

Report of the Digital Evidence Task Group Quality Study

Prepared for

The Organization of Scientific Area Committees for Forensic Science (OSAC)

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OSAC Task Group on Quality Practices in Digital Forensics Laboratories

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Executive Summary

In 2020, the [Organization of Scientific Area Committees \(OSAC\) for Forensic Science's Digital Evidence Subcommittee](#) formed a task group to identify the quality practices and management systems that are most effective within digital forensics laboratories. The task group identified contemporary quality management practices used in forensic labs and interviewed laboratory management, senior staff and digital evidence customers (e.g., law enforcement (LE), attorneys, judges). This report is based on the interviewees' experiences with quality practices and management systems.

The study found significant problems with how quality management systems (QMS) are implemented within digital forensics laboratories generally, though it did not uncover problems with the accuracy of any specific report. The study also found problems with timeliness and the ability of consumers of laboratory products to understand and make use of reports generated by digital forensic laboratories. The study found that accreditation under ISO 17025:2017 and ISO 17020:2012 and formal QMSs are not having the desired outcome of enhancing the accuracy, timeliness, and clarity of reports. Current efforts to improve the processes are not resulting in significant gains and are, in many cases, reducing quality. Some quality elements took significant resources with no benefit and others actually reduced timeliness and clarity. However, this study documented many examples where the implementation of a QMS had significant value. In most of these cases, the QMS had been optimized for digital forensics.

Based on these findings, the study recommends the development of a QMS optimized specifically for digital evidence processing. This new system should be tailored to maximize the improvement of quality that is most important to digital evidence. A digital forensics QMS should focus on quality elements relevant to digital evidence processing rather than shoehorning digital processing into existing frameworks. Since this is a significant undertaking, the task group also recommends some incremental improvements.

Project Overview and Goals

The 2009 National Research Council report, *Strengthening Forensic Science in the United States: A Path Forward* and the 2016 President's Council of Advisors on [Science and Technology \(PCAST\)](#) report on [Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods](#) recommended significant changes to the practice of forensics necessary to ensure the delivery of accurate, trustworthy, understandable results to downstream forensic science "customers" (e.g., lawyers, judges, investigators) in a reasonable timeframe. This objective is central to the administration of justice, particularly in criminal matters, including a criminal defendant's Constitutional rights to due process and access to potentially exculpatory information. To date, efforts to accomplish this objective across forensic

disciplines have included a focus on quality management including training, standardized methodologies, and consistency of forensic testing and analysis.

As with other forensics disciplines, quality management is essential to the field of digital forensics. However, there has never been a study of contemporary quality management practices in the field of digital forensics. Today, there are a wide range of approaches, from formal accreditation to informal protocols. And, critically, there is a significant disparity of opinion in what might be the proper path for the future of digital forensic quality management.

Project Methodology

The task group collected information relating to current quality management practices in several different forensic laboratory environments through interviews with individuals from local, state, and federal law enforcement, private organizations, and digital forensic science practitioners. All but three of the participants worked in the United States. Information was also collected from the “customers” of the output from digital evidence examinations, including attorneys and members of the judiciary.

This research underwent human subject protection review and was approved by the NIST IRB (ITL-2020-0245). Interviewees were recruited by announcements at digital forensics conferences and forums and by personal outreach from the task group.

The interviews included questions tailored to an individual interviewee’s status as either laboratory personnel or a customer. The laboratory management survey included questions regarding quality management elements such as the role of standard operating procedures (SOPs) and tool testing in improving laboratory processes as well as additional questions related to accreditation and quality management. The survey for customers focused on their experience working with digital forensics laboratories. The surveys are provided in Appendices A and B. Task group members were allowed to ask follow-up questions. Interviewees were encouraged to provide details or examples to support their discussion points. Most interviews had two or three members of the task group in attendance; one had only a single interviewer.

Many of the interviewees were either not familiar with some of the quality elements that were the focus of the laboratory survey or were using the term based on how their laboratory operated. (A description of the quality elements is provided in Appendix C.) For example, laboratories had different meanings for many elements, including tool validation and testing, auditing, and management reviews. If an interviewee asked for clarification, it was provided, but the task group allowed interviewees to base their answer on their understanding or interpretation of the quality element being discussed.

The task group consisted of members and affiliates of the OSAC Digital Evidence, Video/Imaging & Analysis, and Anthropology Subcommittees along with members of the Forensic Science Standards Board’s Human Factors and Legal Task Groups. The Task Group Members performed this study in their capacity as members of the Organization of Scientific

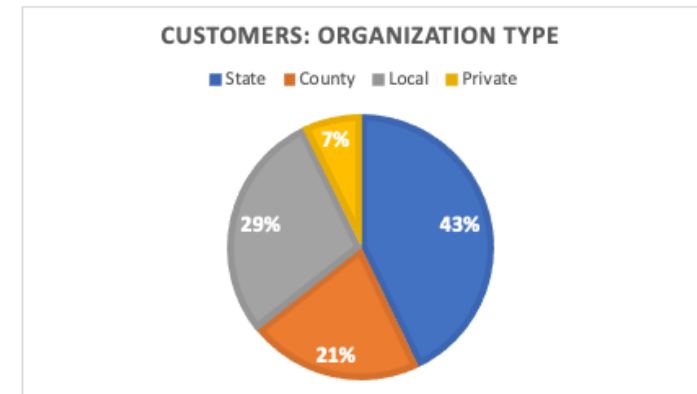
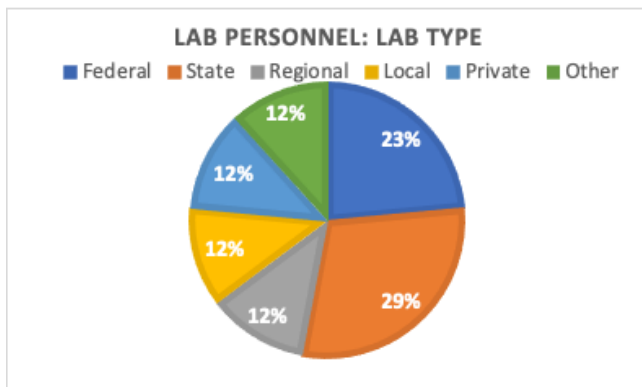
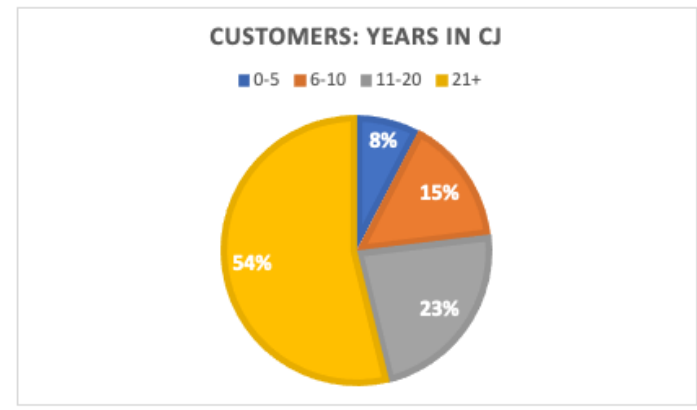
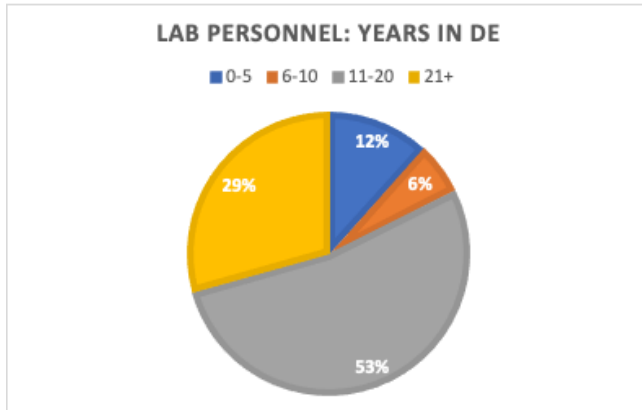
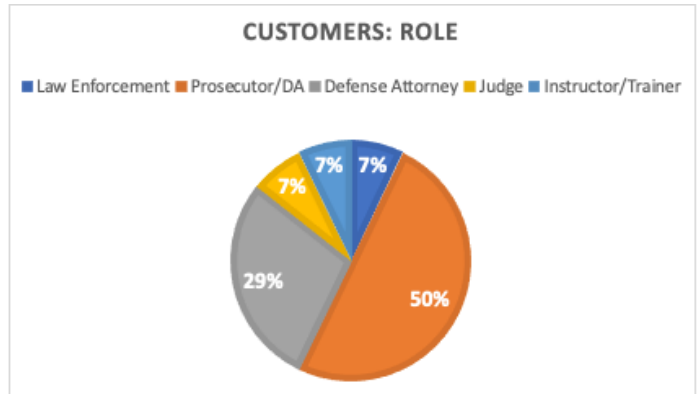
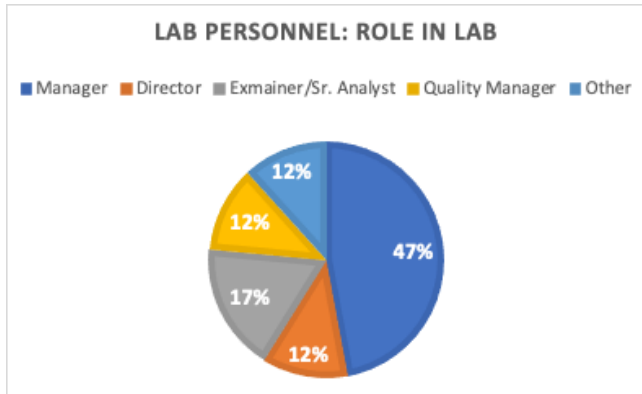
Area Committees for Forensic Science. The views and opinions expressed in this document do not necessarily reflect the official policy or position of the author's employers, NIST, the Department of Commerce or the U.S. government. The members of the Task Group are listed below. The interviewers are designated with an asterisk (*).

Task Group Member	OSAC Subcommittee
William Eber	Affiliate, Digital Evidence
Brandon Epstein*	Member, Video/Imaging Technology & Analysis
Sabrina Fève	Member, Legal Task Group/Digital Evidence
Daren Ford	Member, Digital Evidence
Barbara Guttman*	Vice Chair, Digital Evidence
John Hollway	Member, Human Factors Task Group/Digital Evidence
Christopher Kelly*	Member, Digital Evidence
Troy Lawrence*	Member, Digital Evidence
Jim Lyle	Affiliate, Digital Evidence
Kelly Sauerwein	Member, Human Factors Task Group/Anthropology
Shaun Vodde*	Member, Digital Evidence
Tracy Walraven*	Chair, Digital Evidence

Description of Interviewees

The task group conducted 31 interviews consisting of 17 laboratory personnel and 14 legal customers. The demographics are displayed below, however, some individuals self-identified themselves or their laboratory as having multiple roles but are listed according to the role used

to answer the questions. Note: In the charts below, DE is Digital Evidence and CJ is Criminal Justice.



The tables below provide a breakdown of the demographics based on each interviewee. Many interviewees had worked in multiple locations or were retired. The demographic is given for their primary affiliation. When another affiliation was significant, this is noted in the Additional Information column. International interviewees are categorized based on their similarity to a federal or state/local type of laboratory. Answers provided by the interviewees are used to support the conclusions drawn, however, these are not direct quotes from the interviewee, but instead are summarized from the interviewers' notes. Interviewers collected separate summaries of responses, which were consistent.

Interviewee # (Laboratory Personnel)	Primary Role	Laboratory Type	Additional Roles
Interviewee 1	Management	Medium state/local laboratory	
Interviewee 2	Management	Medium state/local laboratory	Also ANAB assessor
Interviewee 3	Management	Small private laboratory	Also trainer
Interviewee 4	Management	Medium state/local laboratory	
Interviewee 5	Examiner	Small state/local laboratory	
Interviewee 6	Quality management and examiner	Large state/local laboratory	
Interviewee 7	Management	Medium state/local laboratory	
Interviewee 8	Examiner	Small laboratory local lab	
Interviewee 9	Trainer	Large federal laboratory	
Interviewee 10	Management	Medium state/local laboratory	

Interviewee 11	Examiner	Medium state/local laboratory	
Interviewee 12	Management	Medium federal laboratory	
Interviewee 13	Management	Large federal laboratory	
Interviewee 14	Management	Private laboratory	Also an academic
Interviewee 15	Quality management	Large state/local laboratory	
Interviewee 16	Management	Small private laboratory	
Interviewee 17	Management	Large federal laboratory	

Interviewee # (Customer)	Primary Role Used to Answer Interview Questions	Additional Roles
Interviewee 18	Prosecutor	
Interviewee 19	Prosecutor	Also a trainer, previously defense attorney
Interviewee 20	Police chief	
Interviewee 21	Prosecutor	
Interviewee 22	Prosecutor	
Interviewee 23	Prosecutor	Also a trainer

Interviewee 24	Prosecutor	
Interviewee 25	Prosecutor	
Interviewee 26	Prosecutor	
Interviewee 27	Prosecutor	Currently a judge
Interviewee 28	Defense attorney	
Interviewee 29	Defense attorney	
Interviewee 30	Defense attorney	
Interviewee 31	Defense attorney	

Selection Bias of Interviewees

Interviewees were recruited through the use of announcements at digital forensics conferences and forums and by personal outreach from the task group. Additional participants were recruited with assistance from study interviewees. The task group continued to recruit new interviewees for interviews until consistent patterns emerged, stopping when interviewees were no longer introducing new information or patterns.

Organization of the Report

The analysis of the interview results is organized according to interviewee type (i.e., laboratory personnel or customer) with each interview topic discussed. The responses for each interview topic are summarized and grouped into three or four themes that emerged from the interviews. Summaries from the interviewers' notes were utilized to highlight and support each of the themes with additional analysis provided. While the interviewers' notes are not direct quotes made by the interviewee, they do reflect what the interviewees said. A summary provides key

takeaways from the analysis of each quality element. Overall findings are discussed and key recommendations for improving the quality management process are provided.

Results: Laboratory Personnel

The survey included questions covering eight topics addressing common elements of quality management systems. The elements were drawn from common quality practices. Appendix C provides additional references about quality elements and quality systems. The quality elements covered were:

1. documentation,
2. tool validation and testing,
3. management and peer reviews,
4. audits,
5. testimony monitoring,
6. personnel qualifications,
7. presence of a quality manager, and
8. accreditation.

Experiences about strengths, weaknesses, and efficacy of these systems was also asked of the interviewees (see Appendix A for interview questions). Each of these elements is described and analyzed in detail below. The task group asked interviewees to address quality in terms of accuracy, completeness, and timeliness.

While this study was not designed to evaluate the correctness of any specific reports, all laboratory interviewees felt that their laboratories were generating accurate reports and work product. By contrast, timeliness – the ability to generate reports within a reasonable time frame for downstream constituents and the efficient flow of the justice system – was viewed as an endemic problem. Overall, interviewees expressed a commitment to quality but the techniques they were using were often ineffective to achieving their stated goals, mostly by creating inefficiencies, and not focusing on higher-level quality goals.

A summary of all laboratory questions asked is provided at the end of this section.

1. Documentation: How does your laboratory view and use documentation?

Overall, documentation was considered useful in the majority of laboratories, but few interviewees could explain documentation's role in a quality management system. (See Appendix C for references about the quality elements.) A lot of the documentation discussion used standardized terms (from ISO 17025) without demonstrating an understanding of how this related to elements of quality. However, what people considered to be "documentation" varied considerably, ranging from SOPs and chain of custody to case notes. The interviewees found that chain of custody and case note SOPs were the most useful types of documentation.

Responses to the survey fell into four themes:

- Theme 1: Documentation was considered critical with a focus on laboratory operations including managing customer requests, maintaining chain of custody, and tracking of various laboratory operational tasks such as tool validation testing or proficiency testing. Interviewees generally valued documentation for managing expectations and managing general operations within the laboratory. Several interviewees saw a connection to improved laboratory operations, which increased efficiency.¹
 - Interviewee 14 noted that documentation was good for three things:
 - 1) efficiency and helping customers know what they are going to get.
 - 2) accuracy and more dependable products.
 - 3) morale because examiners are happy to know that they are working to an acceptable level.
 - Interviewee 15 introduced streamlined forensic reporting instead of each person doing their own report style. The reporting structure has two phases (a basic report and a more in depth one that is only produced if requested) for increased efficiency. Other parts of their crime laboratory have picked up this approach and all of them are generating reports faster.
- Theme 2: Documentation was considered critical but was focused only on case work to include case notes and a detailed description of analysis. Interviewees highlighted the need for the consistency of process between examiners. Case notes were deemed critical to assist the examiner in the recollection of the examination for testimony purposes. Documentation, particularly SOPs, was used to provide structure to the laboratory and organizations, and for training new examiners. It was also noted that laboratory SOPs were consistently written as high-level overviews to avoid being too prescriptive, since digital examinations often require flexibility. Interviewees noted the tension between standardization and flexibility.
 - Interviewee 4 described documentation about multiple laboratory processes such as authorizing tools and basic workflows. Interviewee thought this was useful for training and testimony reference.
 - Interviewee 5 described documentation as more of a guideline. The interviewee did not think documentation improved quality in terms of accurate reporting but felt that it might be helpful for training new examiners in the laboratory.
- Theme 3: Documentation was considered critical for potential challenges in court. Several interviewees stated that documentation can be used in court to show that the laboratory is following best practices or standardized procedures.
 - Interviewee 6 described the utility of case notes for testimony, for communicating with customers about what is in reports, and for determining time management of tasks as well.
 - Interviewee 2 stated that they can't live without documentation because prosecutors and defense ask for it in court.

¹ Reminder: the bullets are the interviewers' notes summarizing the interviewee's answers and are not direct quotes from the interviewee.

- Theme 4: Documentation was poorly regarded. Several interviewees thought that most, but not all, documentation was either a waste of time or actually made reports worse. Reports were more bureaucratic and harder for the customers to understand.
 - Interviewee 1 thought that the documentation required for accreditation had no impact on quality - just made the reports harder to read for the customer. One of the changes the laboratory made "simplified" reports but left out useful material.
 - Interviewee 10 described how at their accredited laboratory, the paperwork was challenging, not practical and slowed the process down considerably. Digital forensics laboratories were being pulled under the same umbrella as other forensic sciences causing duplication of work and inefficiency. They pulled out of the accreditation umbrella but streamlined procedures with chain of custody documentation remaining in place because it is critical. The essential piece was that the examiners used good forensic practices and procedures.
 - Interviewee 8 stated that they didn't have SOPs because the interviewee thought most SOPs were a waste of time. The Interviewee did have enough case notes to recount the reasons as to why actions were performed in an examination.

Summary: Targeted forms of documentation, especially for chain of custody, case notes, and customer interactions helped laboratories improve their quality. Other forms, especially extensive SOPs, were less useful, except as training aids.

2. Tool Validation and Testing: Does your laboratory conduct tool validation and testing? Why or Why not?

In general, testing tools prior to use (often referred to as validation) was viewed as resource-intensive and was seen as taking away from the primary mission of the laboratory, even though laboratory personnel described it as important. As with other quality elements, there was significant misunderstanding about the element itself. (See Appendix C for references about the quality elements.) This may be partially based on a lack of knowledge about how to perform meaningful testing, which might require a fairly in-depth knowledge of computer engineering, file systems, operating systems, database design, or other knowledge of software engineering.

It was concerning that there were several statements from laboratory professionals that showed a true misunderstanding of how to perform testing and the benefits and limitations of validation and testing.

The comments generally fell into 4 themes:

- Theme 1: Interviewees stated that they valued tool testing but were doing only minimal testing. Of these, some felt the concept was important, but they were not able to effectively implement a testing program.
 - Interviewee 12 says that they never identified software that was working incorrectly, but that testing did reveal unexpected observations, which the

Interviewee thought were presentation issues. Interviewee said it was almost impossible to do validation for all laboratory tools.

- Interviewee 9 thinks that validation as it is done now is not good. The interviewee thought testing needed more transparency, shared testing, standard datasets, and a system where the testing load is shared between vendors and a 3rd party. The Interviewee thought this would result in greater laboratory efficiency (since tool testing takes time away from examinations) and increased testing, enabling newer versions of tools to be used in the labs rather than using older versions.
- Interviewee 1 recounted having to explain to their quality assurance team why digital forensic software is not like biology tools that resulted in added work the interviewee considered unnecessary.
- Theme 2: The majority of interviewees said validation testing made their lives worse because the value did not justify the time commitment involved in proper tool testing and validation.
 - Interviewees 9 and 14 thought that testing was too resource intensive. Interviewee 9 even stated that the poor testing of tools was “a low point for the community.”
 - Interviewee 12 described that the testing done was quite minimal and was limited to checking whether the tool in use obtained the same answer as another tool. Interviewee described the difficulty of keeping up with tool updates.
 - Interviewee 14 described a time when an error in the tool causing mix-ups between time and date stamps on text messages was caught, not with testing, but during an examination. This resulted in the vendor releasing a patch.
- Theme 3: A few interviewees were able to describe actual benefits of tool testing.
 - Interviewee 15 described that their laboratory has a technical lead assigned specifically for validation due to the volume of work caused by changing technology and the constant need for validation of methods. Having a person who did this helped with making the approach to testing more consistent and resulted in tool limitations being clearly defined. This has led to greater consistency across a large laboratory system. While this process was viewed as onerous, the interviewee felt that standardization was helping balance the workload.
 - Interviewee 7 said that performance checks made the tools better, but it takes longer. They described catching the tools not parsing data completely in mobile devices and that performance checks added more confidence that the report going out the door was complete.

Summary: The practice of tool validation and testing is inefficient and poorly understood by many laboratories and they do not take into account best practices for software testing. The inefficient and ineffective testing results in significant costs to the laboratory. These include:

- Inability to update tools to take advantage of new versions (which are generally better than old versions).
- Wasted time.

- Misplaced confidence. Several interviewees felt better about their tools after having performed tests that were not rigorous enough to justify their findings.
- Lack of attention to the human factors involved with tool usage.

3. Management Reviews: How does your laboratory utilize management reviews as part of a quality management system?

Very few of the interviewees were using management reviews as an opportunity for process review and improvement. Differences among laboratories were quite stark. A few were using them to meet other non-quality related objectives. A small number of the interviewees had thoughtfully optimized management reviews for the digital forensic process, but most of the other laboratories that performed management reviews seem to be merely “checking a box.” In addition, laboratories had differing interpretations of what constituted a management review. Accredited laboratories defined management reviews as the annual meeting to discuss trends, deviations, errors, personnel, training, and overall work of the digital laboratory. Non-accredited laboratories defined management reviews ranging from a management review of technical work product to a weekly meeting with management to discuss issues. Some non-accredited laboratories recognized how management review could benefit the laboratories but were mostly performing a more administrative review.

Interviewee comments generally fell into 3 themes:

- Theme 1: Many of the laboratory personnel saw management reviews as mostly nitpicking by their management. They saw only minimal value in the process, which was mostly focused on failure to follow various procedures. These interviewees did generally see some value in the procedure, but they did not see it as worth the effort.
 - Interviewee 13 described a focus on small details with no tie to quality.
 - Interviewee 9 had only done one of these with someone who had digital forensic (DF) experience but found that situation to be the only time that such a review had value, in their opinion. Other such exercises were viewed as “rubber stamping.” The person with DF experience had subject-matter experience and could provide that helpful feedback
- Theme 2: Many laboratories used the management review as a way to communicate with management about activities in the digital forensics section and to ask for resources. Many of the interviewees were from general purpose forensics laboratories and had management that was unaware of the specifics of digital forensic operations.
 - Interviewee 10 described their laboratory’s review process of people, oversight of the unit, and the work product, including both in-house management and onsite/response work. They emphasized that reviewing work products (reports and output) was helpful for monitoring how much work was being done as well as checking on the well-being and mental health (crimes against children in particular) of their employees.
- Theme 3: A few of the interviewees were using management reviews as an opportunity for process improvement.

- Interviewee 2 described using the process to improve evidence handling, intake and archiving. Examiners didn't think that their evidence was as important as DNA and didn't think evidence could intermingle/contaminate. This required some effort since the concept of contamination is quite different for DNA versus digital evidence.
- Interviewee 14 described management reviews as part of a continuous improvement process. They sit down every 12 months and look at what has changed, why it has changed, and whether this is explained to staff. Interviewee 14 stated that it is important and makes sure processes are fit for purpose. This helps keep SOPs up to date and accurate
- Interviewee 15 described a specific improvement in which management reviews identified a bottleneck with peer reviews and enabled a productive change to that process.

Summary: Management reviews can be used for process improvement, but very few laboratories were using them this way. The disconnect between the potential benefits of management reviews and their implementation was particularly striking; this included accredited laboratories which should have a quality management process in place to use this element effectively.

4. Peer Review: What is the value of peer/technical reviews for forensic reports?

Peer review, along with having competent personnel, was the most highly regarded quality control element. Peer review had multiple positive impacts on overall quality including helping examiners learn from each other, streamlining operations beyond the scope of a single review, and reviewing the work performed. Peer review programs that optimized the collaborative aspect were viewed much more favorably. There was a general trend suggesting that the formality of the peer review process decreased its effectiveness.

The comments generally fell into three themes:

- Theme 1: Peer review was well-regarded and integrated into laboratory operations. Peer review was often used as a means of information sharing and process improvement.
 - Interviewee 9 stated that peer reviews “improve the report, improve the reviewer, improve the laboratory.”
 - Interviewee 10's laboratory had specialists in various areas (Mac forensics, cell phones, etc.) and reviews were done informally. Interviewee 10 thought that more informal peer reviews were helpful and more productive than when they are performed under the accreditation umbrella.
 - Interviewee 13 said that peer reviews help to ensure the laboratory meets quality standards. Furthermore, reviews lead to analysts talking with one another and personal advancement. Interviewee 13 also reported that peer reviews created competition amongst analysts which upped the value of work and helped inform adjustments to the quality manual.

- Interviewee 17 reported that peer reviews were performed in 100% of cases and were helpful for the purposes of developing efficiency, investigative methods, learning, etc. They also were looking for things that could be problematic at trial. Overall, peer reviews were more of a learning experience than an anomaly-finding experience.
- Theme 2: Peer reviews were well-regarded but described as a task with no apparent benefit to quality. Interviewees described finding no or only minor (e.g., grammatical) errors. It was accepted as a part of quality management, but people couldn't say why. This is part of a general trend observed about the adoption of quality management techniques without regard to actual quality improvement.
 - Interviewee 1 described peer review as catching small errors such as copy and paste errors, grammatical, and administrative errors, or missed items based on the SOPs, but did not find many technical errors.
 - Interviewee 4 also described not finding anything substantial but thought peer review was important because "we don't know what we are missing."
 - Interviewee 15 described how this helped build trust with customers, especially if a case goes to court. They also said that the technical reviews haven't caught much and have never led to rework.
- Theme 3: Peer reviews were viewed as problematic. A few of the interviewees addressed problems with peer review including delays, potential negative impact on morale and, quite distressingly, a significant specific negative impact. In one case, the requirement for 100% peer review led to a delay in providing information needed for a crime in progress. The Interviewee did report that a new procedure was put in place for urgent situations.
 - Interviewee 2 described how a requirement for peer review for all cases led to not providing information in a timely manner for an urgent case (PD needed a phone number related to a crime in progress). The interviewee called this the "price of an accredited laboratory." It makes the work harder. (Note the laboratory did update its SOPs to allow for release of information for urgent cases.)
 - Interviewee 12 said that peer review was not done regularly - only when a problem was identified. However, Interviewee 12 did say that examiners often sought advice from each other. Interviewee 12 was concerned that double checking people's work could negatively affect morale and that the resulting friction could actually cause mistakes and create a toxic work environment. They hoped that framing this as a quality review instead of checking on people could help.

Summary: A collaborative peer review process can be a very effective part of a quality system for digital forensics. When properly implemented, it has significant benefits for information sharing, staff development, and morale. As with other quality elements, many laboratories viewed peer review as simply an editorial review or (even worse) a "gotcha" environment in which reviewers were deemed to be actively seeking mistakes from the report writers.

5. Audit: How does your laboratory address audits and assessments?

Interviewees' laboratories rarely used audits to improve quality. This was true for both accredited and unaccredited laboratories. The strong negative experience with auditors is unfortunate and suggests that improvements are needed in how audits are conducted. Overall, Interviewees talked much less about their experience with audits than with other techniques. The most beneficial experiences were with fairly specific areas like evidence management rather than the overall quality process. Interviewees answered based on different types of audits, both external (assessments) and internal audits.

Responses generally fell into 3 themes:

- Theme 1: Most interviewees saw little value in audits and thought they focused on finding something just to find something or had findings not relevant to digital forensics.
 - Interviewee 13 stated that if the approach of the auditors was to coach and help, rather than promote competition and try to “ding” the laboratory, there would be far more value to audits.
 - Interviewee 1 described having to explain something at every audit because their laboratory does not have a digital quality person. Policy changes usually result after each audit, but they do not affect the quality of the work product.
- Theme 2: Some interviewees found that the audits identified processes that should be improved.
 - Interviewee 10 described that under accreditation, the QA team did audits frequently and that it was overkill. The process in other disciplines did not apply well to digital forensics, but quality assurance audits applied to everything, which was also too much. Outside of accreditation, their audits were more directed to specific processes with different timeframes, and this was more helpful. The focus was on good forensic practices and personnel. They removed some procedures and added others to streamline the process.
 - Interviewee 14 used spot checks which helped identify chain of custody issues for processing multiple phones.
- Theme 3: One interviewee found the audits useful for internal morale and for marketing to customers.
 - Interviewee 13 stated that audits helped with both the laboratory's reputation and with laboratory personnel's esprit de corps and pride.

Summary: Auditing, as practiced, has not been seen as an effective method to improve quality. The lack of understanding of digital forensics processes has led to a focus on less relevant processes and created a “nitpicking” culture. A few interviewees showed that audits can be beneficial if they are practiced with an understanding of digital forensics and a focus on improvement.

6. Testimony Monitoring: Does your laboratory conduct testimony monitoring? What is the value in terms of quality for this element?

Most laboratories surveyed did not monitor the testimony of digital forensic examiners as a quality management practice. Interviewees often discussed general training for how to testify or other feedback mechanisms. Of those laboratories that actually did go to court to monitor testimony, such monitoring was generally limited to testimony from new examiners.

Responses generally fell into 4 themes:

- Theme 1: No testimony monitoring was done. Most interviewees did not use testimony monitoring.
- Theme 2: Testimony monitoring was useful for training, especially of new staff.
 - Interviewee 10 said they did testimony monitoring as part of their accreditation because there was an annual requirement. When not a part of an accredited laboratory, the interviewee would often go to watch testimony for personal interest, not for the purpose of monitoring. Instead, they would do some testimony reviews primarily for newer examiners.
 - Interviewee 6 stated that testimony monitoring helped examiners learn strategies and tactics for use in court, such as improving reporting and communication, and how to avoid open-ended questions or situations where people feel compelled to expand further on answers
 - Interviewee 14 noted that testimony monitoring could be useful, although it was not done in their laboratory due to lack of resources to develop and implement a policy for it. They would like to implement a “buddy system” to support testimony, provide practice and feedback to examiners, and ultimately result in better testimony.
- Theme 3: Testimony monitoring was not useful and done only to meet an external requirement.
 - Interviewee 15 described having to do this because it is required as part of their accreditation. Interviewee described only finding minor things, nothing critical. This interviewee thought training was far more valuable.
- Theme 4: Laboratories used alternative methods for testimony monitoring. Several interviewees described using feedback from the court to learn about the testimony of digital examiners.
 - Interviewee 17 described using an “officer of the court” feedback form for both defense attorneys and prosecutors to provide feedback, noting that the defense attorneys were the most helpful. The laboratory was very happy with this approach.
 - Interviewee 12 described using several techniques, such as getting feedback from prosecutors, examining transcripts, and having senior staff sit in. The interviewee couldn’t recall any times things went wrong.

Summary: The practice of laboratory staff performing testimony monitoring does not appear to be widely used or effective. The alternate technique of getting feedback from customers (described by Interviewee 17) suggests that more effective practices could be used. Initial training on how to testify was seen as valuable.

7. Personnel: What are key elements of competent forensic laboratory personnel in your laboratory?

Having competent personnel was regarded as the single most important quality element, eclipsing all the other elements combined. The overarching theme in personnel is the inconsistency of training, education, and required knowledge/skills; the skill of the person determines a successful examiner overall. Laboratory programs were quite varied in assessing personnel. In two extreme examples, one laboratory took two weeks to qualify someone to do independent casework and another took three years. Many laboratories lacked formal training programs, although most laboratories had some training for DE and laboratory procedures. There was significant variation even in the more formal programs. The variation suggests that laboratories are unsure what the best methods are to address this critical quality element.

Responses generally fell into three themes:

- Theme 1: Personnel requirements were critically important.
 - Interviewee 13 stated that having the right personnel was more important than SOPs and rigid workflows, that one needed to be able to trust staff to do the job. Interviewee 13 thought that certifications and competency are not emphasized enough in the accreditation process.
- Theme 2: Various personnel requirements are useful but not sufficient. Management or senior staff assessment of capabilities is needed to see if staff are actually good examiners. There were concerns about training and certifications, primarily cost and perceived value.
 - Interviewee 3 wanted the emphasis to be on both problem solving and applied skills. Interviewee 3 felt that applied training and certifications are needed but felt the more elusive problem-solving skill was hard to assess and didn't correlate with a college degree.
 - Interviewee 9 considered training to be the biggest problem in the industry because it is very expensive so only people already in a DE examiner position can afford the training. This makes it hard for newcomers to break in. It would be good for the industry if we had people with different backgrounds to bring in diversity of thought. Interviewee 9 wanted better proficiency assessments based on key work tasks such as being able to find artifacts of value and write a good report, rather than procedural issues.
 - Interviewee 13 was split on the value of certification - there is value when it is done right, but there needs to be a recognized standard for training to competency because the requirements for certifications are becoming too demanding and cumbersome.

- Theme 3: One laboratory also used personnel techniques for non-quality reasons such as supporting testimony or marketing.
 - Interviewee 10 kept up with their International Association of Computer Investigative Specialists (IACIS) and vendor-based certifications and training so when they testified, they could say they completed the courses.
 - Interviewee 12 encourages vendor training and certifications but was worried that certification “does nothing but increase perception that you know something.”

Summary: The large variation seen among interviewees speaks to the need for better programs to adequately address the key factors for understanding the professional development of laboratory examiners. It also speaks to a need for minimum competency standards across the field. Given the breadth of tasks in DE, this may actually need to be multiple standards based on the type of work being done. Note that this was a similar theme in the customer interviews.

8. Quality Manager: What is the value of a Quality Manager in your laboratory and what is this role’s effect on the quality of your laboratory’s work?

Quality managers and quality management systems were viewed as useful in theory by most responders, though they generally got scathing (i.e., quite negative) reviews from the digital evidence laboratory staff based on specific occurrences in practice. Interviewees spoke highly of quality management systems in general, but negatively about quality managers and how quality management systems were implemented in their laboratories.

The key message was that quality systems and managers optimized for digital forensic laboratories were successful at improving quality but that most quality systems and managers were not optimized for digital forensic laboratories. There was a big concern that quality managers were asking laboratories to perform tasks that are not relevant to digital forensics which took people away from case work. These interviewees often felt that quality management systems could be valuable, but not as practiced in their laboratory. There was also a significant call for quality managers who knew or at least understood digital forensics. When laboratories had quality managers who took the time to learn digital, they felt the quality manager was more useful to them. Several interviewees did not have a full-time quality manager nor thought it would be useful for their laboratory.

Responses generally fell into four themes:

- Theme 1: Many laboratories did not have a quality manager or formal quality system.
- Theme 2: Quality management (QM) did not increase quality and, in many cases, just made additional work for digital forensic examiners.
 - Interviewee 10 said that the previous QM did not understand the specific needs of digital forensics and tried to enforce rules that did not apply. After the

laboratory stopped having a QM “it was a breath of fresh air to get out from under them.”

- Interviewee 1 also had a QM that didn’t understand digital forensics. Interviewee 1 felt that the QM was “just finding stuff to do.” This resulted in a lot of time spent explaining digital, such as the difference between validating machines and software.
- Interviewee 5 stated that it could be good to have a QM if they “knew what they were doing.”
- Theme 3: Minimal improvement but with significant overhead.
 - Interviewee 9 stated that QM helps with consistency and general efficiency, centralizing some tasks and allowing the examiner to focus on case work. The QM kept SOPs up to date and performed some spot reviews, but also created templates and took charge of various tasks. Interviewee 9 felt this was an important function for large laboratories but not an efficient use of personnel for medium and small laboratories.
 - Interviewee 13 reported that having a QM working with and guiding the technical manager helped improve quality, but it made things slower and harder with a lot more bureaucracy and a lot more paperwork.
- Theme 4: Laboratories with quality managers who optimized quality systems for DE had a more positive experience with quality management systems.
 - Interviewee 15 described their quality manager as helping the laboratory “lift its head out of the sand.” Improving efficiency and lowering the backlog has been the key to better quality work.

Summary: Having a quality manager or quality management system that understands digital forensics is essential to success but was rarely found in our survey. The current approach to quality management is suboptimal for digital forensics. Many of the frustrations came from quality managers not understanding digital forensics as a discipline. Complaints were centered around the administrators of the quality management system, not the quality system itself.

Higher level look at quality processes and accreditation

The last set of questions asked interviewees to list the most and least effective elements for quality improvement in digital forensic laboratories. They were also asked to address quality improvements outside of discussing the specific quality elements, including accreditation. Overall, interviewees felt that having competent personnel, technical reviews, and chain of evidence controls were the most important.

The least valued elements were testimony monitoring, testing/validation, internal audits, and the overhead associated with accreditation. While almost every interviewee was aware of accreditation, only about a third of the interviewees were in accredited laboratories. In general, accreditation was not viewed favorably across both accredited and non-accredited laboratories. While people liked that accreditation provided a minimum bar, it was associated with a high overhead of resources and time for all types of laboratories. Many stated that laboratory

accreditation standards ISO 17025 and 17020 were not good fits for digital forensics, were too resource intensive, and led to delays in getting reports to customers. In accredited laboratories or those with more formal systems, quality management was more likely to be seen as punitive. The general sense was that quality systems were just used for tracking and not for quality improvement.

- Interviewee 1 stated that early efforts to improve quality were helpful at fixing problems such as a lack of documentation. But after fixing the basics, the improvement has stopped; quality “improvements” are reducing clarity to customers and "It's been a lot of BS."
- Interviewee 10 focused on the need for a commitment of resources to invest in people both financially and institutionally, such as a better career track and mental health support. Interviewee 10 summarized their remarks by saying that personnel is the most important quality system. They see the formal system as wasteful and stifling of staff.
- Interviewee 17 recounted their experience in a very large laboratory with a strong Quality Manager who is looking at the big picture of the laboratory and what it is trying to do. While there was a heavy focus on looking good, it was also about delivering a quality product.
- Interviewee 8 emphasized that an ISO standard specific to digital evidence examinations is important to this field. Ideally, it would be based on input from many agencies and laboratories to determine what practices would scale to labs of all sizes, then implement them in customized form for each laboratory.

Summary: The perception of accreditation and more formal quality systems as punitive is a significant problem. Many digital forensics quality systems, as currently practiced, are failing to promote a strong quality culture.

Summary of Laboratory Interviews

Laboratory management we interviewed were all committed to quality, but interviewees described how the techniques they were using were often making things worse, mostly by creating inefficiencies and discouraging people with paperwork and low impact procedures. The interviews showed that there can be significant value in quality management systems, but not as generally implemented today. Critically, very few problems were discovered in the accuracy of laboratory reports. Many problems were discovered with the clarity and timeliness of the reports. Some of the key trends that were identified are:

- The first trend that emerged from the entirety of data collected was that interviewees felt that the quality practices being performed by accredited laboratories and some non-accredited laboratories were not contributing to a quality work product; in fact, some quality practices were hindering the progress of digital forensic work. In several cases, laboratories described an evolution of discarding quality practices, such as testimony monitoring, that were consuming resources but not adding significant value. Changing quality management practices did not seem to result in changes to the accuracy of

laboratory output. In some instances, the punitive approach of the quality management system caused practitioners to bypass the structured system.

- Another significant trend involved the key element of personnel. The interviewees focused on individual examiners as the key to the production of timely and accurate work. However, interviewees did not agree on how to hire, train, or assess examiners and generally criticized the existing processes as either too expensive, too time consuming, or not meeting their needs.
- Peer/technical review and the exchange of ideas for how to address various issues in digital forensics was also seen as a key quality element.
- There was significant value in documentation for chain of evidence and related processing. This was true for both the laboratories and the customers.
- The other techniques tended to be less valued. In many laboratories, these had been implemented because they were part of the laboratory's existing quality framework for other disciplines as opposed to being optimized for improving digital forensics. The finding that they had less value in a digital forensic context may be based on how they had been implemented, not whether the technique could be used effectively. The task group did see the potential for these elements in a few of the interviews.

Results: Customer Interviews

The customer interviews did not focus on specific quality techniques but investigated how customers interacted with digital forensics laboratories and their perception of the quality.

All but one of the downstream recipients of digital forensic laboratory analysis ("customers") the task group spoke with were lawyers, including prosecutors, defense attorneys and judges. One customer was a police chief. Many of the defense attorneys had previously worked as prosecutors. Many customers had extensive experience with digital evidence including having taken classes and were quite familiar with digital forensic techniques. Most of the laboratories the customers had worked with were law enforcement laboratories.

The survey included questions covering what customers' value in a laboratory, the main problems they have experienced, and what they want from digital evidence laboratories moving forward.

What do customers value in a laboratory?

When customers had a choice of laboratories, they used two criteria to select which laboratory they would work with: timeliness and perceived quality. Timeliness was the single biggest concern. While lawyers said they preferred a laboratory to be accredited and examiners to be certified, this was because they could use it at court, not because they saw an association between accreditation or certifications and quality. In some cases, the decision for which laboratory to use was based on whether the laboratory could handle a certain type of evidence.

- Personnel/Certifications/training. Lawyers had a very strong sense for which examiners did better work, and the lawyers were motivated to get those examiners for difficult cases. Only a few of the lawyers – those with more technical experience – could express *how* they knew whether an examiner was highly skilled. This led them to rely on people they had worked with before. Lawyers also preferred examiners who could testify persuasively.
 - Interviewee 31 emphasized the importance of the individual examiner, not the laboratory and of the work, not the accreditation. They know great people in “shitty labs.”
 - Interviewee 22 said selection of examiners depends on the case, what examiners are available, and who is trusted. Trust is based on past case experience, quality of the work product, and their experience talking to specific examiners.
 - Interviewee 18 selected examiners when they needed certain resources or an answer to a specific question. Interviewee 18 listed several factors they consider when selecting an examiner:
 - Cost,
 - Whether the person is highly competent or takes liberties when researching or speaking,
 - Works within a certified lab,
 - Uses peer-review, and
 - Can explain digital forensic reports and conclusions clearly to a jury.
- Accreditation: Customers generally only used accreditation to bolster a laboratory’s credibility in court. Accreditation was generally not regarded as increasing the quality of the work product. Accredited laboratories were recognized as having more documentation which did not add to the value of the work and caused perceived delays in timeliness. Other types of QMSs were recognized as being valuable.
 - Interviewee 26 thought that accreditation doesn’t matter and that their models are based on things not relevant to digital. Interviewee 26 has worked with both an accredited state laboratory and unaccredited local labs.
 - Interviewee 18 thought that accreditation was not as necessary as having a QMS and following standards in terms of responding to cross-examinations. The Interviewee described a case where testing to verify one key aspect of the case was considered “quality management” even though there was a lack of formal policy or accreditation.
 - Interviewee 30 thought that accredited digital forensics labs have more standard documentation and paperwork which may or may not be helpful. Interviewee wants a system that includes better/more detailed notes and audit logs. Interviewee was concerned that QMSs were hit or miss without an accreditation and was concerned about the lack of a standard certification for digital.
- QMS: The majority of interviewees are in favor of the laboratory having a quality system or elements of a quality system (e.g., SOPs, training program) but not necessarily interested in accreditation. Accreditation was not seen as a necessity as long as quality elements are in place.

- Interviewee 23 stated that it was important that labs have a QMS, but not important if the lab is accredited. The Interviewee was worried about accreditation having a negative impact – examiners are more concerned about working inside accreditation rules than doing good work.
- Interviewee 24 absolutely cared that labs have a QMS. They felt this was important in case evidence is challenged. Interviewee 24 described a QMS as having SOPs so they can say they are doing things accurately and credibly.
- Interviewee 21 does not care whether the lab or the examiner is accredited. They want the examiner to have training and if it comes with a certification that's even better. Interviewee 21 wanted the training curriculum to be accredited but was concerned about the impact it might have on the practitioners who aren't certified.

What are the main problems they have experienced?

Timeliness and the clarity or understandability were big problems.

- The discussion of timeliness was straightforward: evidence took too long to process due to backlogs. The concerns with clarity primarily centered on reports that lacked analysis. Reports were often solely the output of a forensic tool or tools, and customers were left to figure out what the data meant. Note that clarity was not one of the original attributes of quality that the task group considered. However, this is clearly a significant problem as it impacts the ability of lawyers, as officers of the court, to communicate clearly and truthfully the results of the forensic analysis.
 - Interviewee 26 reported that timeliness is a significant problem and slows down investigations considerably. Interviewee 26 also reported that clarity was a huge problem because most reports are “completely incomprehensible.” Most of the reports are the ones that are automatically generated from the tools. That report is sent to the prosecutor, and they are forced to figure them out themselves. This has led to significant problems such as prosecutors thinking that there is evidence to prosecute a Child Sexual Abuse Material (CSAM) case, but the images were actually only in the cache.
 - Interviewee 23 also reported accuracy issues when a search term or search strategy ended up glossing over or leaving out important information. Interviewee 23 was clear that they had never received a report that they thought had false information.
 - Interviewee 22 reported major problems with understandability and timeliness. Timeliness was a factor in every case with only homicide getting priority. Interviewee 22 also stated that most of the end products are unsatisfactory consisting of just the evidence (the output from a mobile extraction) without even a report.
 - Interviewee 27 stated that timeliness is a real problem especially with CSAM cases. Interviewee 27 also stated that the labs stopped doing attribution work, so the reports were less useful. Interviewee 27 attributed this to time pressures.

- There were only a few complaints where customers were able to identify inaccurate or misleading reports, and all of them were about cell site analysis (locating mobile phones based on which towers they connected to) and laboratories overstating the precision of the technique. Other complaints focused on quality management in general.
 - Interviewee 31 said that when courts don't understand digital evidence, they tend to give experts more credibility than is warranted. The interviewee emphasized that this leads to testimony given with no basis in fact or science (e.g., the range of a cell tower). Interviewee 31 also described being able to give expert testimony on stingray technology without ever having seen or used it, suggesting that judicial "gatekeeping" of technical experts was lax.
 - Interviewee 22 described experiences with problems like lack of search warrant procedures, adherence to warrant requirements, unqualified people being appointed to positions of supervision level in DE, chain of custody problems, logging evidence, etc. Today, DE is valued more than any other forensic science, but is not treated with the same rigor as other forensic disciplines in these instances.

What do customers want moving forward?

The majority of the requests centered around both consistency between practitioners and work products, as well as better baseline for testimony along with identification of the sub-discipline(s) the practitioner is an expert in.

- Interviewee 18 thought a centralized resource where different types of qualified forensic opportunities/labs/professionals were broken out would be very helpful for prosecutors. It would be a resource for prosecutors to use to do a secondary review of evidence to determine whether it was done right the first time.
- Interviewee 30 asked how to standardize who is qualified to testify about what? They argued that a person cannot be an expert in all fields of digital evidence, so what is the base level for testimony? What qualifies you: degrees, certs, or something else?

Summary of Customer Interviews

Issues with timeliness and clarity of many laboratory reports are driving customers, including police departments, prosecutors and defense attorneys to developing in-house capability or are using lawyers and investigators for jobs that should be done by a digital forensics expert. (Note that the NIST Foundation Study estimated that there are at least 11,000 digital forensics laboratories in the US.²) Many interviewees expressed concern that this could result in misinterpreting or missing key artifacts that are pertinent to a case. The customers are eager for laboratories to have quality systems that produce more useful, timely, and accurate reports. The interviewees discussed many types of QMSs, but rejected that accreditation was beneficial and had varying opinions about which elements of a QMS were important to them.

² Lyle et. al. Digital Investigation Techniques: A NIST Scientific Foundation Review, NISTIR 8354-DRAFT, National Institute of Standards & Technology, 2022. <https://doi.org/10.6028/NIST.IR.8354-draf>

- Interviewee 22 stated that they are very concerned that so much DE is done by lawyers and detectives rather than DE professionals working with lawyers and detectives. This is starting to cause issues and the interviewee suspects that this will increase. The interviewee gave several examples of customers doing their own analysis poorly; the worst was an analysis (done outside the lab) which missed a living victim who should have been located.
- Interviewee 20 believes that DE needs to be in-house because it is so difficult to use external labs based on both timeliness concerns and that labs won't even take lower priority cases. The interviewee stated that "once you have it you don't want to lose it."
- Interviewee 25 stated that having a QMS would make DE more impactful and had ideas about how to optimize a QMS for the volume and impact that DE can make on a case. The focus was on streamlining some of the operations that are overly constrained based on a division of labor between the simpler and more complex tasks.
- Interviewee 26 stated that there should be a QMS, but accreditation doesn't matter, that the model is based on things not relevant to DE. Interviewee sees no difference in quality between the accredited and nonaccredited labs they work with.

Findings and Recommendations

Based on the responses, the task group recommends that the digital forensics community initiate and continue efforts to improve quality management practices. The current emphasis on accreditation under ISO 17025, ISO 17020, and formal QMSs is not having the desired outcome. One of the problems with the current implementations of QMSs is a lack of understanding of the tasks, methods, and sources of errors in digital forensic processes, particularly among Laboratory Management and Quality Managers. In digital forensics laboratories, a major focus of quality systems has not been on improving quality; it has, instead, focused only on meeting 17025 requirements with little regard for enhancing the quality of the forensic services in the digital laboratory. The spirit of a quality system is lost in the dogmatic adherence to the quality system or the ISO standard rather than examining practices for their enhancement of quality management goals. To be successful, a QMS must have accuracy, understandability, and timeliness as goals rather than a perception that the laboratory has quality. Successful quality systems focused on making things better rather than trying to create paperwork. The task group saw this in very few laboratories. Another problem with current QMS implementations is that there has been a punitive culture rather than a quality culture. No amount of process will improve quality without strong management support.

Findings

In summary, the major findings are:

1. The implementation of quality management systems, as practiced, rarely focuses on trying to improve the quality (e.g., products are accurate, complete, timely, and understandable) of the product of DE laboratories. Laboratory management tends to see quality as demonstrating that the laboratory is “good” rather than a means to improve reports, testimony, and other products.
2. Many people did not understand what the quality elements were meant to achieve or how and why they should be integrated into an effective quality management process.
3. Customers of DE laboratories are unconcerned about quality processes but do have beliefs about which laboratories or examiners are better than others.
4. Everyone interviewed was very concerned with producing or receiving accurate, useful, and timely reports and perceived overall quality (accuracy) as high. Most of the problems discussed were not believed to affect the outcome of an investigation/court proceeding. There were a few exceptions including overselling the results of cell site analysis, failure to provide timely information during a crime in progress, and potential to mix up media from different cases.
5. Timeliness was an endemic problem to the extent that many customers started their own laboratories or were doing forensic analysis by themselves and only using the laboratory for extracting data from mobile phones. Very few interviewees thought of quality as supporting timeliness.
6. People strongly valued peer review even though no one ever cited it for catching anything important. However, interviewees described other benefits in terms of information sharing among examiners and satisfaction of having one’s work be favorably reviewed.
7. Everyone saw the importance of highly competent examiners. This was viewed by customers as the key element of quality. Customers never cited laboratory -wide quality management as being important to quality.
8. The value people placed on other elements was superficial; they were “good” only because everyone says they are good to have. For example, no one spoke persuasively about the benefits of SOPs except for evidence management and customer interactions even if they rated them as critical. Tool validation was another example of an element everyone performed but few valued. People didn’t seem to understand how the various quality elements actually related to quality.

There is value in quality management systems, but not as generally implemented today. Peer/technical review and the exchange of ideas for how to address various issues in digital forensics was the single most valuable technique according to the laboratory personnel. There was significant value in documentation for chain of evidence and related processing. This was true for both the laboratories and the customers. The need for highly competent personnel was universal but most interviewees felt that the methods for recruiting, training, and assessing them were either poor, too expensive, or too time intensive. Most of the other techniques were less valued. In many laboratories, these had been implemented because they were in a quality framework as opposed to being optimized for improving digital forensics. The finding that they were found to have less value may be based on how they had been implemented, not whether the technique could be used effectively.

Recommendations

Based on these findings, the task group recommends refocusing the quality system for DE on improving and supporting the quality of the product rather than forcing “one-size-fits-all” quality techniques from generic quality programs onto DE processes. Although the current system is suboptimal, the team did interview a few labs where quality was thought about more holistically and people actively tailored quality elements to fit the DE process. This should be pursued at the community level. A DE-oriented quality management system should be based on an assessment of which elements are most effective and how to implement it to achieve greater quality. This assessment should be based on this study and include the needs of the many stakeholders including labs and customers. The metrics for what is quality must include understandability as well as having analysis work be performed by competent examiners rather than by the customers. Specific recommendations for designing a DE-oriented quality management system are:

1. Develop material to fundamentally redefine a quality management system that is optimized for digital forensics. This should be a community-based effort.
 - a. This could be done incrementally. As a first step, identify and reduce the use of less effective techniques.
 - b. Develop guidelines to optimize the techniques for digital forensics.
 - c. Develop a digital forensic specific quality management system.
2. Develop material to educate laboratory management, quality managers, and accreditation bodies about quality management for digital forensics.
3. Develop centralized resources to aid labs in addressing the challenges they face, including:
 - a. Personnel recruitment with a focus on critical thinking and technical acumen
 - b. Personnel training and education
 - c. Personnel assessment (e.g., competency, proficiency, readiness for independent casework.)
 - d. Tool testing
 - e. Sharing of resources, tools, tips, and techniques
4. By optimizing the quality system for improving timeliness, accuracy, and understandability over meeting quality requirements, this may help with resourcing in labs since they will have more time for casework and improve morale. Other issues with timeliness are beyond the scope of this document.

Appendix A: Survey Questions (Laboratory Personnel)

1. Tell us about you and your lab:

Type: Federal State Regional Local Commercial Private Other (specify):

Role: Director Deputy, Sr. Analyst Other (specify):

Career Summary:

- a. How big is your lab? Size: small (<5) medium (5-15) large (>15) # of examiners:
- b. Who is/are your customers? Customers: LE, judicial/courts, state, federal, municipal
- c. What types of work does your lab do?
- d. Approximately, how many cases or items to you handle per week (or month)? Turnaround times? Backlog?
- e. How long have you worked there?
years @ current position:
Years in digital:

2. Our next questions are about how you manage quality in your lab. We define quality in terms of timely and accurate outputs that assist with investigatory leads and court proceedings. We have a list of 9 common Quality practices. Can you describe the importance of each: waste of money, time or energy, useful, can't imagine not having this (critical), or other.

a. What documentation do you have and how do you use them? How important are the different types of documentation?

Importance: waste, useful, critical, other (specify):

How is it used:

Made life better or worse:

Result in better products (more accurate, clearer, faster):

Documentation type: SOPs guidance docs nothing other (specify):

Level of detail (high level, all steps, some steps, loose framework)

Deviations:

b. Equipment and software validation

Importance: waste, useful, critical, other (specify):

How is it used:
Made life better or worse:
Result in better products (more accurate, clearer, faster):

c. Management reviews

Importance: waste, useful, critical, other (specify):
How is it used:
Made life better or worse:
Result in better products (more accurate, clearer, faster):
How often (yearly, monthly, other):
Focus of reviews:

d. Peer/technical reviews

Importance: waste, useful, critical, other (specify):
How is it used:
Made life better or worse:
Result in better products (more accurate, clearer, faster):
Release results:

e. Internal and/or external audits

Importance: waste, useful, critical, other (specify):
How is it used:
Made life better or worse:
Result in better products (more accurate, clearer, faster):

f. Testimony monitoring

Importance: waste, useful, critical, other (specify):
How is it used:
Made life better or worse:
Result in better products (more accurate, clearer, faster):

g. People

a. Competency testing

Process for determining that someone is ready to do independent case work/mentorship.
How long does the training process take?
What are its key elements?

b. Education:

Degree required:

c. Examiner training: lab-based, vendor, other

d. Certifications

e. Follow on if needed: Discuss supervision of examiners and oversight of employees and products? What happens when people don't pass tests?

Importance: waste, useful, critical, other (specify):

How is it used:

Made life better or worse:

Result in better products (more accurate, clearer, faster):

h. Quality Manager

Importance: waste, useful, critical, other (specify):

How is it used:

Made life better or worse:

Result in better products (more accurate, clearer, faster):

3. Can you tell us any times that your lab's quality process led to a difference in a report for a) clarity b) accuracy or c) completeness?

a. Can you tell us about any errors or mistakes that you caught and how you changed your process to try and avoid them in the future?

Process changes: training, hiring, accreditation, certification, reviews, audits

b. Can you summarize what you think are your lab's most important quality management processes and which you think are the least effective?

Most important:

Least effective:

4. Accreditation or Other Formal Quality Systems

a. Are you aware of accreditation or other formal quality systems? What do you think are the strengths and weaknesses of formal quality systems? What do you think is a good idea for formal systems for DE?

Meta Questions

5. Are there any questions you want to answer that we haven't asked you?

6. Can you recommend other people you think we should interview?

Appendix B: Survey Questions (Customers)

Background questions to understand the customer and their experience with DE

1. Tell us about your role in the judicial/criminal justice/other system and your experience. How long have you been doing this? (Do NOT record name or name of organization. Categorize by federal/state/local and size)
2. What kind of cases have you been involved with?
3. What kind of forensics and forensics labs do you work with?
4. What is your experience if any with digital evidence? We think of digital forensics as a variety of areas such as cell phone analysis (finding photos and text message), looking at internet search history and complex analyses such as fraud, cell site analysis, etc.
5. Describe how you work with your Digital Forensics examiners and Digital Forensics labs?
6. Have you had any training/workshops related to DE?
7. Have you ever had Digital Evidence go to trial or used Digital Forensics examiners to testify?
 - a. Follow on: have them describe this
 - b. Did you use the examiners as fact witnesses or experts?
8. Do you have a choice what lab to use? Have you made choices about who to hire/select to do Digital Forensics work? If so, why do you pick one lab over another?
 - a. Back pocket question: Do you have a choice what person to use?

Quality Questions:

The next set of questions is about Quality. We think of quality as 3 things: accuracy, understandability, and timeliness.

9. What problems have you had with Digital Forensics work products? Keep in mind all 3 attributes of quality.
 - a. If possible, get a description that is rich enough that we understand the problem and potential root causes and possible corrective action.
 - b. If they go deep enough: Did this result in corrective actions at the lab?
10. Have you ever had problems getting Digital Evidence accepted?

a. If so, please tell us about that.

11. Have you ever had concerns about how Digital Evidence-related testimony in court?

a. If so, please tell us about it.

12. There are lots of types of Digital Forensics Labs and many Police Departments and other groups do some Digital Forensics in house. Have you noticed issues dealing with these different types of Digital Forensics processes?

13. Do you care that a lab you use has a “quality management system” or is accredited? When we think of a QMS, we are referring to management practices such as standard operating procedures, technical reviews, proficiency testing, and 3rd party reviews (often as part of a formal accreditation system)

a. Follow on/skip: Would you use a lab without a documented QMS? Do you handle/present their work differently if they have a QMS?

b. Follow on/skip: Would you use an unaccredited lab for DNA or toxicology? If so, why do you think Digital Forensics is different?

14. If they haven’t talked enough: Describe your best and worst experiences with DE related to your cases.

15. Given a choice, what would be your priorities in determining which lab to send evidence?

Meta Questions

16. Are there any questions you want to answer that we haven’t asked you?

17. Can you recommend other people you think we should interview?

Appendix C: Quality Management Systems

The task group developed a list of common quality management system elements as part of the interview protocol. The list is available in Appendix A. This list was based on multiple documents that address quality management systems. The following references can provide additional information about each quality element and about quality systems in general.

1. Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods (2016)
https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensic_science_report_final.pdf
2. ANAB AR 3125, ISO/IEC 17025:2017 Forensic Testing and Calibration Laboratories Accreditation Requirements
<https://anab.ansi.org/2018-iso-iec-17025-forensic-accreditation-documents-0>
3. International Organization for Standardization. (2017). **General Requirements for the Competence of Testing and Calibration Laboratories** (ISO/IEC Standard No. 17025)
4. International Organization for Standardization. (2012). **General Criteria for the Operation of Various Types of Bodies Performing Inspection** (ISO/IEC Standard No. 17020)
5. Qualitative Assessment Review Guidelines for Investigative Operations of Federal Offices of Inspector General
<https://www.ignet.gov/sites/default/files/files/QAR%20Guide%20Investigations%20July%202017.pdf>
6. Strengthening Forensic Science in the United States: A Path Forward (2009)
<https://www.ojp.gov/pdffiles1/nij/grants/228091.pdf>
7. SWGDE Myths and Facts about Accreditation for Digital and Multimedia Evidence Labs
https://drive.google.com/file/d/1E0nu8_WWBYpXLykOK3BQX329OoFRqdpc/view
8. SWGDE Establishing a Quality Management System for a Digital and Multimedia Organization under ISO-IEC 17025 or 17020
https://drive.google.com/file/d/14LZ2-uuoQqYzKokrgNj_ntW5aeFjKd3z/view
9. SWGDE Minimum Requirements for Testing Tools used in Digital and Multimedia Forensics
<https://drive.google.com/file/d/1QePvaHM2yz4rwL0iiDHm-XVBqW5vAJJk/view>

10. SWGDE Requirements for Report Writing in Digital and Multimedia Forensics
https://drive.google.com/file/d/1_O1WxWa1FTkOqDPJ3n1aul5VXkGITAZh/view