Forensic Intelligence, Databases, and the Challenges of Forensic Investigations in the Nigeria Police Force: An Empirical Study

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Abstract. Forensic intelligence is the use of crime scene evidence such as DNA, fingerprint, and trace evidence to cross-reference within an indexed dataset and link together crime scenes, materials, and suspects. It is thus not practicable without databases. Certain factors could however hinder the reliability of the databases to serve the purpose of forensic intelligence. This study explored factors that could challenge databases and hence affect the realization of the benefits of forensic intelligence. Using the survey method, and with police investigators as respondents, seven challenges were determined, and hypotheses were tested to find out if the challenges have a significant association among themselves. Of the variables (that is, the seven challenges), three (corruption, lack of interagency cooperation, and undue interference in investigations) indicate statistically significant association with unreliable databases. It is therefore recommended that authorities should address the challenges to ensure reliable databases and effective forensic intelligence for the police to utilize.

Keywords: Forensic Intelligence, Databases, Nigeria Police Force, Forensic investigations, Policing challenge

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1. Introduction

From both linguistic and operational dimensions, intelligence is connected to knowledge and information (Brown, 2007). In policing circle, intelligence is a key to action based on raw information about crime and criminal activities, which was hitherto unknown and can be used to improve the efforts of a police investigation and crime management (Europol, 2003). Intelligence is, therefore, central to performing effective police core functions of crime prevention and control. The stronger the intelligence system in a police organization, the more efficient the organization is in terms of useful and usable data to carry out its activities (Ratcliffe, 2005). Accordingly, intelligence is built and maintained through continued accumulation and analysis of information contained in the databases.

The use of intelligence to identify crime patterns and even predict where criminal activity would likely happen has been in practice for decades (James, 2013), albeit, in a rudimentary form. In some police systems, intelligence is so crucial in police investigative activities that the unit responsible for managing intelligence, though independent, works closely and assists the investigation department. This is the practice in Nigeria. Indeed, the popular idea of intelligence-led policing is largely rested on intelligence (Ratcliffe, 2016). Also, the emerging trend of world-class policing which is premised on the effect of globalization on social interactions can hardly be done without an effective intelligence system.

With the developments in forensic science and its application in various aspects of police work coupled with the advances in modern technology, the essential nature of intelligence in ensuring a more effective and speedy police service is becoming clear (Orebaugh, 2006). Thus, forensic data, usually stored in automated computerized databases, are now instrumental in planning police operations,

investigations and management of criminal activities (Mylonas, Meletiadis, Tsoumas, Mitrou, and Gritzalis, 2012). Some of the data related to forensic intelligence include footwear and tyre marks databases, DNA profiles (e.g., NCIDD in Australia and NFDD in South Africa), fingerprints (IDENT1 in the UK and IAFIS in the USA), and other biometric information of individuals.

Looking at what is embedded in forensic data, databases remain the only means through which forensic intelligence could be established and maintained to function and serve its purpose (Ribaux, Walsh, and Margot, 2006). By this argument, reliable databases are then the prerequisite for effective forensic intelligence. Consequently, police organizations should make efforts in establishing and maintaining databases for their forensic intelligence to function effectively.

However, the various challenges confronting police organizations, particularly in Nigeria, might have rendered the databases unreliable in producing the outcome needed to sustain the intelligence system. These challenges are seen to be generic in terms of their impact on police activities as portrayed by previous studies (see, for example, Bakare and Aderinola, 2019; Nte, 2011). Few attempts have thus been made to explore those that are specific to reliable databases vis-à-vis the utilization of forensic science, added to the fact that some assumptions regarding the challenges were not empirically established. The forensic aspect of police work needs to be treated and explored individually considering the sophistication of criminal activities and advances being made in criminal investigations. Indeed, challenges are not necessarily generic, they could differ from one facet of police work to another.

The expectation of the current study, therefore, is that its findings could be utilized by the government, police authority, and other stakeholders in having and maintaining reliable databases and functional forensic intelligence for use by the NP and other law enforcement agencies in Nigeria. Understanding the challenges could also assist in making appropriate efforts towards addressing them and thus improving the general functions of the police.

2. Forensic Intelligence and Databases

Forensic intelligence (Ribaux and Margot, 1999) refers to the use of crime scene evidence such as DNA, fingerprint, and trace evidence to cross-reference within an indexed dataset and link together crime scenes, materials, and suspects. According to Ribaux et al. (2003:172), it "is the accurate, timely and useful product of logically processing (analysis of) forensic case data (information) for investigation and/or intelligence purposes". The concept of forensic intelligence is gaining popularity within policing and security circles due to the increasing volume of data being generated especially through forensic technologies, and the fact that many police organizations can afford it. In forensic intelligence, the dataset is usually subjected to rigorous analyses, both quantitative and qualitative, to identify meaningful patterns of criminal activities (Legrand and Vogel, 2012).

Forensic intelligence permits a timely exchange of data and breaks the wall that creates relational difficulties among different forensic disciplines (Rennison, 2015). Forensic intelligence analysis is important as it directs several approaches to policing like intelligence-led operations, preventative policing, and resource allocation (Legrand and Vogel, 2012). In other words, forensic intelligence plays an important role in proactive policing. For example, from a collection of crime scene evidence, the place where an offender lives, when and where he or she may next commit a crime can be hypothesized, as a result of which police surveillance and or targeted patrol can be organized (Marclay, Mangin, Margot

and Saugy, 2013; Ribaux et al., 2003). Forensic intelligence is thus a concept and practice through which the aims of both reactive and proactive policing can be achieved.

Strong arguments (see: Rennison, 2015; Walsh et al., 2011; Ribaux et al., 2010) have been put forward for the value of forensic intelligence in policing. It is perceived that despite being expensive compared to traditional means, the benefits in terms of accuracy of identification, timeliness, objectivity, and methodological rigor are numerous. It is important to note, however, that the usefulness of forensic intelligence is realized when there is an integration of the different but relevant sources of data across organizations (Ribaux et al., 2010), which incidentally is one of the challenges faced by forensic intelligence. Another challenge and critique of the concept is its ambiguity (Legrand and Vogel, 2012). According to Ribaux et al. (2005), the concept remains 'fuzzy', making it difficult to be integrated into core police practice and training.

Moreover, forensic science of which forensic intelligence is a part; is seen by some people as a reactive effort used only after a crime has been committed (Mennell and Shaw, 2006). This tends to make it a culture different from the frontline policing cultures, though there is evidence that forensic intelligence is an obvious and important component in proactive policing (Legrand and Vogel, 2012). Another limitation of forensic intelligence, which forensic science as a whole also shares, is the timeliness and utility of data (Legrand and Vogel, 2012).

2.1. Challenges of forensic investigations

Studies have shown that the challenges hindering the effective utilization of forensic science in criminal investigations by the police varied from one police system to another. For instance, in cases involving murder, post-traumatic stress was found to be a challenge faced by investigators as it was influenced by years spent as a forensic science investigator, personality type, emotional intelligence, homicide experience, fatigue, and death anxiety (Yoo et al., 2013). Lack of strong forensic intelligence and reliable databases, which are especially relevant in proactive policing are challenges facing forensic science as utilized by the police (Crispino et al., 2015). This challenge seems to be common with police organizations around the world (Interpol Global DNA Profiling Survey, 2017).

Lee and Pagliaro (2013) had found that questionable results arising from wrong methods, contaminations, and un-standardized procedures; are problems faced in a forensic investigation by the police and other practitioners. In another study, the types of victims involved, the nature of the crime committed, the form an investigation will take, as well as cultural, economic, and political constraints; all affect police in using forensic science (Puerto and Tuller, 2017). Issues of policy and specificity, accuracy, and validity were also found to be challenges associated with fMRI-based lie detection (Farah et al., 2014).

Other authors cited problems in the existing policing system as challenges in applying forensic science. For example, lack of standard regulation as to the operation and application of forensic outcomes prevents police and even other supposed beneficiaries of forensic science, from realizing the benefits of the science (Edwards and Gotsonis, 2009; Giannelli, 2007; Jonakait, 1991). According to Kelty et al. (2018), interdisciplinary differences in the form of disharmony and misunderstanding during operations among investigation personnel from different fields are serious challenges to the police in utilizing forensic science. This is especially pertinent in criminal cases that are trans-border in nature, for example, human smuggling and drug trafficking.

This depicts a lack of congruence between forensic science practice and police work, which may negatively impact evidence collection and subsequently have implications on court proceedings. Specifically, the chain and handling of evidence as well as its forensic analyses and interpretation may violate recognized forensic science codes of conduct. It is for these reasons that the issue of challenges in using forensic science has to be addressed, as it can be seen challenges can vary from one situation to another, signifying the non-universality of problems that the application of forensic science faces. In other words, the above-stated challenges may or may not be tenable in Nigeria. There could be different challenges. Since the field of forensic science did not emerge at once in all countries, each country may have its peculiar challenges.

For instance, in Nigeria, inadequate personnel and laboratories were said to be the challenges affecting the police use of forensics (Aigbokhaevbo and Iyamu-Ojo, 2015; Obafunwa et al., 2015; Ladapo, 2011). Power outages, inter-agency cooperation, and corruption were also challenges faced by police in using forensic science (Aigbokhaevbo and Iyamu-Ojo, 2015). Although these authors have put forward their arguments about NPF utilization of forensic science, what they put forward were individual opinions, not the result of empirical studies, where first-hand and reliable information could have been directly obtained from the police themselves.

Anecdotal opinion and opinions not backed by evidence may not be reliable. More scientific and reliable studies are therefore required to fill the knowledge gap concerning the challenges in the application of forensic science as utilized by the NP. Hence, this study intended to empirically reduce the knowledge deficiencies. The study was, therefore, aimed at determining the challenges of reliable databases from the perspective of the Nigeria Police. Null hypotheses were formulated and tested to establish whether the challenges determined in the study have any statistically significant relationship among themselves, and specifically on the unreliable databases. Thus:

H01: there is no relationship between unreliable databases and corruption.

H02: there is no relationship between unreliable databases and lack of interagency cooperation.

H03: there is no relationship between unreliable databases and undue interference in police investigations.

H04: there is no relationship between unreliable databases and questionable forensic results in police investigations.

H05: there is no relationship between unreliable databases and the complexity of crimes in police investigations.

H06: there is no relationship between unreliable databases and cultural /religious beliefs in police investigations.

3. Method

A sample survey method was used in this study. The locations of the study were the Criminal Investigations and Intelligence Departments (CIIDs) in Zone 1 of the Nigeria Police. The respondents were, the Investigating Police Officers (IPOs) serving in the zone's CIIDs. Zone 1 is one of the twelve zonal police commands in Nigeria, comprising of the zonal command headquarters and three state commands, that is, Kano, Jigawa, and Katsina states.

Based on the Investigating Police Officers (IPOs) population of 3,503, a minimum sample size of 347 was determined using Krejcie and Morgan's (1970) Table of sample size estimation. A potential 20%

dropout rate was added, making the sample size 416. Systematic sampling was used to select the respondents, with IPOs identification lists as the sampling frame. After ethical approval was obtained from the Human Research Ethics Committee (JEPeM) of Universiti Sains Malaysia and the NP authority, data were collected via a self-administered survey battery.

At the end of the data collection exercise, a total of 401 usable responses were obtained, satisfying the minimum sample size estimation to generalize findings. The inclusion criteria for the respondents were, 1) An investigator has spent at least two years in service, 2) he or she should have been in the location of the study on a regular posting and not on special assignment, loan, or operation and, 3) was also serving at the State or Zonal CIID in Zone 1 at the time of conducting the study. The responses from 401 respondents were analyzed using SPSS version 24.

4. Results and Discussion

4.1. Sociodemographic profiles of the respondents

This section presents data on gender, age, marital status, highest educational qualification, rank, years spent in service, and forensic science training attended by the respondents. Table 1 shows a summary of the data.

The majority (87.3%) of the respondents were males, while 12.7% were females. Respondents aged between '28 and 37 years' constituted the highest percentage (37.2%) compared to other categories of age. The category that follows in terms of frequency is the '38-47 years' category with 34.4% of the respondents. Very few (9.7%) fall in the youngest respondents' category of '18-27 years' category, and 18.7% of respondents belonged in the eldest respondents' category. In general, the mean age was 39 years while the standard deviation was 6.9 (Table 1 is referred).

Table 1. Socio-demographic characteristics (n=401)

Variables	n (%)	Variables	n (%)
Gender		Rank	
Male	350 (87.3%)	Officers	132 (32.9%)
Female	51 (12.7%)	Inspectors	125 (31.2%)
Age		Men	144 (35.9%)
18-27 years	39 (9.7%)	Years spent in service	
28-37 years	149 (37.2%)	2-5 years	73 (18.2%)
38-47 years	138 (34.4%)	6-10 years	72 (18.0%)
48-57 years	75 (18.7%)	11-15 years	73 (18.2%)
Marital status		16-20 years	94 (23.4%)
Single	78 (19.5%)	21-25 years	30 (7.5%)
Married	313 (78.1%)	26-30 years	54 (13.5%)
Ever married	10 (2.5%)	31-35 years	5 (1.2%)
Highest educational qualification		Forensic training attended	
Primary Certificate	16 (4.0%)	No training	257 (64.1%)
Secondary Certificate	101 (25.2%)	Attended once	96 (23.9%)
Diploma Certificate	141 (35.2%)	>1 training attended	48 (12.0%)
Degree/HND Certificate	115(28.7%)	*Note: Mean (SD) for age = 39(6.9); Mean (SD) for years spent in service = 14.5(5.3)*	
Postgraduate	28 (7.0%)		

Also, as the data in Table 1 indicate, the majority (78.1%) of the respondents were married, few were single, and a small percentage were ever married. In terms of educational qualification, more than one-third (35.4%) of the respondents were diploma holders, one-quarter of the respondents have secondary certificates (25.2%), and 28.7% have bachelor's degrees or their equivalent. A small percentage of respondents have primary (4.0%) or postgraduate (7.0%) qualifications as their highest education.

Concerning rank, each of the categories has more than 30% representativeness, namely, Officers (32.9%), Inspectors (31.2%), and Men (35.9%). Although the percentage of the Men category is a little bit higher, this shows that the CIIDs were composed of IPOs from all categories of rank (that is, higher, middle, and lower ranks almost equally) who were involved in criminal investigations.

As for the years spent in service, the '16-20 years' category has the highest percentage (23.4%) of the respondents. Categories '2-5 years', '6-10 years' and '11-15 years' have similar shares with 18.2%, 18.0%, and 18.2% of the respondents respectively. The most experienced categories of the respondents, i.e., '21-25 years' (7.5%), '26-30 years' (13.5%), and those

above 30 years (1.2%), have the lowest percentages. Thus, the CIIDs constitute IPOs who have less work experience and more years to spend in service; generally, the mean and standard deviation of the variable was 14.5 years and 5.3 years respectively.

According to the data in Table 1, close to two-thirds (64.1%) of the respondents did not have any training in forensic investigation. About one-quarter (23.9%) attended forensic training once. Only 12% had training on a forensic investigation more than once during their service years.

4.2. Challenges of forensic science application in the Nigeria Police Force

From the data displayed in Table 2, unreliable databases have been affirmed by 60.3% of the respondents as one of the forensic science challenges faced by the NPF. Corruption was second (59.9%); undue interference in the investigation (59.6%), and lack of interagency cooperation (59.4%) followed accordingly. Complexities of crimes (54.6%), cultural/religious beliefs (51.1%), as well as questionable forensic results (50.4%), were seen as challenges by more than half of the respondents.

Table 2. Challenges faced in forensic science application (n = 401)

Challenges	Yes	Not sure	No
	f (%)	*f (%)*	*f (%)*
Unreliable databases	242 (60.3)	125 (31.2)	31 (7.7)
Lack of inter-agency cooperation	238 (59.4)	115 (28.7)	46 (11.5)
Corruption	240 (59.9)	83 (20.7)	76 (19.0)
Questionable forensic results	202 (50.4)	141 (35.2)	54 (13.5)
Undue interference in investigation	239 (59.6)	116 (28.9)	43 (10.7)
Complexity of crimes	219 (54.6)	125 (31.2)	54 (13.5)
Cultural /religious beliefs	205 (51.1)	125 (31.2)	69 (17.2)

These findings support some of the claims of previous authors regarding issues affecting the proper application of forensic science in criminal investigations in Nigeria. For example, corruption has been a challenge as reported by Aigbokhaevbo and Iyamu-Ojo (2015). Similarly, the results agree with Crispino et al (2015) and Interpol Global DNA Profiling Survey (2017) regarding unreliable databases as a factor hindering the effective utilization of forensic science. Again, questionable forensic results, which were found by the current study to be a challenge of forensic science utilization, were earlier reported by Lee and Pagliaro (2013) as a problem faced by the police during forensic investigations. However, lack of interagency cooperation, undue interference on investigations, the complexity of crimes as well as cultural and religious beliefs seem to be the challenges not earlier reported by literature the current researcher was able to access.

4.3. Relationship among the challenges of forensic science

A four-way Loglinear analysis was performed. To determine a hierarchical unsaturated model for the associations between unreliable databases, lack of inter-agency cooperation, corruption, and undue interference in investigations. The remaining three challenges (i.e., questionable forensic results, the complexity of crimes, and cultural/religious beliefs) were not included because they indicated no statistical interactions during the preliminary test. Eight cells were having expected frequencies greater than five, no outliers were found, and approximately normally distributed adjusted residuals for the chosen model were observed.

An unsaturated model was chosen using a hierarchical Loglinear model selection procedure with a backward elimination stepwise procedure in SPSS. This produced a model that included all main effects, three-way, and two two-way associations. That is: lack of inter-agency cooperation*corruption*undue interference, unreliable databases*lack of inter-agency cooperation, and unreliable databases*corruption

were statistically significant associations. Similarly, lack of interagency cooperation*corruption, lack of interagency cooperation*undue interference in the investigation, and corruption*undue interference in the investigation were associated pairs. However, the highest-order interaction, that is [Unreliable databases = no] * [Lack of inter-agency cooperation = no] * [Corruption = no] * [Undue interference], was nonetheless not statistically significant. The model had a likelihood ratio of $\chi2(5) = 1.872$, $p = 0.867$. The partial likelihood ratio $\chi2$ is presented in Table 3. The parameter estimates for the model are shown in Table 4. As can be seen, there was a significant association between lack of interagency cooperation, corruption, and undue interference (p=0.000). A significant association was also revealed between unreliable databases and lack of interagency cooperation (p=0.000). The unreliable database was similarly associated with corruption (p=0.000).

Table 3. Partial associations: unreliable databases, lack of inter-agency cooperation, corruption and undue interference

Effect	Partial Association χ^2 (df=1)	p-value
unreliable databases* lack of interagency cooperation* corruption	1.230	0.267
unreliable databases* lack of interagency cooperation* Undue interference	0.010	0.922
unreliable databases* corruption* Undue interference	0.098	0.754
lack of interagency cooperation* corruption* Undue interference	19.378	0.000
unreliable databases* lack of interagency cooperation	23.834	0.000
unreliable databases* corruption	17.583	0.000
lack of interagency cooperation* corruption	23.351	0.000
unreliable databases* Undue interference	0.086	0.769
lack of interagency cooperation* Undue interference	14.153	0.000
corruption* Undue interference	49.211	0.000
unreliable databases	18.730	0.000
lack of interagency cooperation	14.602	0.000
corruption	16.190	0.000
Undue interference	16.190	0.000

Table 4. Parameter Estimates for the Hierarchical Model

Parameter	Estimate	Z	p-value
Constant	4.899a		
[unreliable databases = no]	-1.472	-8.480	0.000
[lack of inter-agency cooperation = no]	-2.260	-9.611	0.000
[corruption = no]	-2.801	-9.554	0.000
[undue interference = no]	-2.061	-8.898	0.000
[lack of inter-agency cooperation = no] * [corruption = no] * [undue interference = no]	5.274	11.718	0.000
[unreliable databases = no] * [lack of inter-agency cooperation = no]	1.229	5.052	0.000
[unreliable databases = no] * [corruption = no]	1.140	4.677	0.000

Note. Z = Estimate/ Standard error; Sig. = p-value

The estimates of the effect among these variables were 5.274, 1.229 and 1.140 accordingly. In other words, the odds of having interagency cooperation in utilizing forensic science for criminal investigation,

for example, is 5.274 times when there is no corruption and undue interference. Similar interactions could be observed for each of the two variables (corruption and undue interference). The challenge of unreliable databases is 1.229 times likely not to be if there is interagency cooperation. Similarly, the odds of not having the problem of unreliable databases for criminal investigation was 1.140 times if there was no corruption.

5. Conclusions

Forensic intelligence remains one of the most important tools through which effective policing could be achieved although it largely depends on the reliability of databases. Databases, which are useful when data are obtained from different sources, could be affected by various challenges. In addition to unreliable databases as a challenge of forensic investigations, other challenges, as could be seen in the context of this current study, including corruption, lack of interagency cooperation and undue interference in investigations. The hypotheses related to these four variables vis-à-vis reliable databases were statistically significant. The remaining two hypotheses were not statistically significant. Thus, some challenges of forensic science application are mutually dependent. Consequently, addressing some of the challenges would likely improve the reliability of databases for the use of the police. In addition, other challenges, specifically, questionable forensic results, the complexity of crimes and cultural or religious beliefs could also hinder the utilization of forensic science in criminal investigations. These challenges should also be addressed for the effective application of forensic science by the Nigeria Police Force.

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