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## Questionnaire Based Survey for Validating Blockchain Usage in Evidence Handling



**Abstract:** - This study aims to assess the existing evidence handling mechanism, stakeholders' expectations and requirements, and Feasibility analysis of blockchain as a solution directive. A 43-item questionnaire was prepared and circulated among 258 respondents. The questionnaire is based on the socio demographic behaviour of the responders, awareness regarding the existing evidence handling system, responder's involvement in evidence handling, existing evidence tracking and securing process, knowledge about blockchain, and regulatory challenges. The collected responses are further analyzed for the solution directive. The survey results show that 80% of responders think blockchain can be a secure, trustworthy, transparent, and effective data handling mechanism.

**Keywords:** Blockchain, Evidence Handling, Questionnaires.

### I. INTRODUCTION

In an era of digital innovation and decentralized technologies, studying blockchain technology from the perspective of law enforcement and investigators has become an imperative endeavour. Originally conceived as the underlying technology for cryptocurrencies like Bitcoin, blockchain has transcended its financial roots to permeate various sectors, presenting opportunities and challenges for those tasked with upholding the law and ensuring public safety [1]. Blockchain technology, at its core, offers a distributed and immutable ledger that records transactions across a network of computers, rendering it resistant to tampering and fraud [2, 3]. This unique feature has made it a fundamental component of various industries, including finance, supply chain management, healthcare, and more. However, this attribute has also attracted individuals and entities seeking to exploit its pseudonymous nature for illicit purposes, such as money laundering, fraud, and ransomware attacks.

From the law enforcement and investigator's perspective, the study of blockchain technology necessitates a multifaceted approach that encompasses technical understanding, regulatory compliance, digital forensics, and international collaboration [4–7].

This research aims to comprehensively analyse the current mechanism for handling evidence within the Indian criminal justice system. The primary focus is on understanding the existing processes, identifying vulnerabilities and potential risks of tampering, and assessing the expectations and requirements of various stakeholders regarding establishing a robust and secure evidence handling system in the country. The objectives of this survey are as follows.

- i. Assessment of existing evidence handling mechanism.
- ii. Stakeholders Expectations and Requirements.
- iii. Feasibility analysis of blockchain as a solution directive.

The research involves the distribution of a carefully designed questionnaire to a random sample of various stakeholders within the Indian criminal justice system. These stakeholders include judicial officers, legal professionals, forensic experts, and IT experts. The rest of the paper is organized as follows: Section 2 provides a detailed discussion of the Survey questionnaire phases, questions, and responders' replies. Section 3 explores a discussion on the results of the survey. Section 4 presents the future research scope. Finally, section 5 concludes our findings with the references at the end.

### II. QUESTIONNAIRES

Questionnaires are essential in many scientific investigations, particularly those about the social sciences. Human social lives frequently involve evaluation, assessment, judgment, perception, and other similar processes. The

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relevant data are often gathered as answers to specific surveys. Galton [8] initially examined questionnaires concerning human groups.

For our survey, questions and answers are framed using binary questions and likert type questions [9]. Binary questions have only two solutions, either yes or no whereas Likert-type questions will get you more granular feedback. This approach allows you to identify differences in viewpoint that may significantly impact how well you comprehend the comments you're receiving. Fig. 2 describes the organization of the questionnaires.

The initial phase of questionnaires is framed to identify socio-demographic profile of the respondents. The socio-demographic profile of respondents refers to the characteristics of individuals participating in a survey, study, or research project. These characteristics are often collected to better understand the composition of the sample

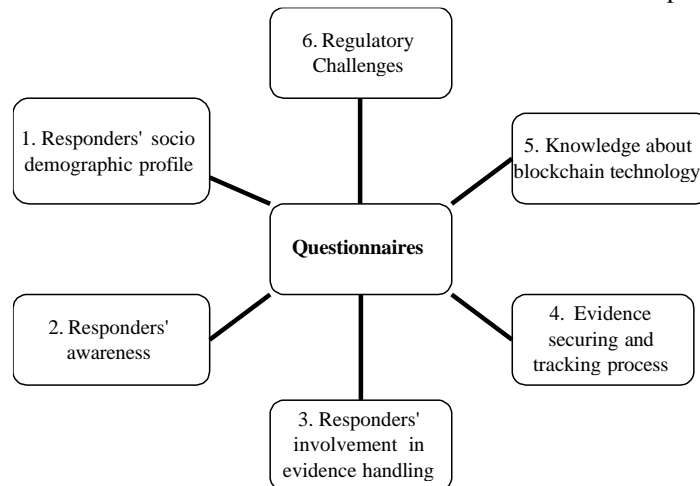
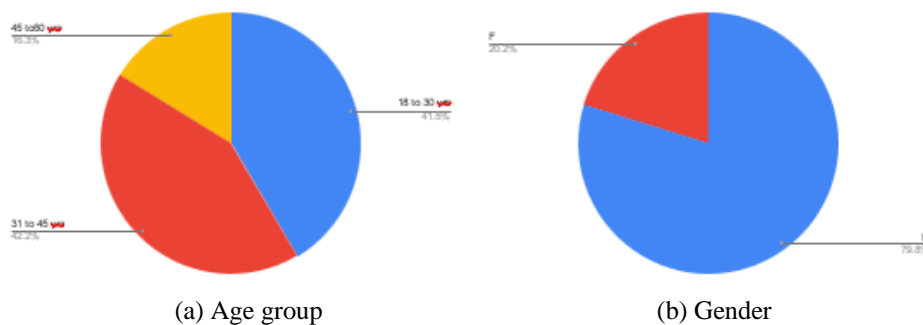


Fig. 1. Organization of the Questionnaires

and to analyze how various demographic factors might relate to the research questions or outcomes. Common socio-demographic variables include age, gender, qualification, and profession. For this survey, 258 respondents from different age groups (varying from 18 to 60), genders, qualifications, and professions participated in this survey. Considered respondents for the survey are from different educational background viz. such as high school diploma, bachelor's degree, master's degree, or doctorate. For our study respondents' are selected based on their profession viz. judicial officer, legal profession, law enforcement, and forensic expert. Figure 2, shows socio demographic profile of the survey respondents. Fig. 2(a) shows that 42.7% respondents belongs to 31-45 age group, 41.5% respondents belongs to 18-30 age group, and 16.3% respondents are of 45-60 age group. Fig. 2(b) shows that 79.8% respondents are men and remaining are women. Fig. 2(c) shows that 99.2% respondents are atleast graduated. Fig. 2(d) denotes that Considered respondents for the survey are from different profession viz. such as Students (25.2%), I.T Experts (14.0%), Forensic Experts (5.8%), Judicial Officers (9.3%), Legal Professionals are (9.3%) and Law Enforcement Officers (36.4%).

These socio-demographic variables are collected to understand the population under study comprehensively. They can analyze the sample, identify trends or disparities, and make inferences about the broader population. The specific socio-demographic



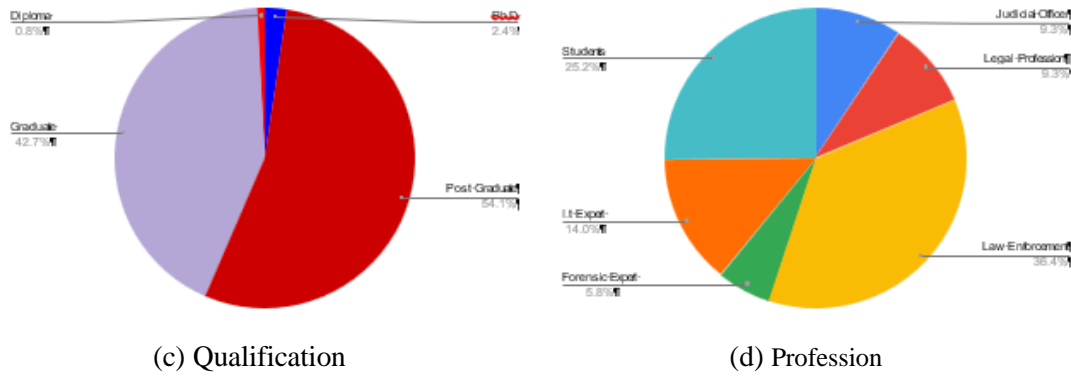


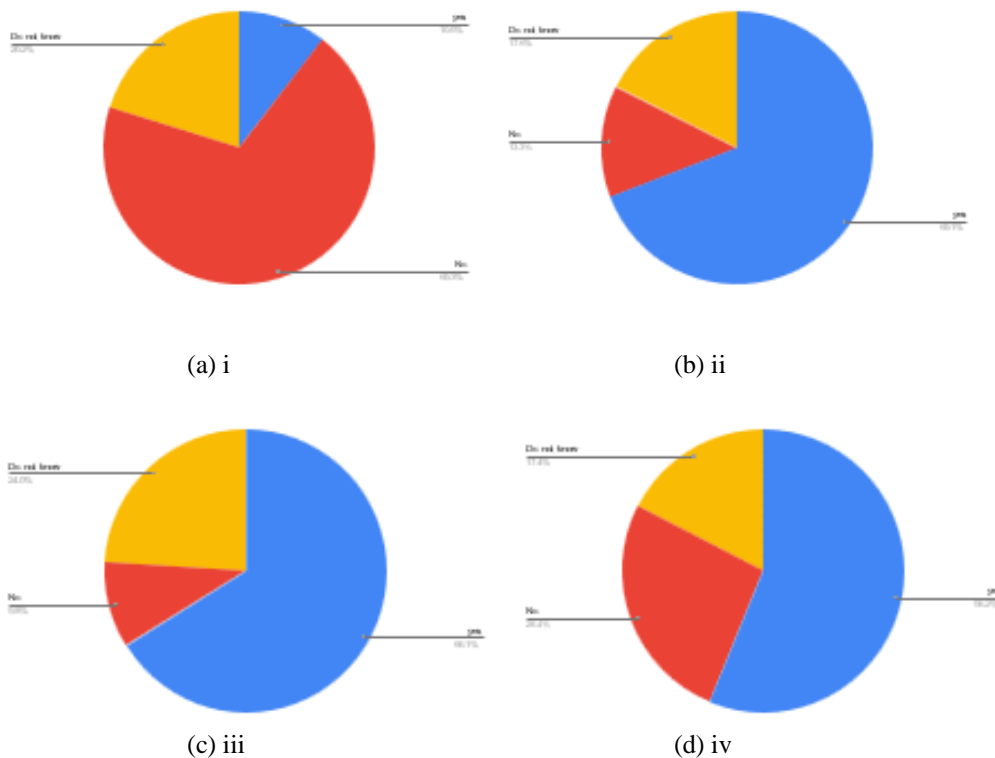
Fig. 2 socio-demographic profile of the respondents

variables collected can vary depending on the research objectives and the study con- text.

The next phase of questionnaires concerns the respondents’ awareness of existing evidence-handling mechanisms. This is important to analyze flaws in evidence handling, legal proceedings, scientific research, and information management. Respondents’ awareness level can impact the effectiveness of evidence handling and the overall reliability of processes. To evaluate respondents’ awareness, formulated questions in this phase are as follow.

- i. Is the existing evidence handling mechanism secured? (Likert-type question)
- ii. Is there any scope for the investigating officer to manipulate the gathered evidence? (Likert-type question)
- iii. Do the investigating officers, sometimes, omit certain evidence from bringing it on record? (Likert-type question)
- iv. Is there any scope for investigating officer to manipulate the date and time of seizure / evidence gathered? (Likert-type question)
- v. Is there any scope for the investigating officer to manipulate the place of seizure? (Likert-type question)
- vi. If the evidences are stored in digital form in a Relational Database Management System, do the data base administrator or the system administrator have scope to manipulate the data? (Likert-type question)

The Fig. 3 shows responders’ response related to the responders’ awareness regarding existing evidence handling mechanism. Fig. 3(a), 3(b), 3(c),3(d), 3(e), and 3(f) shows the responders’ response to the question *i* to *vi* respectively.



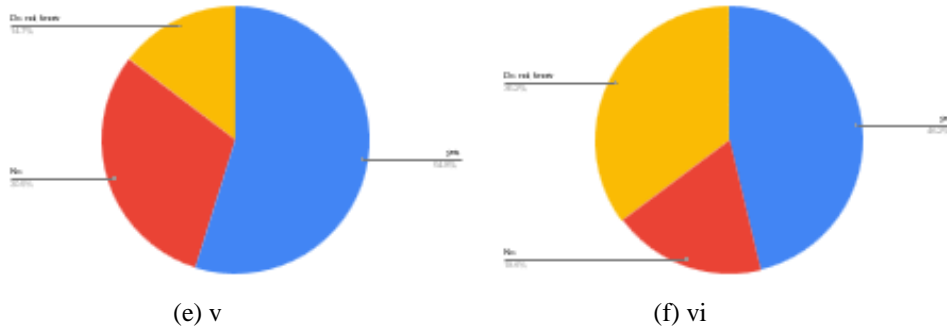
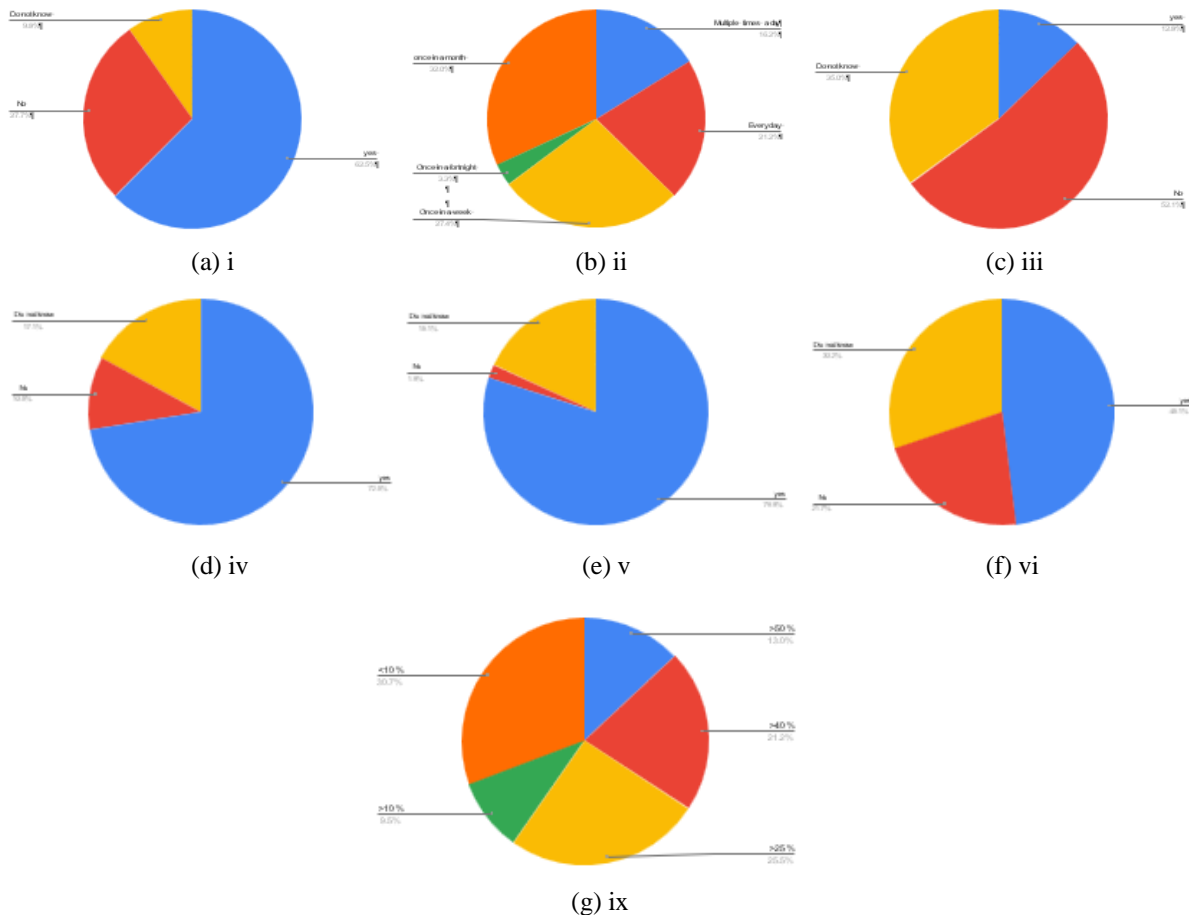


Fig. 3. Respondents' awareness regarding existing evidence handling system.

The third phase of the questionnaires is related to the respondents' involvement with the evidence handling. This interface plays a crucial role in ensuring the validity, reliability, and overall quality of survey research.

The questions in this phase are as follows:

- i. Do you study the evidence that was gathered during investigation at any point from First Investigation report (FIR) to appeal stage? (Likert-type question)
- ii. How frequently you handle / supervise / study the evidence? (Likert-type question)
- iii. Are you satisfied with the present system of handling of evidence? (Likert-type question)
- iv. Do you feel that the evidence handling and tracking should be more transparent, robust and full proof? (Likert-type question)
- v. Do you agree that by using suitable technology we can effectively handle the evidence during investigation/trial? (Likert-type question)
- vi. From your experience, have you come across cases which failed in trial due to mishandling / tampering of evidence? (Likert-type question)
- vii. From your experience, how many cases have failed in trial due to doubts raised about the genuineness of the evidence. (Likert-type question)

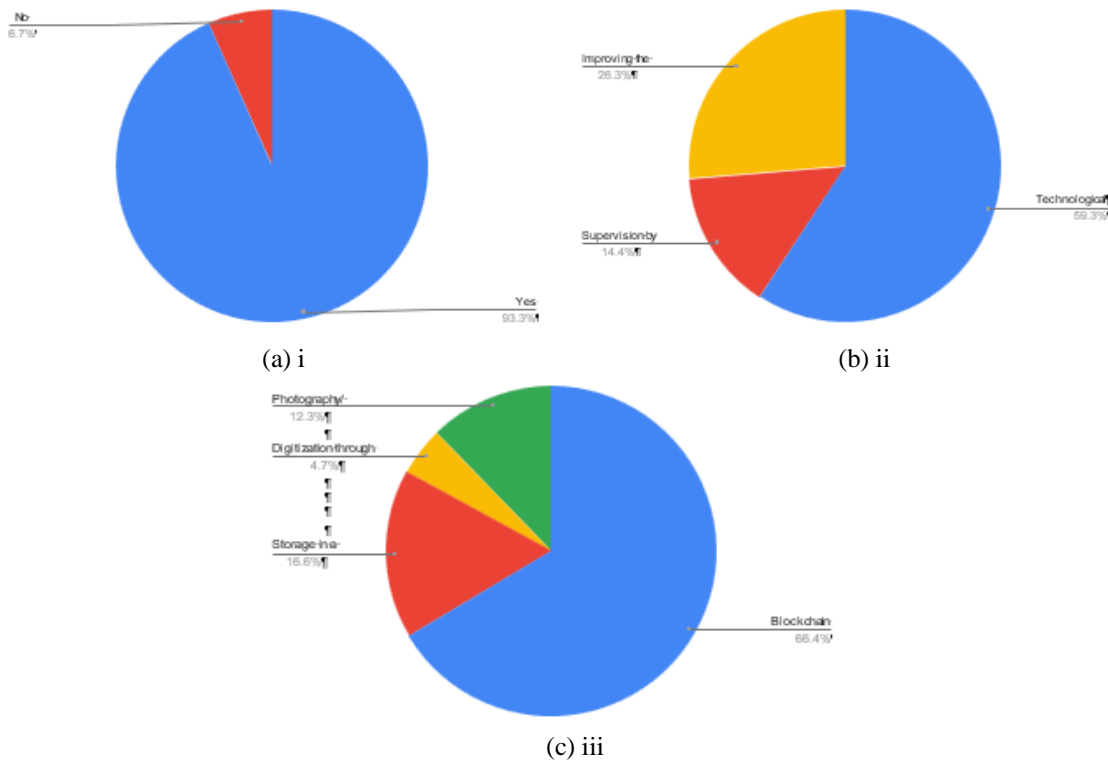


**Fig. 4.** Respondents' involvement with the evidence handling

Fig. 4 describes the responders' response related to their involvement with the evidence handling. Fig. 4(a) to 4(g) shows response to the questions *i* to *ix* respectively. Next phase is related to the securing and tracking the evidence. Effective evidence securing and tracking is crucial for maintaining the trust and integrity of the justice system, scientific research, and various other applications where evidence is a cornerstone of decision-making. The questionnaires for this sections are as follows.

- i. Do you think there is a need for improving the robustness of evidence handling? (Binary type question)
- ii. Which of the following do you think is best suited to solve the problems in evidence handling and tracking? (Likert-type question)
- iii. Which technological intervention do you think is good for evidence handling and tracking? (Likert-type question)

Fig.5 represents response related to the securing and tracking evidences. Fig. 5(a), 5(b), and 5(c) shows response to this phase questions *i*, *ii*, and *iii* respectively.



**Fig. 5.** Securing and tracking the evidence

Blockchain technology is a distributed ledger technology that can be highly relevant for securing and tracking evidence in various contexts due to its inherent transparency, immutability, and security properties. Hence, the next questionnaire phase concerns the respondents' knowledge base identification regarding blockchain technology. The questions are as follows.

- i. Have you heard of the blockchain technology? (Binary type question)
- ii. Do you think the gathered evidence or its attributes (metadata) can be stored in a suitable form on a blockchain Technology server? (Binary type question)
- iii. Do you think the transparency and image of the police can be improved by using blockchain Technology in evidence handling? (Binary type question)
- iv. Do you think that with the use of blockchain technology, the admissibility of the evidence in the Courts will improve? (Binary type question)
- v. Do you think that the investigating agencies should use blockchain technology in evidence handling to overcome the present problems? (Binary type question)
- vi. Do you think that with the use of blockchain technology, the conviction rate will definitely improve? (Binary type question)

- vii. Do you know that blockchain technology is tamper-proof which cannot be altered, not even by the administrator or creator of the software? (Likert-type question)
- viii. Do you know blockchain technology has the capability to enable viewing of all the transactions from the origin and hence has enormous promise for the forensic community? (Likert-type question)
- ix. Blockchain technology gives the opportunity to trail the actions of the investigating officer. (Likert-type question)
- x. Do you know that the law enforcement records become immutable with blockchain technology? (Likert-type question)
- xi. Do you know that blockchain technology enables sharing of confidential information between agencies full proof and faster? (Likert-type question)
- xii. Do you think blockchain technology can be used by Law Enforcement Agencies and Investigators for improving the quality and efficiency of policing? (Likert-type question)
- xiii. Do you know that blockchain technology is already being used by the LEAs in other countries? (Likert-type question)

Fig. 6 shows respondes’s response for this phase. Fig.6(a) to 6(m) are the responses for the questions *i* to *xiv* respectively.

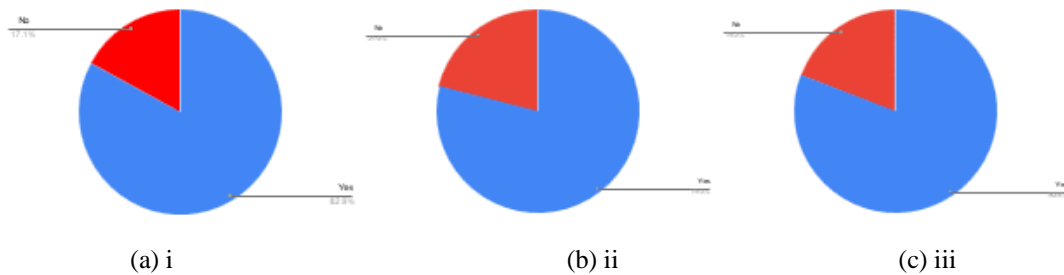
Final phase of the questionnaires is based on the rules and regulation challenges in blockchain adaptation in the digital evidence handling process. The questions are as follows:

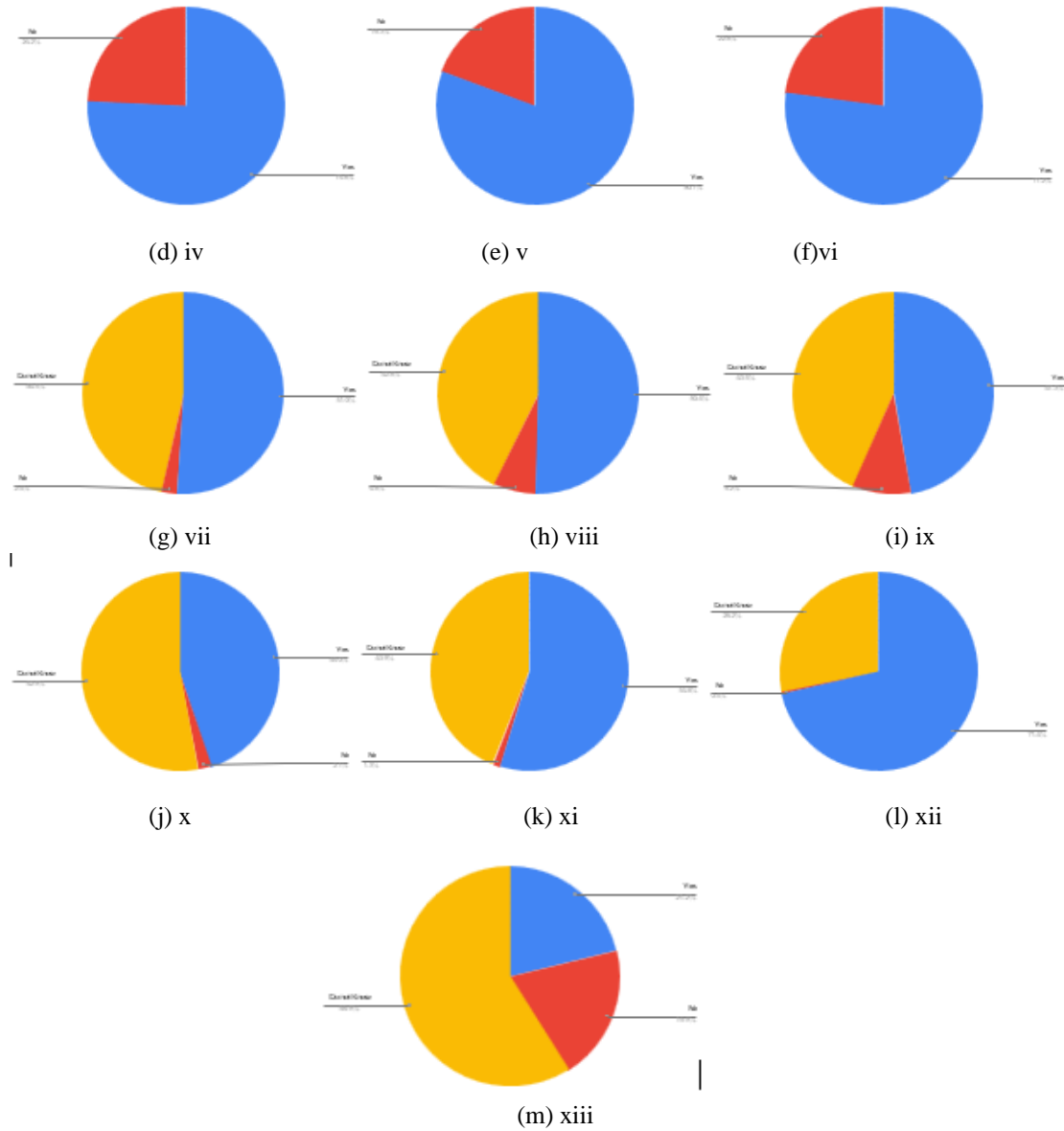
- i. Do you think if blockchain technology is used in evidence handling, it would be legally permissible? (Binary type question)
- ii. Do you think that for use of blockchain technology in evidence handling, we need experts to train various arms of Criminal Justice System about its strengths and tamper-proofness? (Binary type question)
- iii. Do you know the Governments across the world are now trying to use blockchain technology for storage of data? (Likert-type question)
- iv. Can Indian law enforcement agencies adopt the blockchain technology for evidence handling? (Likert-type question)

Fig. 7 describes the responders’ response. Fig. 7(a), 7(b), 7(c), and 7(d) show responses for the questions *i*, *ii*, *iii*, and *iv* respectively.

### III. RESULT AND DISCUSSION

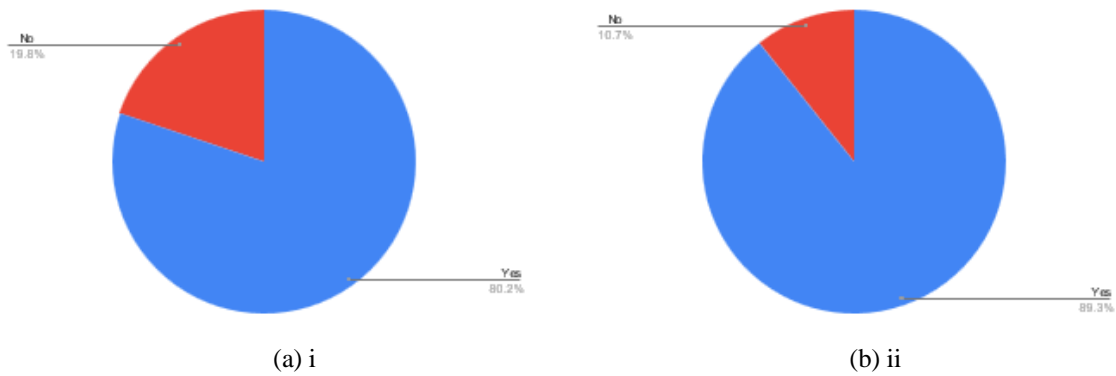
The socio-demographic profile of survey respondents encompasses the attributes of individuals engaged in a survey, study, or research initiative. These attributes are typically gathered to gain insights into the sample’s composition and to explore potential relationships between various demographic factors and the research inquiries or outcomes. The socio-demographic profile of respondents is essential for formulating policies that address the specific needs and concerns of different demographic groups. In addition, it enables comparisons between other demographic groups, shedding light on variations in opinions, behaviours, or preferences among diverse segments of the population. Key socio-demographic variables include age, gender, educational attainment, and occupation. The summarized socio-demographic profile of survey respondents is shown in Table 1. It depicts that 258 participants spanning diverse

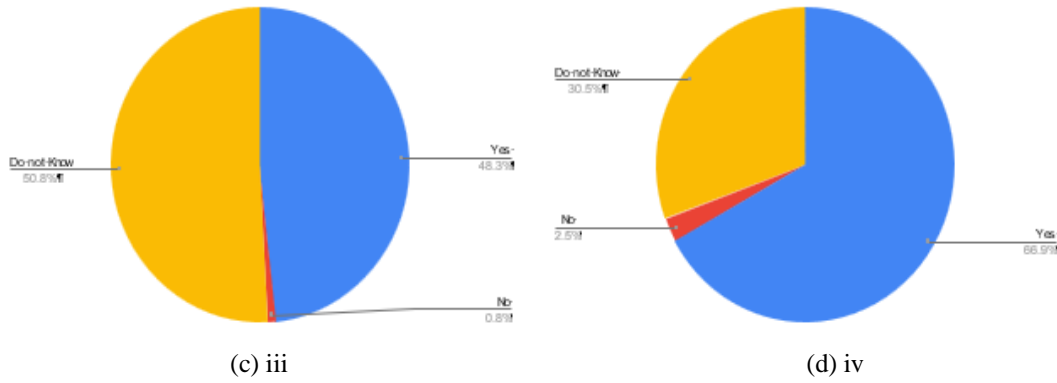




**Fig. 6.** Knowledge about blockchain technology

age ranges (18 to 60), genders, educational backgrounds, and professions contributed to the research. The respondents represent varied academic levels, including a high school diploma, bachelor’s degree, master’s degree, or doctorate.





**Fig. 7. Rules and Regulation Challenges**

**Table 1** Summized socio demographic profile of survey respondents

Criterion	Sub-criterion	Values
Age	18 to 30 yrs	107
	31 to 45 yrs	109
	45 to60 yrs	42
Gender	Male	206
	Female	52
Qualification	Ph.D	6
	Post Graduate	138
	Graduate	109
	Diploma	5
Occupation	Judicial officer	24
	Legal Profession	24
	Law enforcement	94
	Forensic Expert	15
	IT expert	36
	Students	65

The second phase of our survey questionnaires discusses responders’ awareness of exist- ing evidence-handling mechanisms. 69.3% of responders think the existing evidence handling mechanism needs to be more secure. In addition, 69.1% of responders believe the investigating officer always has scope to manipulate the gathered evidence. 66% of responders also think that investigating officers sometimes omit specific evidence from bringing it on record. 58% of responders think there is always scope for the investi- gating officer to manipulate the date and time of seizure/evidence gathered. Finally, 53% of responders believe investigating officers can manipulate the place of seizure. 46% of respondents believe that even if the evidences are stored in RDBMS systems the system administrators have scope for manipulation.

Fig. 8 shows a detailed analysis of this phase. This phase result shows that existing evidence-handling system lacks trust and is prone for manipulation and omissions.



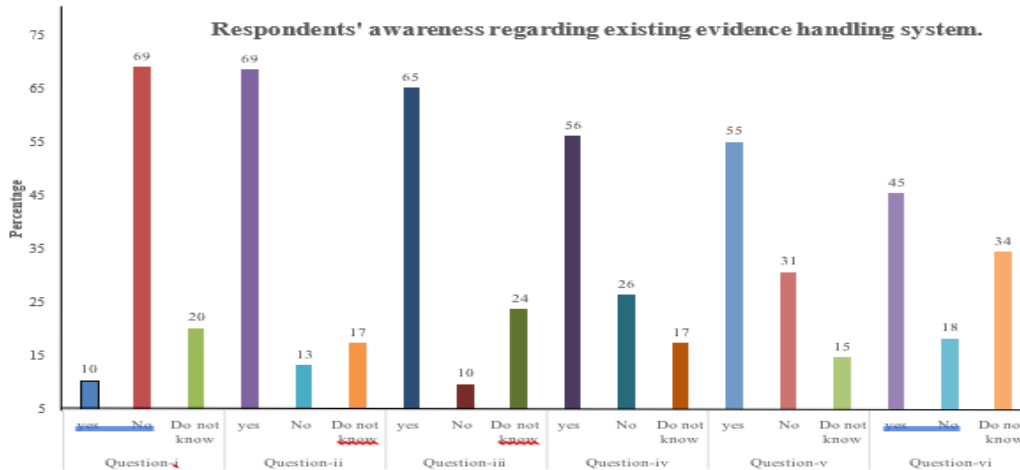


Fig. 8. Existing evidence handling system awareness.

The third phase of the questionnaire focuses on respondents' involvement in evidence handling. This aspect impacts the reliability and validity of the collected data. Responder's involvement in evidence handling ensures that the information provided accurately reflects their authentic experiences or opinions. In addition, this phase strengthens the integrity of survey data. The response shows that 62.5% of responders study the evidence gathered during an investigation. Hence, we only focused on these responders' opinions for this phase to avoid bias. Of these responders, 37.4% of responders handle evidence everyday. 30.7% of responders handle evidence at least once in a fortnight. 32% of responders handle evidence at least once a month. Only 12.8% of responders are happy about the existing evidence handling system. In addition, 72.5% of responders think the current system needs to be made more robust and transparent. 79.9% of responders agree that by using suitable technology, we can effectively handle the evidence during an investigation or trial. 48.1% of responders have experienced a few cases that failed in trial due to mishandling/tampering of evidence. The responses of the next phase show that responders are more worried about Securing and tracking evidence as it is crucial for maintaining the evidence's integrity, reliability, and ethical standards.

The responses of the next phase show that responders are more worried about Securing and tracking evidence as it is crucial for maintaining the evidence's integrity, reliability, and ethical standards. 93.7% of responders think there is a need to improve the robustness of evidence handling. However, 59.3% of responders chose to adopt new technology as the best solution over human supervision or improvement on the existing system to enhance transparency and trust. In addition, 66.4% of responder chose blockchain as the preferred new technology solution. As most responders voted for blockchain as a solution directive, it is vital to check whether they know about blockchain. Responders' knowledge of blockchain adoption revolutionises digital evidence handling processes. Hence, the next questionnaire phase verifies the responder's blockchain knowledge. Almost 83% of responders know about blockchain. 80% of responders believe the gathered evidence or its attributes (metadata) can be stored in a suitable form on a blockchain technology, and 80% of responders are convinced that blockchain technology can improve the transparency and image of the police in evidence handling. 76% of responders think using blockchain technology can enhance the admissibility of evidence in court. 77% of responders believe that blockchain can also improve the conviction rate. However, 50% of responders are unaware of blockchain functionality, viz. trust, transparency, immutability, and tamper-proof. Still, 72% of responders think Law Enforcement Agencies and Investigators can use blockchain technology to improve the quality and efficiency of policing. However, 78% of responders need to be made aware that the LEAs in other countries are already using blockchain technology.

The significance of rules and regulation challenges in blockchain adaptation for digital evidence handling is crucial due to the potential impact on legal admissibility, data privacy, and overall regulatory compliance. Hence, the final phase of the question- naire is based on rules and regulation challenges in blockchain adaptation for digital evidence handling. 82% of responders think using blockchain technology in evidence handling can be legally permissible. 89.2% of responders believe we require a skilled workforce for blockchain technology in evidence handling.

#### IV. CONCLUSION

This survey holds significant importance in the context of the Indian criminal justice system. The findings will be a foundation for developing a more secure, efficient and transparent evidence handling system. Additionally, it will shed light on the potential role of blockchain technology in achieving these objectives. In conclusion, this survey endeavours to bridge the gaps in evidence handling within the Indian criminal justice system. By examining the current system, understanding stakeholder expectations and exploring the integration of blockchain technology in evidence handling.

The aim is to enhance justice delivery, safeguard the integrity of evidence and ultimately strengthen the rule of law in India. The survey demonstrates that the use of blockchain in handling evidence, including securing the Chain of Custody, confirming the integrity of evidence, locating and tracing seizures and maintaining the integrity of the place of seizure, has been successful. The existing blockchain-enabled applications have shown promising improvements in accuracy, dependability, and the ability to conduct more efficient investigations and support the admissibility of evidence in the courts. However, the study also points out several issues and possible directions for further research. Scalability, privacy, interoperability, legal and regulatory issues, and standardised frameworks are some of these difficulties. Researchers, law enforcement agencies, lawyers and technological specialists must work together across disciplines to overcome these obstacles. Future research directions in this field should focus on addressing the scalability limitations of blockchain, developing privacy-preserving mechanisms, establishing interoperability standards, managing legal and regulatory concerns surrounding blockchain-based evidence, and enhancing user-friendliness and adoption of blockchain technology in evidence handling. Future research directions in this field should focus on addressing the scalability limitations of blockchain, developing privacy-preserving mechanisms, establishing interoperability standards, managing legal and regulatory concerns surrounding blockchain-based evidence, and enhancing user-friendliness and adoption of blockchain technology in digital evidence handling.

#### V. NO CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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