

A Comparative Study of Traditional and Artificial Intelligence (AI) Based Methods of Criminal Investigation in Punjab, Pakistan

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Abstract

The study investigates and explores the methods of criminal investigation that are in vogue across Punjab Police. Pakistan, a developing country, still needs to take giant leaps in technology and incorporate its use particularly AI-based methods of criminal investigation. The study explores that the most dominant methods of criminal investigation in Punjab Pakistan are traditional and outdated. Through administering an open-ended questionnaire, the study recorded the responses of ten investigating officers of the rank of Sub-Inspectors. Five of the ten IOs were holding their offices through the selection of competitive exams whereas the other five earned promotions through extensive service, i.e., the respondents were experienced, passionate, and seasoned. The collected data were interpreted using a close reading technique. The study reveals that most IOs were unaware of the use of AI-based methods of criminal investigation chiefly relying upon traditional methods in the investigation process. The study recommends that the latest AI tools be incorporated, acquired and developed to enhance the effectiveness of the criminal investigation procedures followed by the Punjab Police.

Keywords: Criminal Investigation, Comparative Study, Artificial Intelligence, System of Investigation, AI Tools

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1. Introduction

Information and communication technologies (ICT) play a critical role in society and education by bridging knowledge gaps, fostering worldwide connections, and improving learning opportunities (Akram et al., 2021a, 2021b, 2022; Ramzan et al., 2023a, 2023b). Artificial Intelligence (hereafter AI) is evolving and growing rapidly permeating technology nearly all public and private sectors (Abdelrady & Akram, 2022; Chen & Ramzan, 2024; Ma et al., 2024). The potential of AI to revolutionize forensic analysis and criminal justice is tremendous. However, its integration across institutes and countries has its challenges and barriers. It is finding its way to legal frameworks and can secure social acceptance. The study aims to conduct a comparative analysis of the adoption of AI in forensic analysis and criminal investigation. It examines the current state of AI implementation, barriers and challenges and also opportunities for the Punjab Police. The study seeks to contribute to the legal system coupled with an understanding of the role of AI to enhance the system of justice side by side addressing the societal and ethical issues and implications.

As opposed to natural intelligence – human and animal intelligence, Artificial Intelligence is a technology that runs on machines (Akram & Abdelrady, 2023; Ramzan et al., 2020). It can solve problems faster and with more accuracy. It is rapidly making its place in all fields of knowledge. Moreover, AI is seen in criminology and law as an important area of technology to be applied for it can help tremendously in criminal justice. Moreover, AI in criminology is seen as a significant application of technology which is used to make society cautious and equitable in the world of

criminal justice. The face of the earth is rapidly changing, and the ever-evolving landscape of criminal investigation is no exception. Its integration now seems to be inevitable in criminal investigations. For, its integration can enhance the level of accuracy, and a huge amount of data can be analyzed with clinical precision that can be otherwise time-consuming and inaccurate, moreover, it can increase the efficiency of such analysis and procedures. Pattern recognition, automated tasks, predictive analytics, enhanced evidence processing, decision support and improved case management are the few other things that can be achieved through AI. The latest techniques and applications of AI are finding their place quickly in the wake of the twenty-first century in the process of criminal investigation and forensic evidence.

Pakistan is a developing country currently facing numerous challenges and economic crunch. Hence, the adoption of the latest and most expensive technology is difficult to execute because of resource constraints and limited infrastructure. However, there is a huge interest and demand for AI and its adoption in legal circles to prevent crimes and improve investigation. However, so far there is a substantial dearth of research on the role and impact of AI in Pakistan's landscape of criminal justice. Whereas the modern world is at the forefront of the latest technology and the adoption of AI in law enforcement is on solid footing. It has invested much in significant research, and it is developing AI technologies with the pace of the modern world. AI technologies, in the modern world, are in criminal investigation and forensic analysis. It is further, ensuring unbiased and ethical applications of it in its systems.

The study is comparative, and it analyses the state of affairs between the traditional methods and the advanced AI-based methods of investigation to obtain valuable insights into the factors that are influencing the adoption of AI, and also the specific applications that are revolutionizing criminal justice; moreover, it also explores the challenges and barriers associated with its implementation. To bring into light the experiences of the Ios (Investigating Officers) the study is helpful for lawmakers, policymakers, law enforcement agencies and researchers to develop better and more effective strategies to milk the potential of AI while taking hold of its negative impact and risks.

The integration of Artificial Intelligence (AI) and other technologies is fast emerging, revolutionizing the judicial system across the globe. It is a game-changer for law enforcement agencies and their approach to forensic analysis in Pakistan. The country inherited most of its systems from the British Raj that are still operational nationwide. After its creation in 1947 the old traditional methods and techniques persisted and continued with little or no change over the years. even in the twenty-first century, Pakistan is not a developed and technologically advanced country. Pakistan being a developing country is currently going through an economic crunch that is a solid impediment in nearly every state-run office and system. However, in the system of criminal investigation to maintain the pace with the world, law experts are seriously looking into the matter to adopt and utilize new technologies. Although the traditional methods of criminal investigation across Pakistan are dominantly in use, the integration of AI has somehow managed to be a part of it. Although cornerstone of the criminal investigation in Pakistan has long been the traditional methods, the integration of AI is surely inevitable. The study explores the role of AI-driven forensic methods in criminal investigation across the country. The study further explores the barriers to the integration of AI technologies and unearth the reasons behind them. The study also compares the traditional methods and their effectiveness with AI-driven methods. AI-driven technologies have introduced a new age of precision and efficiency, and it is contributing to the process of rapid decision-making. It is further, enhancing the effectiveness of law enforcement agencies and the criminal justice system.

The study delves into the challenges and advantages of traditional and AI-assisted analysis of criminal investigation comparatively in Pakistan. It illuminates the central role that the latest technologies and AI can play in the investigation process and its streamlining. There are many challenges in the present situation of criminal investigation. As a result, the collection of evidence and processing of crime scenes often fall short of standards that are acceptable internationally. It hinders the effective resolution of criminal cases effectively. However, these long-standing issues can be addressed with the emerging AI-driven forensic analysis of crime scenes. AI-driven approaches have the potential to address the issues effectively. One of the key advantages of AI-driven forensic analysis lies in its capacity to enhance the speed and accuracy of evidence processing. It has now become an important area in human sciences that can make tasks easy and more efficient.

Defence providers, organizations, and legal offices across the globe are putting their efforts to use Artificial Intelligence in the best manner. AI can help substantially in investigating crimes, their detection and prevention. The latest research on AI is also looking for early anticipation detection of crimes. There will be analytics to reach legal control. The applications of AI and the interrelated technologies are offered to officers and authorities to enable them to make criminal investigations more reliable and quicker. Internationally AI is determining its execution in the judiciary and justice system. The countries that are advanced in the use of AI have significantly brought the crime rate down. However, in Pakistan, the road is getting ready for AI.

1.1 Significance of the study

The study will help acquire the present picture of the criminal investigation process and where it stands. It will help policymakers, law enforcement agencies, investigators, and forensic experts. It will contribute substantially to the existing body of knowledge. It will determine the position of the traditional and advanced methods, their usefulness, challenges to them and their implementation and benefits in the systems.

The research is significant because it explores AI technologies and their implementation and adaptation within diverse socio-economic, and legal contexts. The study aims to uncover the best practices, their weaknesses and strengths through the comparison of the AI technologies and the traditional methods which will shed light on how AI can impact the accuracy and speed of forensic analysis and criminal investigation. The topic also highlights legal and ethical considerations which are specific to these countries and it will also offer insights for international collaboration and policy improvement. Moreover, this research will map out a plan to better guide the allocation of resources and integration of technology in criminal justice systems globally. In addition, different institutions and individuals such as forensic experts, Law enforcement agencies, policymakers, lawmakers, and researchers in both Australia and Pakistan benefit from it. It will provide insights for the improvement of the applications of AI and their use in the criminal justice system; further, it will inform legal and policy frameworks fostering collaboration on an international level. Moreover, the findings of the research will help developers of AI tools and technologies to make certain improvements.

1.2 Objectives

The objectives of the study are to:

- Trace the current situation of criminal investigation in reference to murder, rape and dacoity and forensic analysis in Punjab, Pakistan.
- Explore the challenges and barriers to advanced methods such as AI tools.

2. Literature Review

This review synthesizes existing literature on traditional and AI-driven forensic methods, providing a comparative analysis of their effectiveness in the context of Pakistan's criminal justice system. Further research and practical implementations are necessary to fully realize the potential of AI in this field.

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think and act like humans. It involves the use of algorithms and computer programs to perform tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making, and language translation, among others (Agarwal, 2013). AI plays a vital role in criminology. With the increasing amount of digital data available today, AI can be used to analyze large datasets quickly and accurately, which can help law enforcement agencies identify criminal activity, detect patterns, and solve crimes more efficiently (Hayward, 2020). Machine learning can be used for crime prediction and analysis by analyzing large amounts of data to identify patterns and trends that may be indicative of criminal activity (Bharati, 2018). Zhang & Lu (2021) explore the history and development of AI and conclude that AI is now inevitable across the fields of study. The techniques of data mining are also used for analysis and prediction of the currently available information that exists on databases.

These can be useful in helping law enforcement agencies and organizations to make good decisions with the help of insight taken from AI that may not be used through simple analysis of the raw data (Dakalbab, 2022). Criminal activities can be prevented with preemptive measures for it can provide early information about the patterns of crime in a certain area. With the turn of the twenty-first century new variety of crimes have emerged that pose a huge threat to the citizens of the world. Flasiński & Flasińsk (2016) define Artificial Intelligence which is abbreviated as AI as a hot topic of debate and research projects. It began in the 1950s with the project of turning test. John McCarthy was the first scholar to coin it in the 1956 Dartmouth Conference which is believed to be the official birth of it. In its development, it has covered nearly all the disciplines of study such as medicine, politics, biology, economics and law. Likewise, the age of the advent of big data provided criminals convenience and equipped them with new and peculiar methods of crime.

The nature of such crimes demands the use of AI. To tackle these crimes with traditional methods, which are utterly passive, is difficult now. Du et, al. (2022) describe in detail the use and integration of AI in criminal investigation and also highlight challenges and suggestions to improve it. They are of the opinion that artificial intelligence has paved the road to the criminal investigation and forensic system hence without its proper integration and use the field of criminal investigation cannot function properly and effectively. Presently, AI is in use among police departments around the world; however, the departments that are reluctant to it face challenges in dealing with the latest nature of crimes. Video image detection, crime prediction, mining of crime data and many more areas can be effectively improved with the help of AI. Although, there are certain risks to the privacy of the citizens yet certain measures can be taken to avoid such happenings. Anwar (2021) states that techniques of data mining and the relevant technologies are paving their way to criminal investigation and producing remarkable results. Hauck (2023) states that Coplink is an effective tool for police and law enforcement agencies for the analysis of criminal justice. It helps in the identification of data trends and patterns of crimes that are the indicators of criminal activity. One thing that should be kept at the forefront is ethics. no human values and rights should be exploited in the execution of such tools.

However, in the use of data ethics should be taken into consideration and no individual rights should be violated. Faggella (2019) also asserts that Artificial Intelligence has a range of

applications that can help in the prevention of crimes. Moreover, AI shall play an even more vital role in criminal investigation shortly than it has now. the future begins with the use and integration of AI in the systems. Chowdhury (2021) believes that AI has tremendous potential to improve criminal justice and forensic investigation systems. It can handle and interpret large amounts of data in a very short time. Hence, it is the future of criminal investigation. However, King (2020) also emphasizes the fair use of AI tools in criminal investigations and asserts that ethical values should not be violated. The multiple potential applications of AI should be used with the prescribed constitutional parameters and individual rights should be ensured. violation of human rights in the use of AI tools at any point should not be compromised. Its use and abuse should be carefully crafted. Aleszavrsnik (2020) argues that all the multiple applications of Artificial Intelligence in criminal justice seem quite reasonable, although, there are risks of their potential misuse and unfair outcomes that can be a challenge to the safety of society. Its applications should be directed towards criminal justice without any inclination or bias from the side of investigation officers. Law and related fields in advanced countries have developed their systems based on AI and these systems are evolving day by day.

Pasha, Ali, & Jeljeli (2022) investigate the role of Artificial Intelligence in cybersecurity and crime against children on cybernetics. They argue that in Pakistani conditions children frequently use mobile phones which are connected to the internet therefore, young children become victims of cybercrimes. The use of AI can help prevent such crimes. They further, investigate different studies that highlight the role of AI-enabled software such as Google AI Tool, SomeBody, Spotlight etc. in criminal investigations in Pakistan. Khan et, al. (2021) describe the role of AI in the propagation of crimes. They argue that AI has enabled criminals to execute crimes more efficiently; therefore, it is much needed in the circles of criminal investigation to enable its system with the help of AI to counter cybercrimes in Pakistan. Saleem, Malhooz & Fatima (2023) explore the engagement of Artificial Intelligence in digital crimes and assaults that are the product of the modern world and Pakistan. The government agencies and law enforcement agencies are well aware of the fact that AI can be a difficult thing to handle without its proper application in the criminal justice. For it can outwit the agencies and the criminals can go off scot. Fusco (2022) explores the spread of fake news in Pakistan and KSA. Fake news spreads rapidly on social media platforms and behind it is the force of Artificial Intelligence. The study investigates the deterrence and punishment in the selected countries of the criminals who spread fake news. The study concludes that Pakistan still needs to engage AI fully and properly to tackle the issue of fake news on social media.

These studies suggest that AI is important in many ways. moreover, its integration can holistically help judicial and criminal systems. so far few studies are comparative with the context of Pakistan and its criminal justice system. The proposed study has the potential to fill this huge gap.

3. Methodology

The study follows qualitative approach to gain in depth analysis of the research problem. The objective was to know the state of affairs that runs in criminal investigation. It was deemed that the relevant officers were not trained in latest techniques of investigation. Hence, to gain maximum real picture of the ground, the qualitative approach was selected. For this purpose, a qualitative open-ended questionnaire was developed which contained ten items of questions to record the opinion of the respondents. Before administering it, the consent forms were distributed among the respondents keeping in view all the concerns of the ethics of research. Their consent was taken prior to recording their response. Through purposive sampling, ten IOs were selected. The questionnaire was administered on site and the responses were recorded accordingly. The recorded response was analyzed and interpreted using the technique of close reading method developed by

Catherine Belsey. This method allows to interpret recorded data closely from all possible angles and perspectives. Hence, it served best the purpose of the study.

4. Data Collection

The data were collected through interviews of ten IOs (Investigating Officers) from five districts of the Punjab, Province – Lahore, Gujranwala, Sheikhpura, Kasur and Okara. Two IOs were selected through purposive sampling method from each of the selected district. The dichotomy of ranker and PPSC was maintained as one IO from each domain was selected comprising the pair in all districts. The three heinous offences – Murder, Rape and Dacoity were selected and put into the interview questionnaire. The interview was semi structured and open ended containing ten items of questions as enlisted in the **Appendix-I**. The consent of the respondent was taken prior to the interview. The response of the sample was noted and recorded manually.

5. Data Analysis

The first question in the interview was :

1. What are the basic steps of Criminal Investigation which are taken by the Police once they reach the place of occurrence of the offence?

All the IOs, without any disagreement, revealed that in these three offences, once they reach the place of occurrence, they tend to cordon off the premises right away ensuring that the crime scene is secured and preserved. Thereafter, they tend to interview the witnesses as to find out what might have happened and how it might have happened and lastly, where did the perpetrators flee. Similarly, most of the time in Murder and rape cases the victim or witnesses know the accused and thus, they tend to nominate the person to police that this/these is/are (our) accused person(s) who have committed the crime. However, in dacoity/robbery mostly the robbers are unknown persons and thus they only provide description of robbers, their direction from where they came/followed and fled. In addition, they investigate whether there were any CCTV cameras installed or simply if Safe City Police Cameras could identify their route, vehicle used in committing the offence or their appearances for sketches.

2. What are the ways to collect evidence from the crime scenes and around?

Out of ten, eight IOs responded in the same manner as to collection, preservation and transportation of evidence to the Punjab Forensics Science Authority (PFSA). The evidence includes blood, murder weapon (if found at the crime scene), fingerprints semen, condoms, CCTV Camera + DVR, Clothes of Victims, residues and remains of trace evidence, soil sample, light bulb etc. In addition, if the accused persons are on the run, then their CDR (Call Data Records) and geo-fencing is done from tracing them. The collected evidence is collected, packaged and sealed in presence of witnesses and then handed over to the Moharrar of the respective Police Station. Two of the IOs were found unclear as to how to begin and end the collection of evidence procedure. All the IOs maintained that the team of the PFSA instead of delivering the packages to the prescribed PFSA Laboratory, submit to the concerned Police Station which results in compromising the authenticity of the chain of custody procedure in criminal Investigation.

3. What challenges do the IOs of Punjab Police face during criminal investigation of these offences?

All the IOs revealed the following challenges which are identical less or more across the sample:

- **Lack of Funding:** The IOs expressed that due to the lack of adequate funding they struggle financially to carry out the investigation effectively and in time. Therefore, the complainant

has to bear the burden of expenses ranging from photocopies of the documents to the fuel of the Police Mobile. Further, meals of the police party, the passing of challan at Prosecution Departments and many more contingencies are a hole on the complainant's pocket.

- **Unnecessary Paper Trail:** The Police Stations have to keep the records in multiple registers, files and compartments and fraction of the data in online format. It is time consuming and laborious work.
- **Lack of Training:** It was revealed that the investigating personnel are not adequately trained to carry out the investigation. They lack basic training skills in particular to rape, murder and dacoity investigations. They are unfamiliar with the use of modern technology and AI tools. In this regard, they are required to get trained (Li & Akram, 2023; Noor et al., 2021). They mostly rely to further their investigation on custodial torture rather than investigating the case in line with contemporary investigation techniques.
- **Access to modern technology and AI Tools:** There is no prompt mechanism in the police department that can help IOs to make use of modern technology and AI tools such as **Cellebrite** (Used for extracting and analyzing data from mobile phones), **Clearview AI** (Utilizes facial recognition technology to help identify suspects by comparing images against a vast database of photos from the internet and Police source), **Palantir** (Provides data integration and analysis tools that use AI to help law enforcement agencies find connections between disparate data sources), **BriefCam** (Uses AI and video analytics to process and review hours of video footage quickly, identifying relevant events and objects), **Veritone** (Offers AI-driven tools for audio and video evidence analysis. It enables objection detection, translation, and transcription), **ShotSpotter** (Uses AI to detect gunfire incidents through acoustic sensors, helping law enforcement respond more quickly to shootings), **PredPol** (it uses predictive analytics which can forecast the time and place of the crimes to occur likely. It also allows preventive measures and better resource allocation), **Cogito** (It helps in detecting stress and deception during interrogation and interviews), **NEC's NeoFace** (It is an AI tool used for facial recognition for identification of suspects from CCTV footages/videos or available photos), **REVEAL** (It helps linking hidden connections between cases using datasets to detect crime patterns) and others. All the IOs were found entirely unfamiliar with these AI tools. In addition, the modern tools such as Geo Fencing, CDR, location tracking and others entails difficult procedures to acquire and use.
- **Security Duties and protocols:** The respondents revealed that they are left under staffed as their personnel are engaged in protocols of government officials, religious and cultural festivals and events such as Majalis and Ashura Processions, Eid prayers and Jumma prayers, Court Duties etc. Moreover, most of the man power of the Police Personnel is deployed on at homes of politicians, VIPs and government officials which hinders and delays the expedited procedure of criminal investigation.

4. What improvements are necessary for enhancing criminal investigations in Punjab?

All the IOs suggested same suggestions and improvements in investigating the selected offences. Following suggestions and improvements were suggested by the IOs:

- **Provision of adequate funding:** As most of the Investigating Officers complained about lack of funds during the interviews, their first and foremost demand was **timely** provision of adequate funds. During research interviews, it was unearthed that the IO is paid Rs. 35,000/- , Rs. 10,000/- and Rs. 10,000/- for Murder, Rape and Dacoity respectively. However, the IO has to spend these investigations expenditures from his own pocket and once the

investigation is completed and final report is submitted, he/she can claim the investigations costs that too after giving up one third of the aforementioned prescribed investigation amount in the form of bribe to the accountants. They not only demanded prompt investigation costs but also asked to have them increased by at least seventy percent.

- **Eliminating Unnecessary Paper Trails:** All of the IOs roughly wanted the digitization of the data by Police at a single platform. This particular platform's access could be given to Judiciary, IOs, Prosecutors and IOs but subject to terms and conditions
- **Constant training workshops and courses at nearest Police Training Colleges:** Seven out of ten IOs admitted that the Police IOs lack knowledge of modern techniques and methods to investigate cases rather they are stuck on conventional methods of detaining the nominated persons in FIR and then torturing them to further their investigations. In addition, all most all of them lacked basic knowledge of securing the crime scene, collection and preservation of Evidence, prompt medicals of victims and lastly exposure to modern technology.
- **Access to modern technology and AI tools:** The IOs must be given access to modern investigation technology and AI tools to enhance and expedite their investigations. All the IO's asked for speedily provision of location tracking of suspects, CDRs, and close collaborations with PFSA for sample testing and speedily delivery of reports. Also, prompt collaborations with NADRA and IB for intel sharing and data collection for expedited investigation.
- **Introducing stringent Punishments for fake FIRs:** All of the IOs were adamant that they tend to counter a lot of fake applications for registration of FIRs. When the IOs investigate, they find that the accused person is/are innocent. Similarly, they tend to nominate entire family of accused persons just to get back at the accused party. However, when the investigation is carried out, the falsely implicated persons are declared innocent or are involved in nominal roles such as Jappa, Lalkara etc., and eventually they tend to get initially bailed out and ultimately acquitted from the court of law and thus making huge dents on the prosecution's story. They all wanted stringent punishments be introduced against those to falsely implicate innocent criminal cases. In addition, especially in rape cases, where most of the times accused are known to the victim are already involved with the accused persons.
- **Evidence Parcels, Role of Moharrar and chain of custody:** Once the Police reaches crime scene, they tend to cordon off the premises and special team of PFSA comes in for collection, preservation and packaging of evidence. However, once they package the evidence, they tend to hand it over to Moharrar of the Police Station to drop off these packages at PFSA within expedited time. According to IOs, it would have been much more convenient if the team of PFSA after packaging the evidence take these packages along them. It shall not only save time but shall also eliminate chances of evidence contamination and tempering as the Police most of the times fails at maintaining chain of custody.
- **Presence of Prosecutors at Police Stations:** Well, surprisingly three out of ten IOs wanted a prosecutor present in the Police Stations to ensure that the police investigations are carried out in the lines of settled principles of law to ensure that the culprits do not get away with the crimes.
- **Online Case Management System:** Nine out of ten IOs suggested that an Online Case Management System must be developed for all court proceedings where the respective judges and senior police officers could have access to case files and documents to monitor,

review and observe the progress by the IOs. Special training must be conducted in this behalf as well. In addition, it shall have its own checks and balances and certain technical tags to ensure accountability. It shall also lessen the need of IOs to be present before the courts for bails and other hearings as the files must be available online and law officers could assist the courts easily.

- **Minimization of Security Duties and Protocols:** All of the IOs were against the security duties and protocols. In short, they were against the VIP culture that has developed over the years in Pakistan in general. Thousands of police personnel are on security duty of politicians, government officials, VIPs etc., which makes the Police Stations under staffed which affects overall performance of the Police.

5. What AI tools are being used by Punjab Police?

Unfortunately, to my surprise all the IOs irrespective of their background no one knew about the AI tools that are already being used by Punjab Police. They were not aware at all about what Artificial Intelligence in general is and how it can be used to enhance the effectiveness of criminal investigation and speed up the investigation procedure. However, I informed them about the following three AI tools that are currently being used by the Punjab Police as per their own website (<https://punjabpolice.gov.pk>) :

- I. **Facial Recognition System:** AI based facial recognition system has been introduced by the Punjab Police which can scan a face against a database of more than 1.6 million photos/faces already gathered by the Punjab Police through their driving licenses database, criminal record holder's database and a database from the prisons. Once the police has a CCTV footage or a photograph or even a sketch, they can scan it against their database to identify the suspect.
- II. **Automated Number Plate Recognition System (ANPR):** This system is capable of monitoring vehicles used in any criminal activity. Through identifying the number plates of the vehicle, it can not only identify the owner of the vehicle but can also capture their routes, other vehicles involved and obviously their photographs as well. It is also beneficial in identifying traffic violations and motor related offences.
- III. **Tag and Trace System:** Through this system, Police and other law enforcement officers are capable of tagging and tracing not only individual suspects but also items. It is one of the most useful tools as it can be used to trace other suspects.

6. What are the most common types of forensic analysis conducted by IOs of Punjab Police in reference to the offences (Murder, Rape and Dacoity) in collaboration with PFSA?

All the IOs revealed all the most identical responses for the methods used in criminal investigation by the IOs in the offences. They rely on PFSA for DNA analysis reports, fingerprints analysis, ballistics, toxicology, digital forensics etc., for murder and rape cases. However, CDR, geo fencing, and record keeping of stolen goods are used for tracking the dacoity cases.

7. How would you rate the overall accuracy of the PFSA reports?

Out of ten, eight IOs blindly trusted the accuracy of the reports submitted by PFSA to the courts. However, two IO's responded that they know people who have connections inside and if paid the right amount, can have the reports altered.

8. What are the major obstacles faced by IO's because of PFSA laboratories?

All the IO's submitted the same identical response that the PFSA laboratories never submits reports in time in addition to their unresponsive behavior. However, PFSA blames it on the following reasons:

- Insufficient Staff
- Inadequate training
- Outdated equipment and technology
- Bureaucratic hurdles
- Lack of funding.

9. What additional training or education do you believe is needed for incorporation of AI tools in criminal investigation and in general enhancing overall procedures of investigation for crime solving?

All IO's besides two were totally unfamiliar with AI. The two IOs who knew what AI is, were unaware of the AI tools being used by their own department. However, all of the IO's almost made identical recommendations which are as follows:

- Forensic Analysis training workshops of the IOs from time to time
- Usage of AI Tools (workshops) for not only crime tracing but also for crime prevention and profiling.
- Certifications, workshops, seminars, courses must be offered by Police Training Colleges/ Academies instructed by professionals
- Complete digitization of police records and data
- Development of new AI tools and/or acquisition of already existing AI tools for enhancing criminal investigation.
- Facial recognition and various AI tools as mentioned above be made readily available for IOs with proper training and technical support and staff.

10. Are you satisfied with the overall burden of cases placed on you as an IO?

Every IO was unsatisfied with the burden of cases. During the interviews, it was observed that every IO was at a time working on more than fifty-five cases. Each IO has to maintain all the records of all the case files he/she is working on and still being assigned with new cases. They are swamped with Zimni writing (Daily Progress report of all cases), Maps, court trips among other assigned work.

6. FINDINGS AND RECOMMENDATIONS

The study reveals that there is lack of interest from the side of lawmakers and policymakers in the government circles to enhance the effectiveness of criminal investigation by means of latest technologies and AI tools. Moreover, it was discovered that the IOs do not receive any state-of-the-art training session that should educate them of the use of technology. It was found that the IOs were unaware of the role of Artificial Intelligence and how it could revolutionize the criminal investigation especially for offenses of murder, rape and dacoity. Majority of the IOs were using conventional methods of criminal investigation i.e., entirely relying on applications upon which First Information Report (FIR) is registered. As a result, complainant leads the investigation by nominating the accused persons and leading the IOs towards that direction especially in cases of murder, rape. However, in dacoity most of the times, accused persons are unknown and other techniques are used for their tracking and tracing such as geo fencing, CDR, mobile phone data recovery, CCTV, etc.

It was found that the IOs lacked basic knowledge of evidence handling especially in regard to chain of custody. Similarly, they lack adequate practical knowledge and training regarding elementary steps of investigation especially in rape cases. For example, they are only concerned

with the medical of victim however, it's of pivotal importance that the medical is conducted as utmost priority. Also, the victim must not be allowed to change cloths. Victim must not be allowed to eat or drink anything. Moreover, all the IOs failed to draw any discrimination between sexual abuse and rape itself. It was alarming that most of the FIRs regarding rape attempts were registered under wrong provisions of law i.e. 376/511, rather, they must be registered under section 377-A/377-B which is sexual abuse. Without an iota of doubt, it shall increase chances of conviction. In addition, in murder cases, collection of evidence and transportation is of vital importance ensuring that the chain of custody isn't compromised. In dacoity, identification of directions of the robbers, their description for sketching, geo-fencing, CDR, CCTV, interviews from the vicinity and set patterns, identification of hotspot locations, recovery of stolen goods/items etc., leads to the culprit.

The use of AI tools is although increasing yet most of the IOs did not know as to what three AI tools does the Police have? When confronted the IOs with the available AI tools they were not interested in even using them during their investigation as they were time consuming especially when they were over burdened with a lot of investigations of cases files and other duties. In addition, the Punjab police entirely lacks contemporary AI tools which can be used for criminal investigation. These tools have already been mentioned in the forgoing paras about which all of the IOs were completely unaware. It is suggested that the government officials and policy makers pay immediate attention towards acquisition/building of new technology and AI tools. Furthermore, the unnecessary paper trails be minimized. Furthermore, the number of cases on each IO(s) be reduced significantly so that the quality of investigation be enhanced resulting in timely submission of Challan.

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