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Harmonizing Global Forensic Practices: Addressing Challenges in Cross-Border Criminal Cases

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ABSTRACT

Scientific advancement greatly impacted forensic science. These advancements have led to the establishment of forensic laboratories, which use standardized methods and utilize scientific approaches to considerations in determinations made in criminal cases. The advances of forensic fingerprinting, toxicology, forensic ballistics, entomology, forensic anthropology, and DNA analysis mean the field has undergone significant revolutions; however, cross-border criminal investigations face obstacles and challenges such as differences in law and processes between jurisdictions, language barriers, and cultural impediments. Forensic collaboration on cases such as the murder of Yara Gambira Sio in Italy and the 26/11 Mumbai attack in India shows the importance of working together internationally through case studies. continued practice requires standardized forensic protocols, training capacity building, ethical implications, data sharing agreements, and non-governmental organizations (NGOs) and intergovernmental organizations are important to the development of forensic ability worldwide. While predictive policing has much promise, it has many ethical and legal concerns. The importance of harmonized forensic processes globally is to help with a range of international investigations and as an entire justice system. This paper discusses the impact of scientific progress on forensic science, region-specific challenges, and case studies on cross-border criminal investigations, implications of advancements for future practice, the role of NGOs and intergovernmental organizations in training and capacity building, predictive policing and international implications, and a place for a global forensic framework.

Keywords: *Global Forensic Practices, Cross-Border, Criminal Cases*

I. INTRODUCTION

Scientific progress has bolstered forensic science, which has significantly altered this discipline. This change has led to forensic labs, standardized procedures, and scientific principles in crime investigations. During the late 1800s and early 1900s various forensic

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laboratories, such as the Bertillon Lab in Paris, and Scotland Yard's lab in London, were established. These forensic laboratories cemented themselves as the laboratories to which law enforcement agencies could employ to establish the evidence in a case and advance the forensic techniques used. Fingerprinting was the major crux of identification methods, with Sir Francis Galton's introduction of fingerprinting along with Sir Edward Henry's system which clearly improved the mechanics of using fingerprints as a focal identification method, and improved its value in investigations. Toxicology also developed through the tools and techniques such as spectroscopy and chromatography which would detect poisons and drugs in the human body. As soon as toxicological evidence was revealed, it would be integral if authorities investigated cases of poisoning or overdosing. There were developments to forensic ballistics, with scientists like Calvin Goddard leading way instruments such as comparison microscopes that allowed experts to connect bullets fired from guns, which could be important towards solving shooting events. Entomology - the study of insects was used by investigators to understand factors contributing to estimating the time of death based on the studied activity of insects upon the body. As with entomology, forensic anthropology was developed to assist investigators in identifying bodies through skeletal remains, also assessing signs of trauma on remains. The most significant opportunity for scientific progress was molecular DNA was developed and then implemented in law enforcement investigations in the late 20th century, considered the most accurate means of scientific identification and possibly connecting to suspects of a crime, or exoneration of the wrongly convicted..(History of Forensic Science - The Legal Quotient, n.d.)[3]

II. CROSS-BORDER CRIMINAL INVESTIGATIONS AND FORENSICS

In the new environment of crime, crimes often do not stop at national borders, and many examples demonstrate how difficult it is for any one country to combat its criminal problems alone. Terrorism, human trafficking, and cybercrime are common examples of cross-border crimes. Terrorism has quickly become a global issue instead of solely a domestic concern as terrorist organizations today rely on international networks for the planning, financing, and carrying out of attacks. To help address these needs, the United Nations Office on Drugs and Crime (UNODC) has developed tools and initiatives that facilitate international cooperation in the fight against terrorism.(2025 Regional Expert Group Meeting Addresses Terrorism and

[3]Adv. Hemant More, *History of Forensic Science*, The Legal Quotient (Apr. 17, 2024), https://thelegalquotient.com/criminal-laws/forensic-science/history-of-forensic-science/3450/ (last visited Feb. 13, 2025).

Foreign Terrorist Fighters in Central Asia, n.d.; The Forensic Science_UK_2010-12, n.d.).[4]

Human trafficking is a serious problem. Human traffickers transport persons across international borders for exploitation, which makes it difficult for authorities to track traffickers. According to the UNODC's Global Report on Trafficking in Persons, international collaboration, such as through intelligence sharing to facilitate the movement of traffickers across borders and simplify procedures for extradition, is vital for the rescue of victims and the prosecution of perpetrators.(Global Report on Trafficking in Persons 2024_BOOK, n.d.).[5]

The growth of the internet led to a huge increase in cybercrime. Criminals can now attack businesses, steal identities, and penetrate government systems from anywhere on the planet. INTERPOL's Cybercrime Directorate works closely with police organisations from around the world to share information about cyber threats and pursue criminals across international borders (INTERPOL Cybercrime). International cooperation, the speedy sharing of information and data, and technological innovation are required to combat these crimes, as well as keeping legal frameworks up to date and fit for purpose in such diverse criminal environments.[6]

III. CHALLENGES IN INTERNATIONAL FORENSIC COLLABORATION

A. Law and process differences

Problems of international cooperation in forensic science can be encountered due to the unique laws and processes of each country. When working with forensic evidence, these differences may complicate how to collect and test evidence and how forensic evidence will be received. For example, evidence that is admissible in one legal system may be inadmissible in another legal system, at least in part based on different legal standards and due process. These differences in law can negatively impact the continuity of forensic information transfer and ultimately impact the evolution of international investigation (Casino et al., 2022)[7]. Furthermore, the absence of universal forensic practices among countries has compounded these challenges. While some countries actively pursue forensic practice and have strict protocols to guide their practice, others have antiquated practices or no practice at all. This

[4] United Nations Office on Drugs and Crime, *2025 Regional Expert Group Meeting Addresses Terrorism and Foreign Terrorist Fighters in Central Asia* (2025), https://www.unodc.org/unodc/en/terrorism/latest-news/2025-regional-expert-group-meeting-addresses-terrorism-and-foreign-terrorist-fighters-in-central-asia.html (last visited Feb. 17, 2025).

[5] United Nations Office on Drugs and Crime, *Global Report on Trafficking in Persons 2024* (2024), https://www.unodc.org/documents/data-and-analysis/glotip/2024/GLOTIP2024_BOOK.pdf (last visited Feb. 17, 2025).

[6] Interpol, *Cybercrime* (n.d.), https://www.interpol.int/en/Crimes/Cybercrime (last visited Feb. 17, 2025).

[7] Fran Casino et al., *SoK: Cross-border Criminal Investigations and Digital Evidence*, 8 J. Cybersecurity 1, art. tyac014 (2022), https://academic.oup.com/cybersecurity/article/8/1/tyac014/6909060 (last visited Feb. 18, 2025).

inconsistency generates some uncertainty about the reliability and accuracy of the forensic results when applying them internationally. Adding complexity is the range of statutes regarding data privacy, witness protection, and sovereignty over evidence all of which could complicate international collaboration. It is up to the investigator to figure out an extremely detailed collection of practices to comply with legal obligations to be compliant with both domestic and international laws, each requiring time and energy. There is a need for international treaties and frameworks to legitimize forensic processes. Common standards and protocols create a common set of practices that would offer opportunities for collaboration with countries collecting, analysing, and interpreting forensic solutions in a similar manner. To summarise, these standards would legitimize forensic results and provide another avenue for seeking justice worldwide.

B. Language and cultural challenges

Language challenges can be significant obstacles in international forensic cooperation. In a forensic investigation, good communication is essential, and any misunderstanding can lead to an incorrect analysis, an unfair finding, or both. Also, language limitations, for example, the specialized vocabulary used in forensics, may not have a specific translation in other languages, complicating accurate translation of the communication. This can create confusion in the interpretation of forensic evidence and expert evidence. Cultural issues also add to the complexities of forensic procedures. Each culture has its norms, which shape how individuals see and interact with the legal processes, affecting the credibility of evidence and the interpretation of behaviours. For example, in some cultures, applicants may be seen as rude or disrespectful to openly show emotions during a testimony. In a culture where showing emotions is inappropriate, the witness's behaviour may be improperly interpreted by individuals not accustomed to those cultural norms as evasive or dishonest. Cultural interpreters and consultants help deal with these issues.

C. International Forensic Investigations Case Studies

Collaboration in forensic science on an international level has become vital for resolving difficult criminal cases across borders. Today, crimes associated with human trafficking, cyber crime, terrorism, and drug trafficking do not usually happen in one country. Criminal investigators from different countries can collect evidence and prosecute offenders although collaborative opportunities often come together in investigating multiple nations. By collaborating, and transferring forensic knowledge, technology, and data, investigators of cross-boundary crimes have been more successful in finding offenders. Organizations such as

INTERPOL have proven there is strength in numbers. They have shown how international collaboration can speed-up, and enhance the quality of international investigations. However, collaboration across borders is identified as a challenging endeavour. Differences in legal processes e.g. some countries speak the same language, some across multiple languages, and others are lost in translation. Variations in forensic science methods can establish miscommunication and delays. International investigations mean different applications for the care and maintenance of evidence, sharing evidence, admissibility of evidence in court and most importantly, protecting human rights.

Some nations may lack sufficient resources to complicate their collaborative efforts. Despite these obstacles, international forensic cooperation continues to advance, underscoring the need for countries to establish unified rules and standards to combat crimes that have global implications more effectively.

IV. FAMOUS CROSS-BORDER CRIMINAL CASES

A. Murder Case of Yara Gambira Sio (Italy, 2010)

Thirteen-year-old Yara Gambirasio's tragic case illustrates the importance and significance of forensic science in the justice system. After her disappearance in 2010, a large series of DNA samples and the technique of reverse DNA identification allowed investigators to greatly reduce the pool of identification for Massimo Bossetti among more than 22,000 possible profiles.[8]. This case demonstrates that broad-based DNA profiling and collaboration in forensic investigations work. The DNA was isolated from Yara Gambirasio's cell phone battery.[9].

B. The Jigsaw Murders (UK, 1935)

On September 14, 1935, Buck Ruxton, a physician from India living in Lancashire, just south of the border of Scotland, killed his wife Isabella and her maid, Mary Rogerson; he then dismembered their bodies and disposed of their body parts. When pieces of their bodies were discovered by a passerby beneath a bridge in Scotland, forensic specialists were assembled and used different scientific techniques to identify the deceased victims and the murderer.[10] This case is a leap forward in forensic science and is a model for future cases.

[8] *Murder of Yara Gambirasio*, Wikipedia (last visited Feb. 20, 2025), https://en.wikipedia.org/wiki/Murder_of_Yara_Gambirasio.

[9] Tobias Jones, *The Murder That Has Obsessed Italy*, The Guardian (Jan. 8, 2015), https://www.theguardian.com/world/2015/jan/08/-sp-the-murder-that-has-obsessed-italy (last visited Feb. 20, 2025).

[10] *The Buck Ruxton 'Jigsaw Murders' Case* (n.d.), Visible Proofs: Forensic Views of the Body, Nat'l Lib. of Med., https://www.nlm.nih.gov/exhibition/visibleproofs/galleries/cases/ruxton_image_9.html (last visited Feb. 20, 2025).

C. State of Maharashtra v. Ajmal Kasab (2012)

An even more interesting example out of forensic science comes from the recent 26/11 Mumbai attack case, where cooperation occurred among India, the United States, and Pakistan, and where forensic science played a significant role. Forensic science played a very important role. After the attacks, the U.S. FBI offered its forensic capabilities in assisting Indian authorities in terms of the supplied aid to investigate the satellite phone data, decrypt GPS devices, and engage with intercepted communications. This cooperation was very important to pull together connectivity to the attackers and handlers across boundaries. In the case of State of Maharashtra v. Ajmal Kasab (2012), the Supreme Court of India considered that the forensic evidence was an important part of convicting Kasab, the one surviving terrorist (Supreme Court Judgment). While cooperation with Pakistan did not occur, the FBI's forensic service aided in bolstering India's case. **(Mohammed Ajmal Mohammad Amir Kasab @ Abu Mujahid_state of Maharashtra_1699358102, n.d.)**[11]

D. The Purulia Arms Drop matter:

India has had notable difficulty proceeding with forensic matters across boundaries. A case illustrating this is the Purulia Arms Drop case of 1995, which involved contraband weapons being dropped from an aircraft, flying over Purulia, West Bengal, and it was a British citizen, Peter Bleach, who was tried and held accountable for the deed. The presenting issues for Indian officials were that they could not fully pursue the relevant forensic and intelligence data because of the lack of cooperation by UK officials. There were allegations in the case that UK intelligence knew about the drop before it occurred but did not provide Indian authorities with actionable intelligence. The trial (State vs. Peter Bleach, Calcutta High Court) was ultimately lessened by the poor state of criminal forensic across a foreign border dependent on forensics through coordination, ultimately backed by political negotiations, which led to the release of Bleach. This case illustrates how there is a failure to cooperate on forensic work internationally, and how this may, ultimately, harm national security.[12]

Impact for Future Practice

The advances in forensic science in international investigations confirm the importance of international partnerships, standard procedures, and ethical frameworks. A review of previous

[11] *Mohammed Ajmal Mohammad Amir Kasab @ Abu Mujahid v. State of Maharashtra, (2012) 9 SCC 1, https://digiscr.sci.gov.in/view_judgment?id=NDI2Ng== (last visited Feb. 21, 2025).*

[12] *Purulia Arms Drop Case: Why Denmark Denied India's Extradition Request for Niels Holck*, Times of India (Aug. 30, 2024), https://timesofindia.indiatimes.com/india/purulia-arms-drop-case-why-denmark-denied-indias-extradition-request-for-niels-holck/articleshow/112910799.cms (last visited Feb. 21, 2025).

case studies tells us about the pros and cons of global forensic practices, and they provide the evidence and direction for future practices.

1. Standardization of Forensic Methods

The first observation from the collaborative approach to global forensic science is the value of standardized methods of practice. Differences in forensic science practices from country to country can complicate the admissibility and interpretation of evidence. For instance, the European Network of Forensic Science Institutes (ENFSI) has been instrumental in promoting uniformity of forensic practice across the European Union, so evidence collected in one country conforms to a standard acceptable in other countries. A consistent framework also benefits investigations and legal processes by simplifying procedures, but can develop a greater sense of faith in international organizations.[13]

2. The Importance of Training and Capacity Building

The gap of forensic discrepancy between countries, especially between the Global North and Global South, requires tremendous amounts of training and capacity building. "Frugal forensics" aims to promote low-cost and sustainable forensic pathways that are suitable for resource-poor settings with an emphasis on resilience, economy, and quality in forensic systems, permitting countries to structure forensic systems that promote efficiency and sustainability whilst striving for justice regardless of an economy.(Bouzin et al., 2023)[14].

3. Ethical Considerations and Cultural Sensitivity

A common challenge of international forensic investigations is that there are many cultural and ethical contexts to navigate. Respecting local customs, traditions, beliefs, and laws when conducting the investigation is essential to maintaining integrity in the overall investigation and gaining trust from community members who may bear witness to some aspects of the investigation at their local levels. For example, to have awareness and to respect cultural practices related to death and burial (e.g., religious) would bear some significant implications for the exhumation or autopsy process. The ethical considerations surrounding data sharing, and in particular DNA and biometric data, need to have clear protocols in place to establish procedures that will respect and protect individual rights.[15]

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[13] International Forensic Strategic Alliance, *Home*, https://www.ifsa-forensics.org/ (last visited Feb. 22, 2025).
[14] Jemmy T. Bouzin et al., *Mind the Gap: The Challenges of Sustainable Forensic Science Service Provision*, 6 Forensic Sci. Int.: Synergy, art. 100318 (2023), https://pmc.ncbi.nlm.nih.gov/articles/PMC9958282/ (last visited Feb. 23, 2025).
[15] Editorial, *The Impact of Forensic Science and Globalization on Law Enforcement* (July 20, 2024), Laws Learned, https://lawslearned.com/forensic-science-and-globalization/ (last visited Feb. 23, 2025).

4. Data-sharing and privacy considerations

While allowing for the public sharing of forensic data that could assist investigations on an international scale can be beneficial, it can also create challenges in regard to data security, privacy, and confidentiality. When sharing information, it needs to be done consistently with guidelines that manage sensitive information. "It is crucial to create explicit data-sharing agreements that define the extent, objectives, and restrictions of data usage.."(Marciano & Maynard, 2023).[16] It must also follow procedural fairness according to applicable legislation and respect for the dignity of rights-holders.

V. TRAINING, CAPACITY DEVELOPMENT, AND INTERNATIONAL COOPERATION

International cooperative programs from an educational perspective in forensic sciences

Global cooperation is vital for enhancing forensic sciences educational efforts. There are many transactions of co-operation taking place among organizations and initiatives that are preparing to move into the training, development, research, and application components of forensic science on a global scale.

Evidence-Based Forensic Education

"A recent article in the Egyptian Journal of Forensic Sciences emphasizes the importance of developing an education (evocation) system in forensic science that is evidence-based. The study described that graduates need to have an education that is based on the most current best practices in order to address complex crime scenes and issues appropriately. It is crucial for academics and practicing professionals to collaborate to ensure that forensic education remains pertinent and adaptable to the evolving demands of the field. A notable example of effective collaboration is the alliance between India's National Institute of Criminology and Forensic Science (NICFS) and the Central Bureau of Investigation (CBI), which has played a key role in advancing forensic training and practice in India."(Nilendu, 2024).[17]

Role of NGOs and intergovernmental organizations in training

Non-governmental organizations (NGOs) and intergovernmental organizations (IGOs) are vital for strengthening forensic science capabilities, especially in areas with scarce resources.

[16] Michael Marciano & Henry Maynard, *Enhancing Research and Collaboration in Forensic Science: A Primer on Data Sharing*, 6 Forensic Sci. Int.: Synergy, art. 100323 (2023), https://www.researchgate.net/publication/368807599_Enhancing_research_and_collaboration_in_forensic_science_A_primer_on_data_sharing (last visited Feb. 23, 2025).

[17] Editorial, *Enhancing Forensic Education: Exploring the Importance and Implementation of Evidence-Based Education System* (2023), Eur. J. Forensic Sci, https://ejfs.springeropen.com/articles/10.1186/s41935-023-00375-w (last visited Feb. 25, 2025).

Their initiatives are centered on training, building capacity, and aiding justice systems.

NGOs in International Criminal Justice

Non-governmental organizations (NGOs) represent one of the most important sectors that further the work of international criminal justice. NGOs also function as implementers in many aspects of the work of criminal justice and invoke advocacy for changes to policies. Many NGOs function in places where governments do not, provide needed service delivery, and accomplish victim advocacy. The existence of NGOs provides an opportunity for greater inclusivity in international criminal justice systems, and will ultimately work to expand the outreach of international criminal justice to meet the needs of victims and the full moral community. "The creation of international tribunals and the role of NGOs in their development, functioning, and maintenance have significantly shaped our understanding of international criminal law, steering it towards a more favorable direction for humanity and victims of large-scale atrocities. NGOs assist prosecutors in fulfilling their duties by engaging in intricate tasks such as gathering evidence, documenting international crimes, offering policy recommendations, and pressuring states to act on commitments. Additionally, they play a crucial role in increasing public awareness of international crimes, providing support where states and international bodies may fall short, and acting as essential intermediaries between victim communities and the global community."(Jalloh, 2015)[18].

ICRC Forensic Capacity Building

"The International Committee of the Red Cross (ICRC) collaborates with local authorities, forensic institutions, and practitioners to empower local stakeholders to deliver high-quality postmortem analysis and information. By offering various training opportunities, practical coaching, and material support, the ICRC seeks to strengthen local forensic capabilities to effectively address emergency mass casualty situations and handle missing persons. Initiatives include ongoing training for forensic specialists both in Lebanon and internationally, as well as ensuring that local medico-legal structures have the necessary storage, analytical infrastructure, and equipment."(*Forensic Capacity Building Civil Society Knowledge Centre*, n.d.)[19] NGOs and IGOs play a crucial role in enhancing forensic capabilities, particularly in nations that are developing or recovering from conflicts. Their programs ensure that local organizations have the skills and resources needed to carry out thorough forensic

[18] Editorial, *The Role of Non-Governmental Organizations in Advancing International Criminal Justice*, 11 Asian J. Int'l Crim. Just. 1, art. 7 (2015), https://heinonline.org/HOL/LandingPage?handle=hein.journals/ajicj2015&div=7&id=&page= (last visited Feb. 25, 2025).

[19] *International Committee of the Red Cross, Forensic Capacity Building (2016), Civil Society Knowledge Centre, https://civilsociety-centre.org/content/forensic-capacity-building (last visited Feb. 26, 2025).*

investigations, thereby promoting justice and upholding human rights.

Predictive policing and global issues

In predictive policing, data and algorithms are used to analyse behavior and predict the actions that cause crime, allowing law enforcement to be more strategic and even preventative with their policing efforts. While these practices are designed to promote a safer society, there is a major global debate about the ethics and success of predictive policing.

Implementation and success

Predictive policing systems emphasized historical data about crime, identified patterns, and could eventually predict the locations of crimes. "Many countries have implemented these methods to enhance their predictive practices, but the impact of predictive policing has been, at best, inconsistent, as studies show various and uncertain degrees of success of telling residents what to expect when it comes to crime."(Gstrein, n.d.).[20]

Ethical and Legal Challenges

The application of predictive policing has created numerous ethical and legal issues.

Data Bias: When history includes bias, predictions will likely reproduce these biases and pit certain communities against one another unfairly.

Privacy Issues: The collection and analysis of personal data may violate privacy rights, but also create an avenue for potentially using the data improperly.

Transparency and accountability: Because the algorithms are generally proprietary, the fairness and accuracy of them can be complicated to assess.

Stigmatization: Communities that are designated high risk may receive increased scrutiny and attention from law enforcement; therefore, distorting relationships with these communities and creating stigmas.

International Perspective: Overall, the implementation of predictive policing varies from country to country, with some countries making strides in implementing predictive policing strategies, while others approach it cautiously. Therefore, it is slowly becoming important at the international level to ensure that predictive policing tools do not violate individual rights and or exacerbate inequality in society. These explorations explore the transformative potential

[20] Oskar J. Gstrein, Anno Bunnik & Andrej J. Zwitter, *Ethical, Legal and Social Challenges of Predictive Policing* (2019), Eur. J. Crim. Pol'y & Res., https://www.researchgate.net/publication/335749347_Ethical_legal_and_social_challenges_of_Predictive_Policing (last visited Feb. 26, 2025).

of AI, ML, and Big Data in forensic science and the implications surrounding the use of predictive policing. As technology continues to improve, other ethics and legal issues will arise, especially if we want to make sure the ongoing advancements in global forensics increase social justice and public safety.

VI. TOWARDS A UNIFIED GLOBAL FORENSIC FRAMEWORK

Criminal acts around the world, unlike before, are no longer limited to nations. Offenders operate in a bio-geographic space across boundaries, and forensic science is at the forefront of law enforcement's capability to solve complex cases within a world that is increasingly more flat. However, forensic practice is, and will be, disentangled from disparate countries on many considerations. Different parts of the world also employ different methods for collection, examination, and evaluation of evidence. Thus, variability leads to inconsistency, and with that relationship, the confidence placed on the forensic evidence is impaired for facilitating an international investigation.

To harmonize refers to the creation of clinical, standardized practice and protocols for forensic practice, whereby evidence of a common type would be treated uniformly across sites. Without harmonization of practice, potentially valid evidence could be excluded in a court of law because of consulting an inconsistent method of analysis. For example, if different nations used DNA profiles, yet in one country they used method A to generate the profile and in the subsequent country, they used method B, there is no direct comparison between the two decisions from the use of the A and B methods. This discrepancy could delay investigations or lead to incorrect conclusions.

Harmonizing forensic practices offers numerous advantages. First, it enhances confidence in forensic outcomes. When nations adhere to identical standards, they are more inclined to recognize each other's conclusions. Second, it facilitates effective collaboration among law enforcement agencies. During joint investigations, everyone can depend on uniform procedures, which accelerates the process and minimizes misunderstandings. Finally, it boosts the training and quality. When everyone is trained using the same methods and utilizes the same tools, the overall standard of forensic work improves on a global scale.

Initiatives to standardize forensic-science practices are currently in progress. The Organization of Scientific Area Committees (OSAC), overseen by the U.S. National Institute of Standards and Technology (NIST), is actively developing standardized procedures for different forensic

fields.(Pollitt et al., 2018).[21]

The European Network of Forensic Science Institutes (ENFSI) is in the process of establishing a standard identified practice and quality control process in its member laboratories in Europe, so that forensic laboratories can assure reliable, valid, and consistent information. Standardisation is very important in a variety of areas, especially in digital forensics, because evidence is predominantly seized from devices/platforms used globally, the rush in which terrorism forensics relies on the exchange of information between countries. Therefore, the priority is to agree on routine procedures that can help with a successful working relationship.

In summary, the harmonisation of forensic procedures to allow equitable international criminal investigations is important; to ensure evidence is examined consistently, at an international level; to assist international joint working relations; and to support the justice system as a whole.

VII. CONCLUSION

Advancements in science have paved the way for the field of forensic science in numerous ways; importantly, the advent of forensic laboratories, protocols, and the application of science to the solving of crimes. Advancements in fingerprinting, toxicology, forensic ballistics, entomology, forensic anthropology, and DNA testing have revolutionized forensic science. In comparison, cross-jurisdictional crime investigations present many challenges related to each country's differing laws and policies, language interpretation, and issues regarding culture. Illustrating this point are the factors surrounding a couple of major case studies, such as the murder of Yara Gambira Sio in Italy and the attacks in Mumbai on 26/11, showing how forensic investigation and collaboration can cross international boundaries, and that there is a good rationale for solving cases. Some overarching themes for consideration for future practice are the standardization of forensic policies and practices, training and capacity building, ethical considerations, and data-sharing agreements. There are also many important roles for NGO's, IGOs, etc. in strengthening and developing forensic capacity on a global scale. While predictive policing initiatives appear operationally viable, concerns exist in the ethical and legal domains. Clearly, the need to harmonize forensic practices on a global level is paramount for international criminal investigations and for the justice system.

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[21] Organization of Scientific Area Committees for Forensic Science, *A Framework for Harmonizing Forensic Science Practices and Digital/Multimedia Evidence* (2018), OSAC Tech. Ser. 0002, https://www.nist.gov/system/files/documents/2018/01/10/osac_ts_0002.pdf (last visited Feb. 28, 2024).