Crime Analysis and Conventional Policing Strategies:
Evidence from a Community in the Western Region, Ghana

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Abstract

The study investigated the application of crime analysis at various police stations within the Tarkwa-Nsuaem Municipality in the Western Region of Ghana with the objective of understanding crime, crime analysis, crime control and crime information management and their implications on conventional policing strategies. Qualitative and quantitative research adopting the questionnaire and interview were conducted with crime analysts and specialized investigators/intelligence analysts through descriptive and explorative research design. The study had a dual purpose of generating operational crime management information in assisting crime prevention initiatives as well as identifying the strengths and weaknesses of current practices for improving performance, mainly focusing on the criminal activities of group offenders (organized crime related), repeat offenders and serial offenders.

Keywords: crime analysis, information management, punitive measures, rehabilitation

1. Introduction

The heightening level of crime in Ghana as observed by Appiahene-Gyamfi (2003) and in particular the rise in organized crime has presented a huge threat to social security, good governance and economic development (Antwi, 2015). The situation according to Appiahene-Gyamfi (2003) has been catalyzed by rigid government centralization and bureaucracy that serves a barrier to police responsiveness to crime, a declining economy with low levels of employment, income and crime opportunities fostered by social changes such as the growth of social media. Avuyi (2017) also laments that the Ghanaian society has increasingly been threatened by heightened criminality such as murder-related crimes, robberies and burglaries, rape and defilement, violence-related crimes and assault, fraudulent acts and drug-related crimes. According to Van Dijk (2008) the increasing proliferation of criminals and criminal activity in Ghana stands in sharp contrast to the declining capacity of the police to deal with such situations. As criminality increases, so has both its direct and indirect costs also grown because the government is forced to spend volumes of resource on managing conflicts, maintaining a larger police force and maintaining courts and prisons (Avuyi, 2017).

Moreover, the threat posed by organized crime goes beyond the happenings of criminal activities within national boundaries which then extend to the growth of these organized crime activities within the West African Sub-Regional level. The functioning of organized crime syndicates is both covert and overt and these syndicates usually bear the characteristics of a well-structured and a well-designed organization (Krause, 2007; South African Police Service, 2002). A number of coordinated response measures have been instituted by West African Crime Experts and Policymakers to find effective solutions at the Sub-Regional level to the growing menace of organized crimes. Different social partnership and stakeholders' engagement programs have been instituted to provide a push for the response initiatives by West African states, regional organizations and civil societies in an attempt to curb the threats posed by

rising levels of organized crime as well as to promote the rule of law and good governance. Collaborative transnational initiatives such as the National Integrated Program (NIP) has been instituted to provide an effective response to the increasing threat posed by illicit drug trafficking and organized crime in West Africa (Krause, 2007; South African Police Service, 2002).

To effectively combat the growing threat of organized crime, it is very important to have detailed knowledge of the nature of their operations, their structures and their modus operandi. This knowledge can be essentially developed through the application of the crime analysis process (South African Police Service, 2002; Ratzel, 2006; Krause, 2007). Additionally, crime analysis can provide very useful information to support the long-term strategic planning efforts of the police by providing assessments and forecasts of future crime trends which should be useful in the design of law enforcement and tactical crime control strategies (Osborne & Wernicke, 2003; Bruce, 2004; Boba, 2005; Andresen, 2006). This research is of the notion that repeat and serial offenders pose a serious security threat to society and the consequences of their criminal behaviors are severe and repetitive.

The problem to be resolved by this study is the identification of shortcomings and constraints pertaining to the use of crime analysis as an effective policing tool in the Ghana Police Service (GPS). The increasing levels of crime in Ghana as cited in Avuyi (2017) and Appiahene-Gyamfi (2003) makes an emphatic case for crime managers and analysts of the GPS to assume a more focused approach to crime management. The general agreement in both the academic and social spheres as well as in law enforcement, policing and crime management circles is that adopting a proactive approach to crime management is more effective and less costly than a reactive approach and this is what all police services around the world are aiming to achieve. However, such a feast is not possible without the advanced application of a well-planned and executed crime analysis process. While the practice of crime analysis has been modernized through the application of improved processes as well as new technologies and supporting software in many developed countries, it is still at the developmental stages in most developing countries like Ghana. Information management and record-keeping which are critical requirements for effective crime analysis are not carried out properly within the GPS (Anning, 2006). Brookman-Amissah et al. (2014) assert that the application of maps depicting crime information is not common in Ghana and the use of Geographic Information Systems (GIS) within the Ghana Police Service is still now being piloted. This means that crime data and statistics are normally reported in manual formats, usually in the form of statistical tables, charts or graphs and spreadsheets to depict crime trends and patterns. Besides making analysis cumbersome, ineffective and inefficient, this situation also slows down the crime reporting process and limits its geographical coverage. Brookman-Amissah et al. (2014) observes that crime information management, distribution and communication in the GPS are still largely manual and analogue and this comes at the backdrop of an increasing complexity and volume of crime data to be handled by the GPS. This study sought to examine crime analysis and its implications on conventional policing strategies in the Tarkwa-Nsuaem Municipality in Ghana with specific focus on the pattern and trend of crimes within the Tarkwa-Nsuaem Municipality; the effectiveness of current crime analysis and crime control strategies in the Tarkwa-Nsuaem Municipality; and to identify hotspots as well as driving forces for different types of crime so as to develop a methodological framework for crime mapping using pattern and trends of crime.

2. Literature Review

The International Criminal Police Organization (2004) assert that crime analysis has become recognized and operationalized within international law enforcement agencies as an effective exercise for crime prevention and control for the past twenty-five years (Taylor et al., 2007). Beginning with just a few selected countries adopting and promoting the practice, an increasing number of countries are now incorporating crime analysis into the work of their police services with the roles and responsibilities of crime analysts evolving quite rapidly over the last ten years (Trenholm & Jensen, 2013). From basic statistics gathered, crime analysis as a discipline has evolved tremendously to incorporate advanced analytical work which involves the analysis and extrapolation of critical data to uncover expected criminal behavior (INTERPOL, 2004).

Peterson, Morehouse and Wright (2000) describe crime analysis as the process of compiling, summarizing, comparing and organizing of information into meaningful relationships about crime and disorder. Boba (2005) also assert that crime analysis is a planned and systematic exercise which involves analysis of criminal activities and criminal behavior in terms of socio-demographic, spatial and temporal factors and is purposed on helping law enforcers in their crime control and prevention efforts. The International Association of Crime Analysts (IACA) (2014) opines that crime analysis is both a profession and a process involving the application of a range of statistical and qualitative analytical techniques to crime data for the determination of trends, patterns and issues aimed at enhancing the work of the police. The outcome of such an analysis is valuable to the strategic, tactical, administrative and investigative aspects of the work of law enforcement agencies (Pistorius, 2002).

From the above definitions, it can be identified that crime analysis is a systematic activity that follows a stage by stage process aimed to: (a) identify and analyze patterns and trends of *crime* and disorder (b) help unearth information useful to law enforcement agencies in crime prevention and control as well as the effective deployment of resources (c) assist detectives in identifying and apprehending suspects (d) guide in the formulation of solutions to crime problems and (e) help in crafting crime prevention strategies (Ratzel, 2006). The work of crime analysts is primarily to provide support to law enforcers, policymakers and decision-makers and to empower them to handle crime threats more prudently and more proactively.

Five basic steps may be associated with the crime analysis process: (1) gathering of data (2) collation of data (3) analysis of data (4) dissemination of results and (5) seeking for feedback from users of the information (Boba, 2005; Taylor, Kowalyk & Boba, 2007; Bruce, 2004) (See Figure 2.1 below). This process can basically be applied to any type of crime analysis. Although the use of each type may require variations in the specific data to be gathered, the methods to be applied and the purposes of the analyses also require variations. It is essential to state that the crime analysis process defined above is cyclical rather than linear due to the fact that the successful completion of one stage leads to the successful completion of another stage while improved insight gained from latter stages can inform modifications to earlier stages (Boba, 2005).
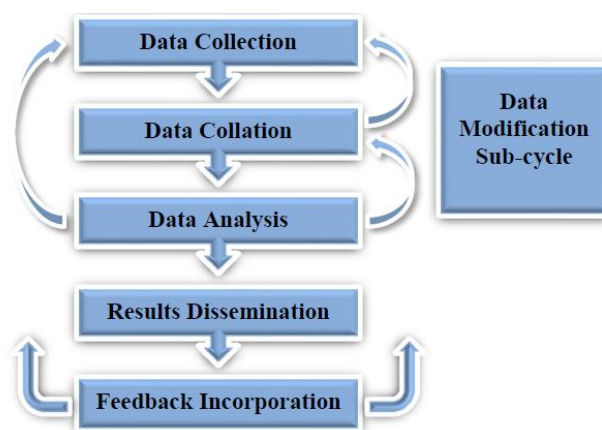

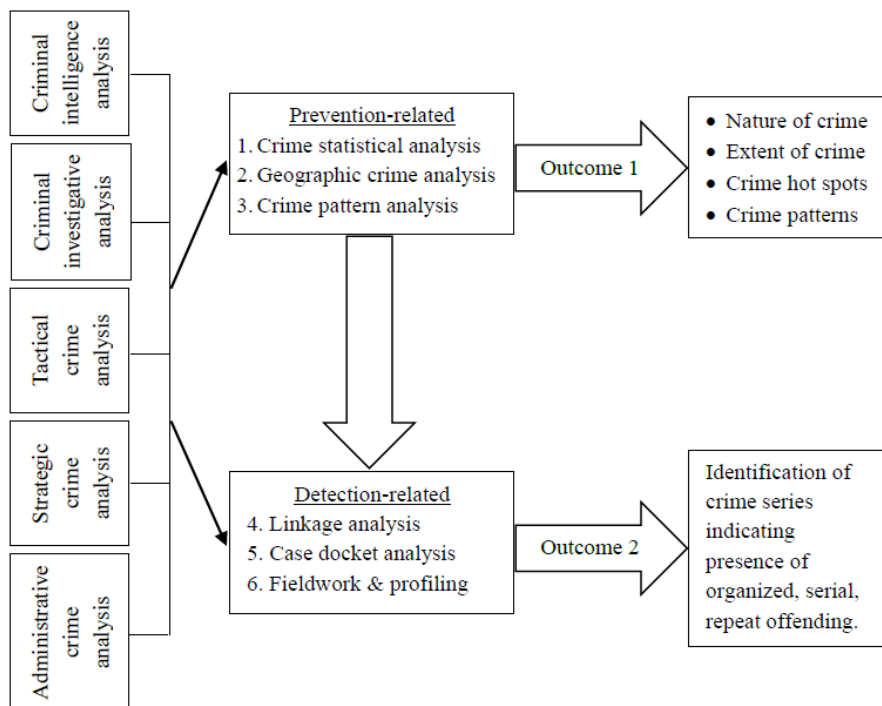Figure 2.1. The Crime Analysis Process (Adapted from Boba, 2005)

Figure 2.2. Conceptual Framework: The Outcomes of the CTA Process

Source: Researchers own construct (2019)

3. Research Methodology

The approach to research design used in this study can best be described as descriptive in nature. Descriptive research designates a situation, subject, behavior or phenomenon under study with the aim of determining the actors and factors pertaining to the situation under study as well as timing, location and process/methodological aspects of the phenomenon (Shields & Rangarajan, 2013). Descriptive research was used in this study to assess and describe the application of crime analysis strategies and crime control models used in the Tarkwa-Nsuaem Municipality as well as to assess the crime information system with the view of determining problems and constraints. The study adopted a survey research to capture two main types of research data, that is, qualitative and quantitative data. The study adopted a qualitative data and methods to examine non-numerical data for the purpose of discovering insider descriptions of crime analysis, crime control and crime information management within the study area (Singleton & Straits, 2009). The study also adopted a quantitative data and methods to execute statistical analysis of quantifiable data focusing on three main crime incident series, that is, organized crime, repeat offending and serial offending. This aspect of the study was completed by manipulating pre-existing statistical data using computational techniques based on data to be obtained from police stations within the study area. The primary goal in conducting quantitative research study was to determine the relationship between an independent variable and a dependent variable within a population (Babbie, 2010; McNabb, 2008). Thus, the quantitative research used in this study aimed at achieving two of the main objectives of the study, namely, the examination of crime patterns/trends and the identification of crime hotspots as well as the driving forces for different types of crime. The quantitative aspect of the research focused on the long-term patterns of crime trends over the past six years (2012–2017).

3.1 Study Area: Tarkwa-Nsuaem Municipality (A Community in the Western Region)

The Tarkwa-Nsuaem Municipality has Tarkwa as its capital. The land size of the municipality is nine hundred and seventy-eight point two six square kilometres (978.26 sq. km) which is grouped into five (5) Zonal Councils and an Urban Council covering twenty (20) towns. The Zonal Councils are Benso, Simpa, Nsuta, Dompim and Nsuaem with Tarkwa as the Urban Council. The Ghana Statistical Service's 2010 Population and Housing Census pegs the estimated population of the municipality at two hundred and fifty thousand (250,000) growing at a rate of two point nine-seven percent (2.97%). Four hundred and thirty-six (436) communities make up the Tarkwa-Nsuaem Municipality.

The Tarkwa-Nsuaem Municipality abounds in many types of natural resources–gold, bauxite, manganese and timber. As such, there are many mining firms in and around the municipality, with the capital being host to three (3) major mining firms (i.e. Gold Fields Ghana Limited, AngloGold Ashanti-Iduapreim Mine and Ghana Manganese Company). Tarkwa and the municipality at large therefore have a high population of both national and foreign immigrants who come in search of jobs. There is the University of Mines and Technology which is the Western Region's first public university. The Tarkwa-Nsuaem Municipality experiences one of the highest rainfall patterns in Ghana with a mean annual rainfall of 187.83cm.

3.2 Population and Sampling

The target population of this study consisted of two groups. These were: (a) Station Information Managers (also called crime analysts) and (b) crime investigators and intelligence analysts.

The first target population comprised all Station Information Managers (crime analysts) who were stationed within the Tarkwa-Nsuaem Municipality and it encompassed the following eight (8) police stations: Tarkwa Divisional CID, Tarkwa Station, Tarkwa Railways, Tarkwa District, Nsuta, Dompim, Nsuaem and Bonsa. The number of crime analysts stationed at each branch was shown as follows: Tarkwa Divisional CID had eight (8), Tarkwa Station had eight (8), Tarkwa Railways had three (3), Tarkwa District had six (6), Nsuta had four (4), Dompim had one (1), Nsuaem had three (3) and Bonsa had one (1). This produces a total of thirty-four (34) crime analysts.

For small populations with less than 1000 population sizes, researchers need a large sampling ratio of thirty percent (30%) or more of the population (Krause, 2007). Thus, simple random sampling was used and a sample size of fifty percent (50%) of the population was drawn from this population group. This produced a sample size of seventeen (17) respondents. These respondents are referred to as respondents A–Q in the rest of this document.

The procedure that was adopted in selecting the seventeen (17) respondents is as follows:

- The names of the crime analysts at police stations where there is only one crime analyst were drawn on paper and set aside for automatic involvement in the study. This was to ensure a fairly balanced cross-sectional representation of all geographical areas within the study area in the study. This meant that the crime analysts at Dompim and Bonsa were automatically part of the study.
- The names of the crime analysts at the six (6) remaining police stations where the remaining thirty-two (32) crime analysts are stationed were drawn on an A4 sheet;

- The A4 sheet was cut into thirty (30) pieces each bearing the name of a crime analyst
- The thirty-two (32) pieces of paper were folded twice and stapled, placed in a box and shuffled by an independent colleague
- A third colleague was asked to draw fifteen (15) pieces of paper from the box
- The researchers then unfolded and opened the fifteen (15) pieces of paper to reveal the names of the rest of the crime analysts who were to be covered in the study.

The second (2nd) target population was made of crime investigators and intelligence analysts. The population size for this target group comprised of thirty-eight (38) investigators and four (4) intelligence analysts within the study area. This produced a total population size of forty-two (42). Based on the sample size of 50%, a total of twenty-one (21) individuals from this second (2nd) target population were selected using a non-probability sampling method specifically the purposive sampling technique. Purposive sampling meant that the researchers selected the sample based on prior knowledge of sample members such that those who had the capability to make the richest contribution to the study based on their expertise or experience in the field were selected (Ritchie & Lewis, 2004). The reason for adoption of this method of sampling instead of simple random sampling was that the Tarkwa-Nsuaem Municipality lacks an ample collection of investigative and crime analysis experts to enable the researchers gather a reasonable sample size from which a generalization can be made. This limited the researchers' ability to use simple random sampling techniques. For this reason, twenty-one (21) individuals were selected purely on the basis of their unique expertise in relation to crime investigation and/or crime analysis.

3.3 Data Collection Methods

A range of data collection techniques exist for collecting qualitative and quantitative data. Postal surveys, telephone surveys, face-to-face interviews, respondents-completed or self-completed questionnaires and focus group discussions are just some of the methods (Babbie, 2010; McNabb, 2008). The data collection method that was employed was face-to-face interviews. This approach allowed for both quantitative and qualitative data to be obtained. The interviews were held by the researchers one-on-one with the respondents. This allowed the researchers to build rapport with the respondents while at the same time being able to clarify issues with regards to some aspect of the questions (Babbie, 2010).

3.4 Data Analysis

Data analysis involves processing raw data into useful information upon which conclusions can be drawn (Adèr & Mellenbergh, 2008). Techniques for data analysis were arranged in four dominant categories: time series analysis, pattern matching, explanation-building and program logic models (Tabachnick & Fidell, 2007; Adèr & Mellenbergh, 2008). The qualitative aspect of this research was analyzed by following the "explanation-building" technique and an interpretational method was adopted to analyze the data collected. During the interviews, the researchers personally recorded all the respondents with a digital voice recorder and supported this with handwritten notes. Babbie and Mouton (2009) assert that recording the interviewees' responses exactly as given was very important for the purposes of maintaining objectivity in the process. The voice recordings and handwritten notes were transcribed and organized by sorting and coding them along with the themes of the questions asked. The researchers then sought to ascertain the trends in the data collected to ensure an analytical description and discussion of findings based on the theoretical perspectives of authorities in the literature review.

To analyze the quantitative data, the respective questions were subjected to thorough statistical analysis using the Microsoft Excel Version of the Statistical Package for Social Sciences (SPSS) software. The edited data were coded and directly entered into a database. Descriptive statistics were utilized in presenting the data using tables. Descriptive statistics showed the minimum and maximum values of the variables that helped in getting a picture about the extent of responses regarding various items on the questionnaire. In using percentages, all figures were rounded to whole numbers. This implied that where the total percentage exceeds 100% due to rounding, an adjustment was made to one of the figures to ensure that the total adds up to 100%. Quantitative data analysis also made some limited use of CrimeStat IV (version 4.02).

4. Results and Discussion

This section looked at the analysis of crime patterns and crime hotspots based on secondary data obtained from the crime analysis information system of the Tarkwa-Nsuaem Municipality. The first section presented data on the general crime trends pertaining to the Tarkwa-Nsuaem municipality recorded up to 2017. The second section presented data to identify crime hotspots within the municipality.

4.1 Trends in the Levels of Crime from 2012 to 2017

Table 1 presents the crime statistics for the Tarkwa-Nsuaem municipality from January 1, 2012 to December 31, 2017. From the statistics in Table 1, it can be deduced that the crime type with the highest frequency of occurrence over the time period of 2012 to 2017 was assault, followed by stealing and then fraud. In terms of percentage increase or decrease in levels with regards to the three types of crime, assault again showed a percentage decrease of 9.7% over the period under review, followed by stealing at 9.2% and then fraud which recorded an overall decrease of 4.6%. A significant observation worth mentioning was that there was a dramatic decrease in crime levels with regards to the three types of crime under consideration for the period of 2013 to 2014. Assault recorded the highest average percentage reduction of 64.7% during this specific period with fraud following at a percentage of 54.7% and stealing recording a percentage of 48.0%.

Table 1. Crime statistics for Tarkwa-Nsuaem Municipality, 2012–2017 compiled by the researchers

NO.	OFFENCES	2012	2013	2014	2015	2016	2017	TOTAL
1.	Murder	15	15	7	4	6	9	**56**
2.	Attempted murder	11	2	-	-	2	1	**16**
3.	Robbery	15	49	9	10	20	12	**115**
4.	Attempted robbery	1	1	1	1	2	-	**6**
5.	Defilement	30	88	5	26	36	39	**224**
6.	Rape	15	16	-	-	11	8	**50**
7.	Attempted rape	2	-	-	-	2	-	**4**
8.	Attempted suicide	12	3	5	-	1	1	**22**
9.	Stealing	1,192	1,319	686	769	738	550	**5254**
10.	Assault	1,654	1,978	699	935	875	521	**6662**
11.	Causing harm	141	172	78	84	66	46	**587**
12.	Threatening	410	573	201	293	322	121	**1920**
13.	Fraud	405	642	291	379	278	180	**2175**
14.	Causing damage	208	303	131	68	137	100	**947**
15.	Issue of false cheque	14	23	27	18	14	-	**96**
16.	Being on premises	21	-	-	-	27	13	**61**
17.	Abortion	10	11	2	4	1	1	**29**
18.	Attempted abortion	4	-	-	-	-	-	**4**
19.	Possessing narcotics	15	10	3	10	3	-	**41**
20.	Abduction	19	23	3	9	1	9	**64**
21.	Possessing fake currency	3	4	1	2	5	-	**15**
22.	Illegal mining	13	30	23	30	23	53	**172**
23.	Possessing firearm	1	310	2	1	-	1	**315**
24.	Other offences	375	207	249	266	209	450	**1756**

Source: Field Data, 2019

From Table 1 above, attempted abortion was a type of crime which recorded the overall lowest level, registering only 4 cases in 2012, which decreased to zero cases over the rest of the period from 2013 to 2017. Two types of crime that engaged the special attention of the researchers were robbery and rape, specifically because these two had shown significant radical behaviors over the years under review. Robbery though recorded relatively low levels over the year under review; however, it showed a dramatic and exponential percentage increase of 26.7% from 2012 to 2013, coming down to 81.6% decrease between 2013 and 2014, and then ballooning again to 100% from 2014 to 2016. From there, a huge percentage reduction of 40% was again recorded in robbery cases during the end of 2017. On the contrary, rape cases showed a slight percentage increase of 6.7% between 2012 and 2013 and then took a very sharp decrease of 100% from 2013 to 2014. Overall, robbery cases recorded an average percentage increase of 36.0% over the period of 2012 to 2017.

4.2 Geographic Crime Analysis – Crime Hot Spots

This aspect of the analysis employed Spatial and Temporal Analysis of Crime (STAC) ellipses to create crime maps and analyze crime distribution within the Tarkwa Police Subdivision within the Tarkwa-Nsuaem Municipality. A STAC ellipsis is the use of automation to analyze scatter of events across a map that contain the densest clusters of events. The work was produced on a pilot basis and was intended to enable senior officers have an analytical framework for prescribing action. Based on concerns raised by many social groups indicating that high assault levels are as a result of increasing number of liquor establishments within the municipality, spatial data of 779 crime incidents in the category of assault which occurred in or around the alcohol establishments was analyzed using CrimeStat IV software. This data was then geo-coded into a pinpoint map for analysis. The choice of assault as a crime for the hotspots analysis was based on the fact that it was a type of crime that had recorded the highest total number of incidences within the municipality over the defined period of time as indicated by Table 1. To analyze data for the municipality, STAC ellipses were utilized. Location data of establishments with alcohol licenses were retrieved from the Ghana Revenue Authority in Tarkwa. Three types of liquor licenses were utilized: pubs, branded alcohol and incidental consumption. As of December 2017, there

were a total of 33 alcohol licenses with some establishments holding no license at all. This data was also geocoded to create a pinpoint map of the respective locations. The study of incidents was a six-year period from January, 2012 to December, 2017.

STAC ellipses were used as a means of examining the clustering of alcohol establishments and crime incidents where five ellipses showed the areas of concentration of the alcohol establishments. The results showed that all ellipses were contained in the central part of the municipality in areas with vibrant nightlife, a fashionable single area and shopping centers. Six ellipses were generated for the crime incident hotspots. Two of the ellipses were concentrated in areas of hotspots of alcohol establishments, whereas four of them resided in low-income zones. It was therefore concluded from these ellipses that the correlation between alcohol hotspots and crime (assault) hotspots was negative.

This study further examined the statistics of crime and its relation to alcohol establishments by dissecting the amount of each category that was included in each ellipsis. It was determined that the crime of assault was typically committed in low-income areas with no proximity to the alcohol establishment hotspots. It was therefore concluded that the number of alcohol licenses had a weak correlation with the concentration of crime. While locations of alcohol establishments can be crime attractors, they cannot be considered as the definitive cause of crime.

Finally, the analysis showed that cases of assault are highly concentrated in such areas as Tarkwa Railway Station, Nzemaline, Efuanta, Layout, and Akoon. Before police could succeed in arresting criminals, they undergo series of briefing.

4.3 Respondent Group A–Q

The first group of respondents (A–Q) was all Station Information Managers (Crime Analysts). A total of 11 respondents actually participated in the survey out of the 17 sampled in this category producing a response rate of 64.7%.

From Table 2, it can be deduced that majority of the respondents were males with a percentage of about 73% with only a few being females having a percentage of 27% respectively. In terms of age, majority of the respondents (around 45.5%) were aged between 41 to 45 years, followed by those aged between 31 to 35 years (around 27.3%). None of the respondents were aged below 26 or above 45, meaning that all the respondents were aged from 26 to 45. In terms of rank, only one of the respondents was a Senior Officer, meaning that the rest were of occupying junior officer ranks. This corresponded with the intended target group for this category of respondents as majority of those involved in crime analysis were information managers based at the station level.

Table 2. Biographic profile of respondents

Gender	Male	Female				
	8	3				
Age group	Below 26	26–30	31–35	36–40	41–45	46+
	-	1	3	2	5	-
Rank	Senior Officer			Other		
	1			10		
Total years of police service	Below 10	10–13	14–17	18–21	22–25	
	2	2	4	3	-	
Years of crime analysis experience	Below 4	4–5	6–7	8–9	10+	
	-	3	3	2	3	
Highest education	SSS/SHS	Ord. Dip.	Higher Dip.	Und. Degree	Pg. Degree	
	2	4	-	2	3	

Source: Field Data, 2019

With regards to the total years working in the police service, Table 2 indicated that majority of the respondents (around 36.4%) had 14 to 17 years of experience, followed by those with 18 to 21 years of experience (27.3%). None of the respondents had beyond 21 years of police service experience. In terms of total number of crime analysis experience, around 27.3% each of the respondents indicated they have had 4 to 5, 6 to 7 and beyond 10 years of experience, with around 18.2% having had 8 to 9 years and none having below 4 years of experience. On education, majority of the respondents (around 36.4%) indicated they have had an ordinary diploma, followed by those with Postgraduate Degrees (around 27.3%), with none having a Higher National Diploma. Finally, majority of the respondents (around 73%) indicated having attended at least one crime information management and analysis course in the course of duty, with just around 18.2% or two of the respondents indicating having not attended any course. There was one item of non-response to this question. From the above analysis, it can be concluded that the biographic profile of the respondents who participated in the survey indicated a high respondent suitability for the purpose of the survey in line with the proposition in the literature.

4.4 Types of Crime Analysis Techniques and Activities Applied

Respondents were asked to indicate the types of crime analysis techniques they apply (i) as an integral part of the CTA (a crime analysis technique) process or (ii) on an ad hoc basis when specifically tasked to apply or (iii) they otherwise do not apply at all.   Table 3 illustrates the responses accordingly.

From the responses shown in Table 3, it was evident that all the respondents applied the following crime analysis techniques and activities as integral aspects of the CTA process: crime pattern analysis, geographic crime analysis, linkage crime analysis, case docket analysis, interviewing (activity), and crime scene visits. The finding above corresponded with the views of SAPS (2000) and was in line with the conceptual framework that the CTA process should integrate the findings of different crime analysis techniques, including: geographic crime analysis or crime mapping, crime pattern analysis, linkage analysis, case docket analysis, fieldwork and profiling. A more detailed discussion is provided below.

Table 3. Types of crime analysis techniques and activities applied

Types of techniques	Integral to CTA process	Ad hoc basis	Not applied
Ratio/100,000 pop.	5	-	4
Crime pattern analysis	11	-	-
Crime mapping	11	-	-
Linkage crime analysis	11	-	-
Case docket analysis	11	-	-
Interviewing	11	-	-
Crime scene visits	11	-	-

Source: Field Data, 2019

Application of geographic crime analysis: The analysis showed that all the respondents apply geographic crime analysis. This was in line with the theoretical proposition by *Maltz, Gordon & Friedman (2000) and Leong & Chan (2013*) that crime mapping enables the police to determine the location and timing of crime incidents for the purposes of identifying crime hotspots.

Application of crime pattern analysis: All the respondents indicated that they apply crime pattern analysis. This concurred with the theoretical proposition by Stenton (2006) and IACA (2014) that crime pattern analysis is noted to enable law enforcers to determine the spatial nature of crime as well as to determine important issues such as mode of operation, target/victim details, and offender particulars in order to identify distinct patterns.

Application of linkage analysis: All respondents indicated that they apply linkage crime analysis. This supported the theoretical perspectives provided by Stenton (2006) and De Kock (2004), who also identify linkage analysis as one of the key steps in the CTA process.

Application of case docket analysis: All respondents indicated that they apply case docket analysis in the process of crime analysis. This supported the theoretical perspectives provided by Stenton (2006) classifying case docket analysis as a crime analysis technique that can help to determine the similarities in the modes of operations of criminals and subsequently uncover the activities of repeat offenders, serial offenders and/or group offenders in a crime series.

Application of fieldwork and profiling: All the respondents indicated that they apply fieldwork and profiling in line with theory as described in De Kock (2004) who also identified fieldwork as an essential component of the crime analyst's work and in Stenton (2006) expressing that fieldwork can potentially assist crime analysts by providing information on a criminal act to aid in offender identification and subsequent apprehension. In addition, all the respondents indicated that they apply profiling as an integrated part of the CTA process, demonstrating the significance of profiling to the CTA process in resonance with similar assertions by in Stenton (2006) and De Kock (2004).

Application of ratio per 100,000 of the population analysis: With regards to the application of ratio per 100,000 of the population analysis, 5 respondents (representing around 45.5%) indicated they use it as an integral part of the CTA process while 4 respondents (representing around 36.4%) indicated they do not apply it at all. This means that the practice among station officers relatively largely corresponds with the theory in that applying this method enables the police to compare and determine whether crime levels at a specific police station are higher than, equal to or lower than the national or regional crime norms as described by Stenton (2006).

The respondents who indicated not applying the ratio per 100,000 of the population analysis at all as a technique provided the same reasons for this. Two reasons that were commonly being provided included: (a) the research area being predominantly a local area, most of the jurisdictions (villages) the police officers operate in populations are far less than 100,000 and (b) there is lack of accurate population data on all the localities the police officers operate in. Two of these respondents added that the only official population figures available are the 2010 population census statistics from the Ghana Statistical Service, however, this set of population figures cannot be used because the definition of geographical boundaries for national census purposes differs from the definition of geographical boundaries for policing purposes.

Moreover, the definition of geographical boundaries by the municipal authorities also differs from the police's definition of geographical boundaries. These two respondents further indicated that this method may be more common among police officers at the regional and national levels because they have access to census data and that population sizes are higher at these levels.

Regarding other crime analysis techniques, the respondents mentioned intelligence gathering from informants, and one mentioned crime sampling. Both intelligence gathering and crime (DNA) sampling as mentioned by the respondents however fall under fieldwork and profiling techniques.

4.5 Effectiveness of Various Crime Control Strategies at Crime Control

Respondents were asked to rate the extent to which they consider the various crime control strategies as being effective. The responses are shown in Table 4. The crime control method rated most effective by majority of the respondents was imprisonment, which saw 10 out of the 11 respondents rating it as highly effective (representing around 91%), with the remaining 1 respondent rating it as moderately effective and none of them rating it as ineffective. These findings were in line with earlier findings by Antwi (2015) which states that the Ghanaian justice system is still highly punitive rather than rehabilitative. Majority of law enforcers and crime managers believe that the best approach of controlling people from engaging in criminal acts is to 'lock them up'.

Table 4. Effectiveness of various crime control strategies

Strategy	Highly effective	Moderately effective	Ineffective
Capital punishment	2	3	6
Imprisonment	10	1	-
House arrest	-	1	10
Fines	7	4	-
Restitution	4	7	-
Community service	2	5	4
Rehabilitation	4	6	1
Surveillance (CCTV)	6	5	-
Restraint	9	2	-

Source: Field Data, 2019

The second most effective method of crime control per the responses was 'restraint' having around 81.8% of the respondents rating it as highly effective and the remaining around 18.2% of the respondents rating it as moderately effective. None of the respondents viewed this approach as ineffective. Third on the effectiveness scale was 'fines' which recorded around 63.6% of the respondents rating it as highly effective and the remaining rating it as moderately effective. The least most effective approach to crime control, based on the opinion of the respondents, was 'house arrest' with 10 out of the 11 respondents rating it as ineffective and only 1 respondent rating it as moderately effective and none rating it as highly effective.

Regarding the use of other crime control methods not mentioned in the interview guide, one respondent indicated the use of police warning letters was a highly effective approach while another also mentioned the use of surveillance through the physical deployment of policemen was also a highly effective method.

4.6 Sources of Information Used During Crime Analysis

Respondents were asked to indicate the various sources of information they frequently use or do not use during their crime analysis activities. The responses are shown in Table 5. Four sources of information stand particularly prominent as the most frequently used during crime analysis exercises were calls for service, records of arrest reports, station diaries and detective case folders each recording all 11 (100%) respondents rating it as frequently used. Following these come sentencing dispositions and accident reports as the next most frequently used sources, each recording 10 out of the 11 respondents (around 91%) rating it as frequently used and the remaining respondent for each rating them as not frequently used (no respondent indicated that these two approaches are not at all used) (see table 5).

Police personnel files and data collected by prosecutors also stand quite prominent, recording 9 out of the 11 respondents (around 81.8%) indicating they frequently used and each of the two remaining respondents rating them as not frequently used. Again, none of the respondents indicated that these sources were not used at all. The sources that appear not used at all are computerized records of written reports and ad hoc databases, each of which saw 3 out of the 11 respondents indicating they do not use these sources at all. For computerized records of written reports, only 1 respondent out of the 11 indicated it was frequently used with around 63.6% indicating that it was used but not on a frequent basis. This again simply reflected lack of technology to support automated operations of data manipulation in the local area as well as nationwide. Majority of the respondents indicated that their crime analysis information system sources were not computerized. With GIS technology still in its experimental stages in Ghana, it was only obvious that

majority of the crime analysis information systems will still be manual rather than being computerized.

Table 5. Sources of information used during crime analysis

Source of information	Frequently used	Not frequently used	Not used
Calls for service	11	-	-
Computerized reports	1	7	3
Arrest reports	11	-	-
Surveys of residents	7	4	-
Sentencing dispositions	10	1	-
Self-reports	8	3	-
Station diary	11	-	-
Detective case folders	11	-	-
Police personnel files	9	2	-
Ad hoc databases	5	3	3
Prosecutor data	8	3	-
Accident reports	10	1	-
Personnel surveys	9	2	-
Census etc. data	6	4	1

Source: Field Data, 2019

5. Conclusion

The findings of this study reemphasize the point that crime analysis is a critical requirement for effective crime prevention and crime control. The findings also suggest that while crime analysis and crime control practices keep improving in the advanced countries and crime analysts are constantly finding improved ways of practicing the trade, crime analysis practices in the developing countries are, at best, still stagnant, if not deteriorating. Information systems are largely manual and do not contain the relevant and adequate information. These poor information management practices have made it difficult for the crime analysts in the study area to effectively apply some of the crime analysis techniques examined in the study such as the ratio per 100,000 of the population method. Crime analysis at the local level also seems to encounter further inhibiting factors than in the cities due to differences in population sizes, geographical boundaries, and access to national-level facilities such as logistics.

6. Methodological Framework

- The police should maintain or further step up current efforts being made to control the top three serious types of crime (assault, stealing and fraud) as these efforts are yielding positive results, reflected in the declining levels of crime. Moreover, the police should now focus their attention on fighting robbery by researching, devising and executing appropriate crime control measures as robbery cases are threatening to become a serious issue in the municipality.

- Geographic police boundaries should be differently defined for the local research area from the geographic municipal boundaries upon which the national population census depends, where geographic police boundaries are based on clusters of areas that add up to 100,000 populations. Then accurate and regular local area censuses ought to be designed to suit the specific requirements of the police separately from the national census.

- Crime management information systems should be computerized and automated and the required training provided to personnel on the use of such systems.

- Crime analysts should redirect their efforts into rendering a more effective and efficient service to the Criminal Investigation Department (CID)   of the GPS by providing it with crime analysis findings, derived from the CTA process, pertaining to the criminal activities of repeat offenders for crime detection purposes.

Conflicts Of Interest

The authors declare that they have no conflicts of interest in conducting this study.

Acknowledgments

Ethical Considerations

The respondents were informed about the study and their cooperation was fully sought for. The researchers also adhered to the prescribed code of ethics that governs academic research work. Respondents were also granted and assured of adherence to all calls for anonymity. Additionally, all authors of literature sources cited in the study were duly acknowledged, and no unauthorized copying from sources would be included in the report. Finally, official permission was obtained from the GPS prior to conducting the research.

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