20 | 16.9 |
| Disagree | 3 | 2.5 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The results of the study on whether the public CCTV system is threatening to breach private security systems revealed that 80.5% of the respondents agreed that in some cases the CCTV camera system is installed by police to surveil political opponents’ homes, get to know and follow the opposition operations in certain areas like Magere where the leading opposition figure stays, and trail the opposition members. They can also breach into the privacy of people’s residences which creates unnecessary tension in the community.

# 4.4.8 The operations of the CCTV system are not independent of security manipulation in police and by the hackers

The study findings on whether the operations of the CCTV system are not independent of security manipulation in police and by the hackers are presented in table 2.34;

# Table 2.34: The operations of the CCTV system are not independent of security manipulation in police and by the hackers

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 89 | 75.4 |
| Not Sure | 18 | 15.3 |
| Disagree | 11 | 9.3 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The findings of the study on whether the operations of the CCTV system are not independent of security manipulation in police and by the hackers revealed that 75.4% of the respondents agreed, 15.3% were not sure and 9.3% disagreed. With 75.4% in agreement, it implies that sometimes, accusations have come up in which the police officers have been accused of selling information, while 15.3% were not sure and 9.3% noted that the police safeguard its information generated though the CCTV system and that they do not encourage leakage. But it has been proven some police officers can misuse and sale information to those They connive with.

# 4.4.9 There are cases of some security officers misusing the footages due to corruption and rivalries or political interests

The study findings on whether there are cases of some security officers misusing the footages due to corruption and rivalries or political interests are presented in table 2.35;

# Table 4.35: There are cases of some security officers misusing the footages due to corruption and rivalries or political interests

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Frequency** | **Percent** |
| Valid | Agree | 32 | 27.1 |
| Not Sure | 56 | 47.5 |
| Disagree | 30 | 25.4 |
| Total | 118 | 100.0 |

**Source: Field data, 2021**

The findings of the study on whether thereare cases of some security officers misusing the footages due to corruption and rivalries or political interests revealed that 27.1% of the respondents agreed, 47.5% were not sure and 25.4% disagreed. With 27.1% in agreement and 47.5% were not sure, it means that in some cases of some security officers misusing the footages due to corruption and rivalries or political interests happens. The findings of the study on whether police has low capacity in terms of trained personnel to handle this technology to the best use in addressing crime revealed that 60.2% of the respondents agreed, 16.1% were not sure and 23.7% disagreed. With 60.2% in agreement, for example because of having less numbers than they should have, in the Independent of June 18th, 2021, they quoted police CCTV operators complaining about long working hours. These security Closed Circuit Television Camera-CCTV operators were concerned about the long working hours they are subjected to which affects their ability to closely monitor all events happening around, particularly in Wakiso and Kampala.The CCTV operators work for more than 12 hours a day and are expected to stay glued on the screens, taking a keen interest in the developments and peculiarities around the city. For example even when two warnings had been issued to them by Information and Communications Technology and Criminal Investigations Directorate directors prior to the shooting of former army commander, Gen Katumba Wamala before 1st June on the edges of Wakiso District, the fatigued and demoralized officers could not get on top of their game. But the monitoring rooms need full-time attendance so that the real-time intelligence provided by these cameras is put to effective use. The full-time vigilance of the CCTV monitoring team enables them to send signals to motorized patrollers for a timely response. But CCTV operators stated that they would be more efficient on the job if their working hours are reduced and that they should be given special gear to protect them from lights produced by the monitors saying that excessively watching these monitors is likely to affect their eyesight.

# 4.4.10 The other technical challenges associated with the CCTV system

According to the study,

*“there are failures to often detect patterns indicating potential attacks due to cyber-crime, weak monitoring of the user behaviour including potentially suspicious activity, failure to detect potential threats, failure to detect data exfiltration, failure to monitor employees, failure to detect insider threats, failure to identify compromised accounts, failure to identify improper user account usage such as shared accounts, failure to investigate malicious activity, failure to demonstrate compliance during information audits and failure to investigate cyber-security incidents due to limited knowledge of how things are managed”.*

R8

From secondary data by Biryabarema (2020), President Yoweri Museveni issued a directive to install CCTV cameras in Kampala Metropolitan area which includes Wakiso district; and this was seen as a good idea in curbing down the ill conducts of criminality, terrorism, theft, and reckless driving among others. This called for alternative sources of power along with the CCTV cameras perhaps solar powered cameras or power backups for a 24/7 surveillance to give no chance to the criminals. As one respondent noted, some people in the political opposition of Uganda claim that the CCTV camera system was introduced in order to carryout surveillance on the opposition and to follow up and break opposition gatherings and also use the footages which have been doctored in courts of law.

# 4.4.11 The other social challenges associated with the CCTV system

For one respondent who used a prism of the human rights, noted that the CCTV camera system which is directed at some one’s house is an infringement on your civil liberties. In support of this argument, Piza et al., (2014) questioned why film innocent people doing nothing criminal in public places and some even appear in public restrooms. Those who give up liberty for safety deserve neither; a camera everywhere is not a deterrent as all that’s needed is a mask. Another respondent noted that it allows governments to watch us, which may not matter now, but in the wrong hands, can be catastrophic of the footages are misused or are influenced by the state to prosecute those who do not support them.

In another argument by the respondent,

*“even when the cameras detect an accident, it often takes police 1 to 2 hours to arrive at the scene, and for the ambulances, without money it may never come or can come after 2 hours to get to the injured person. The surveillance cameras do nothing to help the man, so the idea of the CCTV camera is an awful idea because if a window is open somewhere, a person could look through and watch them all the time so that is an invasion of privacy”.*

R9

One local resident revealed that,

*“CCTV cameras are just a less effective alternative to having police walk the streets. CCTV cameras are just there to give the public a false feeling of safety and are a less effective replacement for policing”.*

R10

The myth is that CCTV cameras prevent crime, but the reality is that they do not, Internet connected IP cameras being particular.

**4.5 The ways in which the CCTV camera system can be made more effective to enhance detection and response to crime as well as improve law enforcement in Wakiso District**

The study findings on the ways in which the CCTV camera system can be made more effective to enhance detection and response to crime as well as improve law enforcement in Wakiso District are presented in this section;

# Table 4.36: The ways in which the CCTV camera system can be made more effective to enhance detection and response to crime as well as improve law enforcement in Wakiso District

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | **Frequency** | **Percent** | **Valid Percent** | **Cumulative Percent** |
| Valid statement | Adoption of CCTV surveillance in order to identify criminals involved in any form of criminality | 21 | 17.8 | 17.8 | 17.8 |
| Promoting CCTV camera system surveillance and civil liberties coexistence | 03 | 2.5 | 2.5 | 20.3 |
| Using the CCTV camera system as a cost-effective way to deter, document, and reduce crime | 14 | 11.9 | 11.9 | 32.2 |
| Enhancing technological advances in forms of CCTV camera system to boost the ability of security agencies to monitor public spaces | 20 | 16.9 | 16.9 | 49.1 |
| Adopt the use of CCTV for deterrence of crime | 06 | 5.1 | 5.1 | 54.2 |
| The CCTV camera systems promotes better security management in open and closed public spaces | 11 | 9.3 | 9.3 | 63.5 |
| The improved security enabled brought about by new technologies facilitates a radical extension of surveillance by both public institutions and the private sector | 14 | 11.9 | 11.9 | 75.4 |
| The CCTV camera system is got at enhancing situational crime prevention | 17 | 14.4 | 14.4 | 89.8 |
| The CCTV system should be adopted vigorously for use in housing category protection | 12 | 10.2 | 10.2 | 100.0 |
| Total | 118 | 100.0 | 100.0 |  |

**Source: Field data, 2021**

The study findings on the adoption of CCTV surveillance in order to identify criminals involved in any form of criminality revealed that 21 (17.8%) agreed, thus the potential value of public surveillance technology has taken on new meaning when investigators use it to identify criminals involved in any form of criminality for example those who robbed and killed people at Cheap Hardware in Nasana in 2019, after sifting through video images captured by the businesses’ and area CCTV camera system. Such cameras play in offering safety on a daily basis and during events both big and small, this was also accepted by La Vigne (2013) who states that the successful use of this technology in such a high-profile investigation is likely to prompt other major cities to reaffirm and even expand their investment in and use of surveillance cameras in Uganda. The study findings on promoting CCTV camera system surveillance and civil liberties coexistence revealed that 2.5% of the respondents agreed which means that the CCTV camera system surveillance and civil liberties can coexist if cameras are implemented and employed responsibly, for using public surveillance systems advises law enforcement to consider privacy issues when creating surveillance policies and implementing them in Uganda. For one,

*“cameras should avoid or mask inappropriate views of private areas, such as yards and second-story windows. Law enforcement agencies more so police should also document and publicize policies governing how surveillance cameras can be used and what the disciplinary consequences are for misuse, and this should be done where officers should be thoroughly trained on these policies and held accountable for abiding by them”.*

R11

On whether using the CCTV camera system as a cost-effective way to deter, document, and reduce crime, 11.9% of the respondents agreed, that using the CCTV camera system for public surveillance can be a cost-effective way to deter, document, and reduce crime. Urban’s research has shown that in Uganda, particularly in Kampala Metropolitan Area comprising Wakiso, Mukono and Kampala, the existing CCTV cameras are linked to reduced crime, even beyond the areas with camera coverage. The cost savings associated with crimes averted through camera systems in Wakiso saves the district a lot of time and personnel by four dollars for every dollar spent on the technology. As with any technology, the use of cameras is by no means a substitute for good old-fashioned police work. The ICT professionals and police detectives interviewed reported that,

*‘camera footage provides additional leads in an investigation and aids in securing witness cooperation. And police also believes that video footage serves as a complement to but not a replacement for eyewitness evidence in the courtroom’*

R12 et al., 2021

So, according to William (2014), to cover a public area under the CCTV surveillance is the best way to control the crime rate. Just in general security, cameras can be a big deterrent to criminality. The police officer revealed that when people see cameras mounted any criminal that is presumed half smart will feel it is riskier just to go to any house or building or business and commit whatever act against them because by surveillance, they are to get easily arrested.

Regarding the responses on whether enhancing technological advances in forms of CCTV camera system to boost the ability of security agencies to monitor public spaces, 16.9% of the respondents agreed, that technological advances in forms of CCTV camera system continue to enhance the ability of security agencies to monitor public spaces. One respondent noted that,

*“by extension, technology will continue to aid efforts to prevent crime and apprehend criminals for example the use of cameras enabled the police to identify suspects involved in the murder of Naggirinya and Kitayimbwa, the bomb suspects in Nansana in November 2021, and other cases which may prompt cities to seize upon additional surveillance opportunities, they should do so cautiously and with the benefit of lessons learned from other cities”*

R13

From a distant related source, from Boston (April 30th, 2013), it was revealed that the Boston Marathon bombers were apprehended quickly due to surveillance cameras at the site. No dispute over how well the public cameras were on that day. Police, citing public interest of all cameras could not resist capturing the images of the terrorists, so as noted in the interview, CCTV system surveillance cameras are important to deter crime. Through protecting the rights of the public interest of all surveillance cameras, police have allowed for the closing of legal loophole with electronic evidence collection by police where applicable.

Findings of the study on whether the adoption of the use of CCTV is vital for deterrence of crime, 5.1% of the respondents agreed. Further, according to respondents, the other major argument in favour of implementing camera surveillance is its assumed deterrent effect. Claims by police, private security and camera technology companies, deterrence is being proven for example Panga wielding criminals were captured in the compound of one person in the late hours of the night, which indicates that crime deterrence can be achieved in some locations like homes, parking garages and so on. Surveillance cameras in the public areas are very much effective compared to other security system even though they are important too. And Adesanmi Adedotun, 2014 stated that surveillance security camera is highly recommended for every sector home inclusive. Protecting life and properties this day is not easy since no one can present in two places at the same time but with the help surveillance security camera, you can be rest assured that you are 99% saved from intruders. A respondent noted that,

*“the first function involves deterrence of potential perpetrators of crimes and misdemeanours. It is based on the belief that people are rational and calculate risks involved in their actions, and because of the presence of a camera they will give up on their criminal plans. The detection function, through the recording of events and all types of behaviour, enables the detection of specific offenses and immediate response of authorized agencies”*

R14

Therefore, it points to the possibility of ascertaining the occurrence of an event that can be considered as an offense and recording the behaviour of persons participating in such an event and the way the perpetrators acted. The evidence collection function, on the other hand, indicates the possibility to attempt to identify groups or individual persons and material objects based on a recorded image from the place of an event recorded by a video surveillance system.

From the study on whether the CCTV camera systems promotes better security management in open and closed public spaces, 9.3% agreed, thus the CCTV camera systems promote better security management in open and closed public spaces. A senior security officer noted that,

*“the law governing the use of CCTV camera systems can divide spaces with video surveillance into open and closed public spaces, while giving only the police the power to conduct video surveillance in open public spaces. The law should also set out the prerequisites for the possibility of using video surveillance in public spaces to increase security, to improve the comfort of use of public spaces, and to prevent crime”*

R15

In Sustainability 2020, video surveillance systems can perform many different functions, which is due to the complex nature of the image captured by cameras, which consist of events and their sequences, spaces, people, material objects, and their dynamic changes in time and space. According to the application of video surveillance, there are three basic functions of video surveillance in the field of public security and order: protection and prevention, detection, and collection of evidence.

Findings of the study on whether the improved security enabled brought about by new technologies facilitates a radical extension of surveillance by both public institutions and the private sector, 11.9% agreed that the improved security enabled brought about by new technologies facilitates a radical extension of surveillance by both public institutions and the private sector. According to Farmer and Mann (2013), in the future, surveillance will become so ubiquitous, networked, and searchable that unmonitored public space will effectively cease to exist. Nemeth and Hollander, on the other hand, claim that public spaces are no longer places of open, democratic expression and relative anonymity, and are seen as potential targets of terror attacks and as such must be protected by any and all means necessary, which renders the deployment of CCTV surveillance necessary.

Findings of the study on whether the CCTV camera system is good at enhancing situational crime prevention, 14.4% of the respondents agreed. So, the CCTV camera system is good at enhancing situational crime prevention; CCTV is a type of situational crime prevention strategy that increases levels of formal surveillance within a target area for example a township. In a study by Cornish and Clarke (2003) and Welsh and Farrington (2009), this situational crime prevention helps in preventing crime by reducing criminal opportunities and increasing the perceived risk of offending through modification of the physical environment, which in this case involving CCTV camera surveillance. The situational prevention of crime is largely rooted in the rational choice perspective, which considers crime as purposive behaviour designed to meet the offender’s commonplace needs. As per the rational choice perspective, offenders consider a number of choice structuring properties which include the potential rewards and inherent risks involved in the commission of a particular crime. The primary aim of CCTV is considered to be the triggering of a perceptual mechanism that impacts an offender’s choice structuring properties in a manner that persuades them to undertake or abstain from crime in Wakiso and elsewhere.

Findings of the study on whether the CCTV system should be adopted vigorously for use in housing category protection, 10.2% of respondents agreed that the CCTV system should be adopted vigorously for use in housing category protection. For one respondent,

*“City/town centre surveillance like in Kajjansi, Kitovu, Kijapaani, Bbira-Nakabugo, Bujjuuko, Kyengera, Namayumba, Kakiri, Wakiso Town Council, suburbs of Entebbe Municipality, which are areas primarily comprised of residential and non-residential building types, such as commercial businesses require heavy deployment of CCTV surveillance”*

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In housing schemes, CCTV cameras cover the grounds of the complex such as the courtyard or areas in front of building entrances; and just like residential CCTV schemes which cover all public areas such as streets. Even if a housing complex is present within the view of residential CCTV cameras such settings were considered residential if public areas, rather than housing-complex property and are target of surveillance.

# CHAPTER FIVE

# SUMMARY, CONCLUSION AND RECOMMENDATIONS

# 5.0 Introduction

This chapter provides the summary, conclusion and recommendations in line with the efficacy of crime mapping technologies particularly Security Cameras on law enforcement in Wakiso District. The researcher obtained on the ways in which the CCTV camera system enables law enforcement agencies to obtain information on criminal incidents, the relevance of CCTV Camera system in storage and retrieval of information on crime incidents to enable law enforcement agencies track and prosecute criminals and the challenges facing the CCTV Camera system operation in providing evidence to prosecute criminality in Wakiso district.

# 5.1 Summary of findings

# 5.1.1 The ways in which the CCTV camera system enables law enforcement agencies to obtain information on criminal incidents in Wakiso district

The study discovered that Close Circuit Television camera system is used to detect criminal incidents as agreed by 82.2%. since the cameras offer surveillance for 24hours/7days (24/7), as remote sensing instruments, in the process, any criminal act like theft, Murder, kidnap and so on that take place within their range of capture, is stored, and can be retrieved as evidence for example the 2020 case of Naggiriinya and Kitayimbwa who were kidnapped and murdered, the CCTV system enabled the police to apprehend the murderers. Furthermore, since the Close Circuit Television camera system has been installed at vital points such as junctions, town allays, estates, traffic arteries, grounds of importance to promote smart city security arrangement.

According to the study, the existing Close Circuit Television camera system somewhat scares off criminals as they believe that their faces, car registration number plate and other features may be instantly captured and lead them inot prosecution. This fear is well rooted because the security information and communications Technology operators are able to transmit suspicions videos for security analysis to the necessary security bodies.

The study discovered that the CCTV camera system is a vital early warning system which can provided pre-crime alerts if the videos are analysed properly and critically. This existing CCTV camera system serves to remind the people of their security measures that they would otherwise forget easily, and as such it serves as an early warning system in such cases, people walking, working, or operating in the protected areas, which renders credence to Bennett & Gelsthorpe (2010) who pointed out that the common goal of CCTV camera systems is the prevention of crime and disorder through deterrence, so they provide public reassurance and therefore reduces fear of crime, which may, in turn, increase the use of public spaces in urban and per-urban areas such as Kinaawa, Nansana, Kajjansi, Kawuku, Abaita-Ababiri and others. This eye-CCTV camera system sees both during the day and at night thereby recording whatever takes place. As Baryamwisaki (2020) was quoted, the CCTV cameras aid investigation and enhance surveillance where more crime cases have been recorded over the years as the real time footage is accessible to different police units and security forces for the necessary security action.

CCTV can prevent crimes through other mechanisms (Welsh and Farrington, 2009b). Scholars have concluded that increased offender apprehension, increased natural surveillance, publicity, and improved citizen awareness are potential mechanisms of CCTV-generated crime reduction (Gill and Spriggs, 2005). Furthermore, CCTV has the potential to assist police after the commission of crimes, specifically by improving the response of personnel to emergencies (Ratcliffe, 2006), providing visual evidence for use in criminal investigations (Ashby, 2017), and securing early guilty pleas from offenders (Owen, Keats, and Gill, 2006).

We must also acknowledge the possibility for CCTV to increase reported crime, as CCTV can detect crimes that would have otherwise gone unreported to police (Winge and Knutsson, 2003) or to make citizens more vulnerable by providing a false sense of security, causing them to relax their vigilance, or stop taking precautions in public settings (Armitage, Smyth, and Pease, 1999).  
Systematic reviews and meta-analyses conducted by Welsh and Farrington (2002, 2008,  
2009a) have synthesized the empirical knowledge on CCTV. The initial review (Welsh and  
Farrington, 2002) included 22 evaluations and found that CCTV had a small but significant effect on vehicle crimes and no effect on violent crimes. The updated review (Welsh and Farrington, 2008, 2009a) included 44 evaluations and examined the effect of CCTV across four main settings: city and town centers, public housing, public transport, and car parks. It was found that CCTV was associated with a 16% reduction in crime, a significant effect. This effect was driven by a 51% reduction in crime in the car park schemes, with CCTV in the other settings having small and no significant effects on crime.

# 5.1.2 The relevance of CCTV Camera system in storage and retrieval of information on crime incidents to enable law enforcement agencies track and prosecute criminals in Wakiso district

The study discovered that the existing Close Circuit Television camera systems is serving the purpose for which they were installed. Wherever cameras capture and unusual incidents, alarm notifications alert the officers who can then create a footage, isolate and analyze in order to respond, though many respondents could not detail how, and the police officers identified contacted) could not divulge into detailed, but confirmed they are alerted. With 61.9% in agreement, it means that both the security officers and local people feel that with the existing Close Circuit Television system crime in urban areas, alongside major wads and in many motel areas in Wakiso district can be reprimanded because many areas are under 24/7 surveillance; for many petty criminals and criminals gangs have relented on their operations. In addition to that, 73.7% agreed that the Close Circuit Television camera system deliver information which enable police and security forces to collaborate pieces of information for necessary action.

The study revealed that since Close Circuit Television camera system is mounted with critical vision lens or “eyes”, 73.7% agreed that these provide the police with detailed visual information that is vital to reprimand with certainty the perpetrators of crime. So as agreed by 78.8%, implies that the captured videos are developed into footages which are then used to map out incidents and produce them when needed to reconstruct crime scenes and incidents as well as evidence when required.

The existing idea of secure smart city model (SSCM) has made it imperative for CCTV camera system to become ubiquitous in Wakiso District. This is to aid security agencies and police to have well monitored public areas, contrary to the traditional policing of observing by the deployed police with their eyes. The security forces in Uganda, more so police for law and order now employ public video surveillance as a primary tool to monitor population movements and to prevent crime and terrorism, both in the private and public sectors. The effective operations of the CCTV camera system is enabled by the integrated Artificial Intelligence and analytics software available for use to enable operators real time access to information they can analyse and address crime.

# 5.1.3 The challenges facing the CCTV Camera system operation in providing evidence to prosecute criminality in Wakiso district

The study discovered that 60.2% agreed the police CCTV operators complain about long working hours because they are few in number yet glued to the monitors for many hours which compromises their effectiveness. The intended full-time vigilance of the CCTV monitoring team enables them to send signals to motorized patrollers for a timely response, but for the CCTV operators can be more efficient on the job if their working hours are reduced, are availed special gear to protect them from lights produced by the monitors, because the current system risks damaging their eyesight.

The study revealed that the police lack adequate ICT staff to handle the operations of the CCTV system centre where video analysis takes place. For these operators, it is not easy to be seated in one place with eyes glued on a monitor for more than 8 hours. This is further exacerbated by the fact that they do not have resting places or accommodation at or near the workstations. And with the absence of strong internal checks and balances, these tired and less motivated officers become sources of classified information to potential misusers of it like criminals.

The study also discovered that it was expensive to set up more than 428 cameras in Wakiso District alone as agreed by 51.7% because in the words of Biryabarema (2020), the cameras and all accessories were very expensive, making it expensive still to maintain them including the cyber cables, monitors, installation poles, labour costs and so on. Despite the system being expensive to purchase, put in place and maintain, it has not been immune to hacking as was briefly reported in March 2021 when hackers jammed the flow of information on the police website. This partly incapacitated the CCTV camera system’s operations.

Also, much as the system is powered by solar, it also requires flow of power at the centre, but the occasional and routine load shedding breaks the flow of power, yet it is constantly required to run the system.

Being eagle eyes, the public CCTV system is threatening to breach private security systems as agreed by 80.5%; so some in opposition like Ingrid Turinaawe of FDC noted that the CCTV camera system is installed by government to surveil them, their homes and activities the case in Magere where the CCTV camera was later installed to look directly in the house of the Ugandan leading opposition figure’s (bobi Wine/Robert Kyagulannyi Ssentamu) home. Further still, some police officers have been accused of trading the information for money or for use by authorised security agents as agreed by 75.4% of respondents.

The study revealed that there are failures to often detect patterns indicating potential attacks due to cyber-crime, weak monitoring of the user behaviour including potentially suspicious activity, failure to detect potential threats, failure to detect data exfiltration, failure to monitor employees, failure to detect insider threats, failure to identify compromised accounts, failure to identify improper user account usage such as shared accounts, failure to investigate malicious activity, failure to demonstrate compliance during information audits and failure to investigate cyber-security incidents due to limited knowledge of how things are managed. For Piza et al., (2014), why film innocent people doing nothing criminal in public places and some even appear in public restrooms. The CCTV system allows governments to watch us, which may not matter now, but in the wrong hands, can be catastrophic of the footages are misused or are influenced by the state to prosecute those who do not support them, but more critically, reprimand crime and criminals.

# 5.1.4 The ways in which the CCTV camera system can be made more effective to enhance detection and response to crime as well as improve law enforcement in Wakiso District

The study revealed that the adoption of CCTV surveillance is so in order to identify criminals involved in any form of criminality, the CCTV camera system surveillance and civil liberties can coexist if cameras are implemented and employed responsibly, for using public surveillance systems advises law enforcement to consider privacy issues when creating surveillance policies and implementing them in Uganda. Using the CCTV camera system for public surveillance can be a cost-effective way to deter, document, and reduce crime. Urban’s research has shown that in Uganda, particularly in Kampala Metropolitan Area comprising Wakiso, Mukono and Kampala, the existing CCTV cameras are linked to reduced crime, even beyond the areas with camera coverage. The cost savings associated with crimes averted through camera systems in Wakiso saves the district a lot of time and personnel by four dollars for every dollar spent on the technology. As with any technology, the use of cameras is by no means a substitute for good old-fashioned police work. According to William (2014), to cover a public area under the CCTV surveillance is the best way to control the crime rate. Just in general security, cameras can be a big deterrent to criminality.

The rapid smart city technological advances in forms of CCTV camera system continue to enhance the ability of security agencies to monitor public spaces. By extension, technology will continue to aid efforts to prevent crime and apprehend criminals for example the use of cameras enabled the police to identify suspects involved in the murder of Naggirinya and Kitayimbwa, the bomb suspects in Nansana in November 2021, and other cases. Implementing camera surveillance is its assumed deterrent effect. Claims by police, private security and camera technology companies, deterrence is being proven for example Panga wielding criminals were captured in the compound of one person in the late hours of the night, which indicates that crime deterrence can be achieved in some locations like homes, parking garages and so on. Surveillance cameras in the public areas are very much effective compared to other security system even though they are important too. And Adesanmi Adedotun, 2014 stated that surveillance security camera is highly recommended for every sector home inclusive. Protecting life and properties this day is not easy since no one can present in two places at the same time but with the help surveillance security camera, you can be rest assured that you are 99% saved from intruders. The first function involves deterrence of potential perpetrators of crimes and misdemeanours. It is based on the belief that people are rational and calculate risks involved in their actions, and because of the presence of a camera they will give up on their criminal plans. The detection function, through the recording of events and all types of behaviour, enables the detection of specific offenses and immediate response of authorized agencies. Therefore, it points to the possibility of ascertaining the occurrence of an event that can be considered as an offense and recording the behaviour of persons participating in such an event and the way the perpetrators acted. The CCTV camera systems promote better security management in open and closed public spaces. The law governing the use of CCTV camera systems can divide spaces with video surveillance into open and closed public spaces, while giving only the police the power to conduct video surveillance in open public spaces. The law should also set out the prerequisites for the possibility of using video surveillance in public spaces to increase security, to improve the comfort of use of public spaces, and to prevent crime.

Further, the improved security enabled brought about by new technologies facilitates a radical extension of surveillance by both public institutions and the private sector. The use of CCTV camera system is good at enhancing situational crime prevention, to which Welsh and Farrington (2009) stated that this situational crime prevention helps in preventing crime by reducing criminal opportunities and increasing the perceived risk of offending through modification of the physical environment, which in this case involving CCTV camera surveillance. The situational prevention of crime is largely rooted in the rational choice perspective, which considers crime as purposive behaviour designed to meet the offender’s commonplace needs. Thus, the CCTV system should be adopted vigorously for use in housing category protection. In housing schemes, CCTV cameras cover the grounds of the complex such as the courtyard or areas in front of building entrances; and just like residential CCTV schemes which cover all public areas such as streets. Even if a housing complex is present within the view of residential CCTV cameras such settings were considered residential if public areas, rather than housing-complex property and are target of surveillance. City/town centre surveillance like in Kajjansi, Kitovu, Kijapaani, Bbira-Nakabugo, Bujjuuko, Kyengera, Namayumba, Kakiri, Wakiso Town Council, suburbs of Entebbe Municipality, which are areas primarily comprised of residential and non-residential building types, such as commercial businesses require heavy deployment of CCTV surveillance.

# 5.2 Conclusion

# 5.2.1 The ways in which the CCTV camera system enables law enforcement agencies to obtain information on criminal incidents in Wakiso district

The Close Circuit Television camera system is used for 24/7 surveillance, and in the process, any criminal act like theft, Murder, kidnap and so on that take place within their range of capture, is captured, and relayed to the control centre. The cameras enable police to detect and monitor how the people move and operate, and in case of any occurrence of a security incident police can collate the movements of criminals and how they operate. The current Close Circuit Television system can hardly be used to detect hackers, the existing Close Circuit Television camera system somewhat scares off criminals, and where it is detected, the public and her sister security agencies can know the exact location and respond in time and appropriately, the security information and communications Technology operators are able to transmit suspicions bites or videos for security analysis in which criminality is identified, reported and followed up, the system has brought some undoubtable degree of success in following up on criminality in the district.

The cameras have the eagle eye to detect and store or relay all what happens which provides the platform for the security officers to make the appropriate decision on regarding follow up and stopping criminal activities in the areas where they are established and those without them, but where collaboration with individual households can be established to have footages shared about criminal incidents for example the murder of Mulindwa, a boda-boda cyclist in 2020 was well captured on a private Close Circuit Television camera which was shared with police and the assailants were apprehended, prosecuted and sentenced to imprisonment, the Close Circuit Television camera system have enabled the security agencies to reprimand criminals like in 2019, the army used the camera’s in Kyengera to get information about a runaway vehicle from Entebbe that had criminals who wanted to disappear with army / SFC attires and machinery, while in 2020 a young man who plucked off the side mirrors and door lockers from an SUV Toyota Land Cruiser Pad was taped well by a Close Circuit Television camera on a domestic wall.

# 5.2.2 The relevance of CCTV Camera system in storage and retrieval of information on crime incidents to enable law enforcement agencies track and prosecute criminals in Wakiso district

According to the study, the Close Circuit Television camera systems is serving the purpose for which they were installed, but the limitations with their surveillance structures and extent makes it head for them to capture all incidents police would naturally be very interested into compile information on criminality. Wherever cameras capture and unusual incidents, alarm notifications alert the officers who can then create a footage, isolate and analyze in order to respond, though many respondents could not detail how, and the police officers identified contacted) could not divulge into detailed, but confirmed they are alerted. Both the security officers and local people feel that with the existing Close Circuit Television system crime in urban areas, alongside major wads and in many motal areas in Wakiso district can be reprimanded because many areas are under 24/7 surveillance; for many petty criminals and criminals gangs have relented on their operations though there are many incidents that go unreported for example the September incident in Nangabo where a 9 year old child was killed supposedly for ritual sacrifice. But on the grander scale, they are a vital back up security apparatus that is highly appreciated.

The study the Close Circuit Television camera system is crucial monitoring every situation in their range, and this can enable police and security forces to collaborate pieces of information from different shots or videos to create a scenery and track crime, but crime has not been fully eradicated, but has been reduced as some criminals fear to act in areas where the Close Circuit Television is seen. The Close Circuit Television camera system is amounted with recorders, or the control centre has recorders where the captured images are stored for retrieval and security decision making in the areas which are affected for example the theft of property. The police have chance now to reprimand with quite better source of evidence, for example in the case of the murder of Naggirinya in 2020, the police were able to build its file with detailed evidence of photographs/images and videos on suspects as they had been able to retrieve it from the Close Circuit Television camera control system. The captured videos are developed into footages which are then used to critically follow-on incidents and produce them when needed to reconstruct crime scenes and incidents for better follow-up on the certain crime or crimes.

The existing Close Circuit Television Camera system can ably recognize license plate at most stations, and this is what has partly enabled the police to track down all the assailants, thieves, burglars, highway robbers and so on. The CCTV Camera system in place The CCTV Camera system is used to obtain facial recognition of suspects in crime which is why most criminals who have carried out their criminality where these cameras can reach have been easily recognized and some nabbed by the security forces.

There is some degree of use of edge computing, edge computing is a distributed information technology architecture in which client data is processed at the periphery of the network, as close to the originating source as possible, so with the existing CCTV Camera system, this is only possible for a short time. These CCTV Camera systems are awash in an ocean of data, and huge amounts of data is routinely collected operating in real time from remote locations and inhospitable operating environments almost anywhere in the district of Wakiso as long as the camera can pick there.

# 5.2.3 The challenges facing the CCTV Camera system operation in providing evidence to prosecute criminality in Wakiso district

The study revealed that police have low capacity in terms of trained personnel to handle this technology to the best use in addressing crime revealed that 60.2% of the respondents agreed because of having less numbers than they should have, in the Independent of June 18th 2021, they quoted police CCTV operators complaining about long working hours. These security Closed Circuit Television Camera-CCTV operators were concerned about the long working hours they are subjected to which affects their ability to closely monitor all events happening around, particularly in Wakiso and Kampala. The CCTV operators work for more than 12 hours a day and are expected to stay glued on the screens, taking a keen interest in the developments and peculiarities around the city. For example even when two warnings had been issued to them by Information and Communications Technology and Criminal Investigations Directorate directors prior to the shooting of former army commander, Gen Katumba Wamala before 1st June on the edges of Wakiso District, the fatigued and demoralized officers could not get on top of their game. But the monitoring rooms need full-time attendance so that the real-time intelligence provided by these cameras is put to effective use.

The police have few personnel to run the camera centre, and as such the existing ones are overloaded with work. According to URN, 2021, one officer at the police CCTV ICT centre noted that it is not easy to be seated in one place with your eyes glued on a monitor for twelve hours. The security camera operators said they would wish to be given accommodation just like their colleagues attached to National CCTV Command Centre at Naguru, so that they can respond to emergencies in the event that anything happens when they are already out of the station. Though on a small scale, but police is not having strong internal checks and balances to safeguard all the information well from being pirated for ill use, the screen monitors, cameras, installations, cyber cables are so expensive.

The hackers jammed the flow of information in the police websites and emails, rendering even the CCTV camera system vulnerable in this case. The CCTV system relies on Hydro-Electric power or solar power, the CCTV systems do not require supply of Hydro power which is often unreliable but use solar power and batteries; but often also need Hydro which when not available their transmission capacity is quite slow. The results of the study show that 80.5% of the respondents agreed that in some cases the CCTV camera system is installed by police to surveil political opponents’ homes, get to know and follow the opposition operations in certain areas like Magere where the leading opposition figure stays, and trail the opposition members. Sometimes, accusations have come up in which the police officers have been accused of selling information, but it has been proven some police officers can misuse and sale information to those hey connive with.

The findings of the study show that in some cases of some security officers misusing the footages due to corruption and rivalries or political interests happens. Having less numbers than they should have, in the Independent of June 18th, 2021, they quoted police CCTV operators complaining about long working hours. These security Closed Circuit Television Camera-CCTV operators were concerned about the long working hours they are subjected to which affects their ability to closely monitor all events happening around, particularly in Wakiso and Kampala. The full-time vigilance of the CCTV monitoring team enables them to send signals to motorized patrollers for a timely response. But CCTV operators stated that they would be more efficient on the job if their working hours are reduced and that they should be given special gear to protect them from lights produced by the monitors saying that excessively watching these monitors is likely to affect their eyesight.

# 5.2.4 The ways in which the CCTV camera system can be made more effective to enhance detection and response to crime as well as improve law enforcement in Wakiso District

The study concludes that the adoption of CCTV surveillance in order to identify criminals involved in any form of criminality thus the potential value of public surveillance technology has taken on new meaning when investigators use it to identify criminals involved in any form of criminality for example those who robbed and killed people at Cheap Hardware in Nasana in 2019, after sifting through video images captured by the businesses’ and area CCTV camera system, promoting CCTV camera system surveillance and civil liberties coexistence which means that the CCTV camera system surveillance and civil liberties can coexist if cameras are implemented and employed responsibly, for using public surveillance systems advises law enforcement to consider privacy issues when creating surveillance policies and implementing them in Uganda.

For one, cameras should avoid or mask inappropriate views of private areas, such as yards and second-story windows. Law enforcement agencies more so police should also document and publicize policies governing how surveillance cameras can be used and what the disciplinary consequences are for misuse, and this should be done where officers should be thoroughly trained on these policies and held accountable for abiding by them.

According to the study, using the CCTV camera system for public surveillance can be a cost-effective way to deter, document, and reduce crime. Throughout Wakiso, the existing CCTV cameras are linked to reduced crime, even beyond the areas with camera coverage. The cost savings associated with crimes averted through camera systems in Wakiso saves the district a lot of time and personnel by four dollars for every dollar spent on the technology.

As with any technology, the use of cameras is by no means a substitute for good old-fashioned police work. Enhancing technological advances in forms of CCTV camera system to boost the ability of security agencies to monitor public spaces, technological advances in forms of CCTV camera system continue to enhance the ability of security agencies to monitor public spaces. By extension, technology will continue to aid efforts to prevent crime and apprehend criminals for example the use of cameras enabled the police to identify suspects involved in the murder of Naggirinya and Kitayimbwa, the bomb suspects in Nansana in November 2021, and other cases which may prompt cities to seize upon additional surveillance opportunities, they should do so cautiously and with the benefit of lessons learned from other cities.

The other major argument in favour of implementing camera surveillance is its assumed deterrent effect. Claims by police, private security and camera technology companies, deterrence is being proven for example Panga wielding criminals were captured in the compound of one person in the late hours of the night, which indicates that crime deterrence can be achieved in some locations like homes, parking garages and so on. The first function involves deterrence of potential perpetrators of crimes and misdemeanours. It is based on the belief that people are rational and calculate risks involved in their actions, and because of the presence of a camera they will give up on their criminal plans.

The detection function, through the recording of events and all types of behaviour, enables the detection of specific offenses and immediate response of authorized agencies. Therefore, it points to the possibility of ascertaining the occurrence of an event that can be considered as an offense and recording the behaviour of persons participating in such an event and the way the perpetrators acted. The evidence collection function, on the other hand, indicates the possibility to attempt to identify groups or individual persons and material objects based on a recorded image from the place of an event recorded by a video surveillance system.

Welsh and Farrington (2008, 2009a) referred to the housing category as “public housing” given that all of the complexes in the identified evaluations were publicly owned. The present review identified CCTV evaluations that were conducted in housing complexes that were privately owned and operated, rendering the “public housing” label inaccurate. Rather than treat the different types of housing complexes separately, we use the more generic label “housing” in reference to all evaluations of CCTV in housing complexes.

Given the potential overlap between the setting categories, we feel that further explanation of the classification is necessary. Residential settings are distinguished from housing in terms of the areas that are under the view of CCTV.

The CCTV camera systems promotes better security management in open and closed public spaces; thus the CCTV camera systems promote better security management in open and closed public spaces. The law governing the use of CCTV camera systems can divide spaces with video surveillance into open and closed public spaces, while giving only the police the power to conduct video surveillance in open public spaces. The law should also set out the prerequisites for the possibility of using video surveillance in public spaces to increase security, to improve the comfort of use of public spaces, and to prevent crime. The improved security enabled brought about by new technologies facilitates a radical extension of surveillance by both public institutions and the private sector.

According to Farmer and Mann, in the future, surveillance will become so ubiquitous, networked, and searchable that unmonitored public space will effectively cease to exist. The CCTV camera system is good at enhancing situational crime prevention; CCTV is a type of situational crime prevention strategy that increases levels of formal surveillance within a target area for example a township. In a study by Cornish and Clarke (2003) and Welsh and Farrington (2009), this situational crime prevention helps in preventing crime by reducing criminal opportunities and increasing the perceived risk of offending through modification of the physical environment, which in this case involving CCTV camera surveillance.

The study revealed that the CCTV system should be adopted vigorously for use in housing category protection. In housing schemes, CCTV cameras cover the grounds of the complex such as the courtyard or areas in front of building entrances; and just like residential CCTV schemes which cover all public areas such as streets. Even if a housing complex is present within the view of residential CCTV cameras such settings were considered residential if public areas, rather than housing-complex property and are target of surveillance. City/town centre surveillance like in Kajjansi, Kitovu, Kijapaani, Bbira-Nakabugo, Bujjuuko, Kyengera, Namayumba, Kakiri, wakiso Town Council, suburbs of Entebbe Municipality, which are areas primarily comprised of residential and non-residential building types.

Public interest and safety along with surveillance cameras are here to stay. The definition of a public camera for public interest vs a private surveillance camera placed for bad behavior has a very blurry line. Four privately owned security cameras deliberately aimed to view inside of my windows, invade my privacy within my own domain has a fact of life. By placing personal identifying information in view of said camera, thus rendering any pictures useless; privately owned, operated surveillance cameras are treated the same as public cameras.

# 5.3 Recommendations

Having carried out a successful study on the efficacy of crime mapping technologies particularly Security Cameras on law enforcement in Wakiso District, I recommend as follows;

1. Regarding the ways in which the CCTV camera system enables law enforcement agencies to obtain information on criminal incidents in Wakiso district, the study recommends that there should be advancement of the CCTV system in such an urbanised district in order to improve the recording and storing technologies and software such as video analytics to make them more efficient as a forensic tool that is collecting evidence about crime.
2. Regarding the relevance of CCTV Camera system in storage and retrieval of information on crime incidents to enable law enforcement agencies track and prosecute criminals in Wakiso district. It was suggested that the existing CCTV surveillance systems should become more easily integrated with monitoring devices, alarm systems and access control devices in order to help security personnel to identify and interrupt security breaches so that they can launch pre-emptive attacks on criminal activities.
3. Regarding the challenges faced in using the existing CCTV Camera system to produce adducible incriminating evidence to prosecute criminality in Wakiso district, there should enhancement of intelligent video algorithms like motion detection which can identify unusual movement patterns and alert a guard to watch a particular video screen. This object-recognition algorithm can identify someone who might simply be loitering or even a briefcase or other suspicious object that is left somewhere to alert a monitoring guard so that appropriate action can be taken.
4. Regarding the possible ways to overcome the challenges facing CCTV camera system, it was recommended that the CCTV technology should be connected to the smart phone so that the security officers and owners are linked to monitor CCTV where the CCTV monitoring software allows authorised users to receive notifications on their smart phones whenever certain incidents occur including movement within a defined area if motion detectors or smart video analytics have been included in the installation.

# 5.4 Areas for further study

The following areas for further study are explored;

1. **The contribution of CCTV camera technologies to preventive crime prevention in Uganda**
2. **CCTV surveillance technologies as effective tools for evidence collection and ensuring organisation’s physical security in Uganda**
3. **Effectiveness of CCTV camera surveillance of private and sensitive area to ensure organisation secrecy in Uganda**
4. **CCTV cameras as effective tools to protect against false liability lawsuits, avoid theft, lower risk of vandalism and moderating security expenditure in Uganda**

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# Appendices

# Appendix 1: Questionnaire Guide

**NKUMBA UNIVERSITY**

**SCHOOL OF SOCIAL SCIENCES**

**Dear respondent,**

I am Joseph Brown, a student of the above mentioned University and currently undertaking a research study titled, ***“the efficacy of crime mapping technologies particularly Security Cameras on law enforcement in Wakiso District.”,*** request you to provide responses to the questions in this questionnaire. The responses you provide shall be treated with confidentiality and will never be divulged for any other use other than the academic interest for which they have been solicited from you.

**Yours truly,**

**……………………………..**

**Researcher**

**Section A: The respondents’ Bio data**

|  |  |  |
| --- | --- | --- |
| **Category** | **Tick the most appropriate** | |
| Gender/sex of respondents | Male |  |
| Female |  |
| Age range of respondents | 15-30 years |  |
| 31-45 years |  |
| 46-60 years |  |
| 61 years and above |  |
| Respondents level of education | No education at all |  |
| Primary |  |
| Secondary |  |
| Tertiary |  |
|  |  |  |
|  |  |
|  |  |
|  |  |
|  |  |  |
|  |  |
|  |  |
|  |  |
| The position you occupy | Police officer |  |
| Local leaders |  |
| Boda-Boda cyclists |  |
| Traders |  |
| Community members |  |
| ICT professional |  |

**For section B, C and D, determine the answer through the following 3 point Likert Scale:**

**A=Agree (3), NS=Not Sure (02) and D=Disagree (1), and also respond to the structured questions**

**Section B: The ways in which the CCTV camera system enables law enforcement agencies to obtain information on criminal incidents in Wakiso district**

1) The period you have seen CCTV cameras in your area

i. 1-4 years ( ) ii. 5-9 years ( ) iii. 10-14 years ( ) iv. 15 years and more ( )

2) The period you have known and worked in the CCTV camera system

i. 1-4 years ( ) ii. 5-9 years ( ) iii. 10-14 years ( ) iv. 15 years and more ( )

|  |  |  |  |
| --- | --- | --- | --- |
| **Statement/question** | **Distribution of responses** | | |
| **Agree** | **Not sure** | **Disagree** |
| 3) The CCTV camera system are used to detect criminal incidents |  |  |  |
| 1. With remote sensing capabilities, CCTV camera system are employed for safety of the cities/towns |  |  |  |
| 1. The CCTV camera system is used to monitor the movements and operations of the general community or people |  |  |  |
| 1. CCTV camera system is used to enhance cyber security to fight cyber crime |  |  |  |
| 1. CCTV camera system is in place to enable effective public safety interventions to curb crime and improve the liveability and economic well-being of their communities |  |  |  |
| 1. The CCTV camera system is used for monitoring foreigners’ activities in the area |  |  |  |
| 1. CCTV camera system is used to identify, report and follow up criminality |  |  |  |
| 1. The CCTV camera system is used to watch over and carry-on video surveillance duties on the streets and urban areas |  |  |  |
| 1. The CCTV camera system offers physical security in homes and in public places |  |  |  |

1. What is the effectiveness of CCTV camera system as an early warning system in fighting crime?

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1. In what ways do CCTV camera systems enable the police ICT personnel to identify the nature of crime captured?

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1. In what ways do CCTV camera systems enable the police ICT personnel in police to indentify the perpetrators of crime as captured?

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1. In what ways do CCTV camera systems enable the police to investigate the type of crime committed?

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1. In what ways do CCTV camera systems enable the police ICT department to document crime?

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**Section C: The relevance of CCTV Camera system in storage and retrieval of information on crime incidents to enable law enforcement agencies track and prosecute criminals in Wakiso district**

|  |  |  |  |
| --- | --- | --- | --- |
| **Statement/question** | **Distribution of responses** | | |
| **Agree** | **Not sure** | **Disagree** |
| 1. There is effective utilization of the existing CCTV Camera system (video cameras) in surveillance of a particular area where they are installed and used to monitor |  |  |  |
| 1. The CCTV Camera system’s alarm notification provides notifications to the police officers |  |  |  |
| 1. The CCTV Camera system offers a line confident line of psychological preparation of the population as they get to know that crime is being tracked and managed |  |  |  |
| 1. The CCTV Camera system is vital in monitoring and eradication of crimes through availing vivid evidence |  |  |  |
| 1. The CCTV Camera system enables the retrieval of video evidence to track and reprimand criminals |  |  |  |
| 1. The CCTV Camera system avails video footages as evidence in court against criminal suspects |  |  |  |
| 1. The CCTV Camera system enables credible video analytics in reconstructing crime incidents |  |  |  |
| 1. The CCTV Camera system is vital in llicense plate recognition so that vehicles used by criminals can be well tracked |  |  |  |
| 1. The CCTV Camera system is used to obtain facial recognition of suspects in crime |  |  |  |
| 1. With CCTV Camera system, artificial intelligence-enabled solutions are at the disposal of police to establish security breaches logically |  |  |  |
| 1. The CCTV Camera system offers edge technology for real-time video streaming of events as they happen including crime incidents within their range of observation |  |  |  |

1. In what ways does the CCTV Camera system help in addressing crime and criminality in your area?

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1. How important is the analytics-based security approach to security management in the area?

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1. In what ways do the CCTV Camera system provide video evidence which can help the police to obtain forensic samples at crime incidents?

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**Section D: The challenges facing the CCTV Camera system operation in providing evidence to prosecute criminality in Wakiso district**

|  |  |  |  |
| --- | --- | --- | --- |
| **Statement/question** | **Distribution of responses** | | |
| **Agree** | **Not sure** | **Disagree** |
| 1. The police has low capacity in terms of trained personnel to handle this technology to the best use in addressing crime |  |  |  |
| 1. The police lacks adequate ICT staff to handle the operations of the CCTV system centre where video analysis takes place |  |  |  |
| 1. The police lacks checks and balances on those managing the information centre where video analysis is done |  |  |  |
| 1. The CCTV system and its accessories are so expensive for the police to manage those which can cover the entire district |  |  |  |
| 1. Hacking is common because the system is vulnerable to artificial intelligence and space technology |  |  |  |
| 1. The district experiences inadequate power to constantly run the system, so vital real information is missed whenever power is off |  |  |  |
| 1. There are inadequate coverage of the CCTV system in the district |  |  |  |
| 1. The public CCTV system is threatening to breach of private security systems |  |  |  |
| 1. The operations of the CCTV system are not independent of security manipulation in police and by the hackers |  |  |  |
| 1. There are cases of some security officers misusing the footages due to corruption and rivalries or political interests |  |  |  |

1. What are the other technical challenges associated with the CCTV system?

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1. What are the political challenges associated with the CCTV system?

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1. What are the other social challenges associated with the CCTV system?

……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………….

**End**

# Appendix 2: Interview Guide

**NKUMBA UNIVERSITY**

**SCHOOL OF SOCIAL SCIENCES**

**Dear respondent,**

I am Joseph Brown, a student of the above mentioned University and currently undertaking a research study titled, ***“the efficacy of crime mapping technologies particularly Security Cameras on law enforcement in Wakiso District.”,*** request you to provide responses to the questions in this questionnaire. The responses you provide shall be treated with confidentiality and will never be divulged for any other use other than the academic interest for which they have been solicited from you.

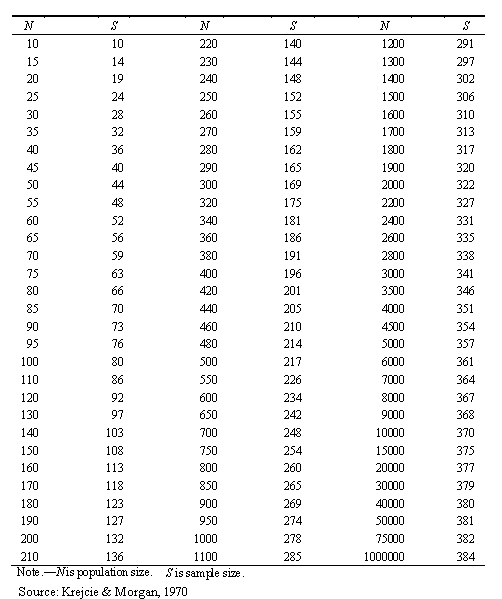
**Researcher**

In what ways is CCTV camera system activating the early warning in addressing criminality?

1. What roles do the CCTV camera system information managers at police play ensuring that ICT personnel are in place to carry out video analytics?
2. How effective are the CCTV camera system in supporting police to investigate and document crime?
3. In what ways is police leveraging or benefiting from the available CCTV Camera system to promote artificial intelligence-enabled solutions?
4. How useful is the CCTV Camera system videos in prosecuting criminals?
5. In what ways does the CCTV Camera system enable the enforcement of national cyber security policies in Wakiso?
6. How vital are CCTV Camera system videos vital for biometric information automation?
7. What is the usefulness of CCTV camera system’s data in reprimanding criminals?
8. What the possible solutions to the challenges facing the existing usage of CCTV camera system in addressing crime?
9. What are the best practises in the use of CCTV camera system for reducing crime in Wakiso District?
10. Any other information?

**Thanks a lot**

# Appendix 3: Table for determining a sample from a definite population, 1970

[](http://www.kenpro.org/wp-content/uploads/2013/08/krejcie-and-morgan-table-of-determining-sample-size.png)

# APPENDIX 4: WORK PLAN AND BUDGET LINE

1. ***Research work plan***

|  |  |  |  |
| --- | --- | --- | --- |
| **Period** | **Activities** | **Resources** | **Persons involved** |
| **August 2021** | Submission of the research topic | **Scholastic materials** | Researcher and supervisor |
| **October 2021 to November 2021** | Writing of the research proposal | **Scholastic materials** | Researcher and supervisor |
| **November 2021** | Approval of the research proposal | **Scholastic materials** | Supervisor |
| **December, 2021** | Data collection | **Scholastic materials** | Researcher and Respondents |
| **December, 2021** | Submission of the research report for corrections | **Scholastic materials** | Researcher and supervisor |
| **January, 2022** | Submission of the research report for marking | **Scholastic materials** | Supervisor |

# 

# *(b) Budget Estimates*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Items** | **Quantity** | **Unit cost** | **Amount** |
| 1 | Transport to and from the field | 06 | 110,000 | 660,000 |
| 2 | Typing and printing | 08 copies | 12,000 | 96,000 |
| 3 | Stationery | 05 reams | 20,000 | 100,000 |
| 4 | Binding | 04copies | 15,000 | 60,000 |
| 5 | Communication | Airtime and internet charges | - | 70,000 |
| 6 | Contingency | All | 245,000 | 245,000 |
|  | **Ground Total** |  |  | **1,327,000/=** |