Received: 5 July 2023 | Revised: 4 September 2023 | Accepted: 6 September 2023

DOI: 10.1002/wfs2.1501

ADVANCED REVIEW

WIREs FORENSIC SCIENCE WILEY

The long journey of resistance toward acceptance: Understanding digital forensic accreditation in England and Wales from a social science perspective

Dana Wilson-Kovacs[1] | **David Wyatt**[2]

[1]Department of Social and Political Sciences, Philosophy and Anthropology, University of Exeter, Exeter, UK

[2]School of Population Health and Environmental Sciences, King's College London, London, UK

Correspondence
Dana Wilson-Kovacs, Department of Social and Political Sciences, Philosophy and Anthropology, University of Exeter, Exeter, UK.
Email: m.d.wilson-kovacs@exeter.ac.uk

Funding information
Economic and Social Research Council, Grant/Award Number: ES/R00742X/1

Edited by: Carole McCartney, Editor

Abstract

Drawing on topical academic and practitioner accounts, our contribution examines the challenges of accreditation in digital forensics (DF), specifically, the adoption of ISO/IEC 17025 standard for forensic science support providers in England and Wales. We built on the debate generated by the Forensic Science Regulator's introduction of this standard in DF to reflect on the position and status of DF community of practice. We argue that a social science approach can help illuminate the organizational and professional tensions generated by this development and to understand better the implications for the role of DF specialists and their position in the wider forensic science community.

This article is categorized under:

Digital and Multimedia Science > Cybercrime Investigation

Crime Scene Investigation > Education and Formation

KEYWORDS

accreditation, digital forensics, england and wales, profession, standards

1 | INTRODUCTION

In a recent contribution to this journal, Kaufmann (2023) drew upon the newly formulated Sydney principles of forensic science and the idea of forensic trace as a vector of information (Roux et al., 2022), to propose that DNA traces are also information, dynamic and in permanent flux. She based this observation on the ongoing development of forensic genetics and the increasing use of algorithms and big data to analyze DNA trace. We wish to extend this metaphor to argue that among all the forensic disciplines, the field of digital forensics (DF) is the one most acutely information, given its expansion, velocity, and diversity. DF has developed in the last 40 years, from a "niche science" and a "relatively obscure tradecraft" (Garfinkel, 2010) to an integral part of most investigations, growing from basic data recovery and file carving techniques on single desktop computers, to complex operations involving multiple devices, different operating systems, various file formats and vast storage capabilities. DF is now routinely used by law enforcement: in England and Wales, for instance, 90% of criminal investigations carry a digital element (National Police Chiefs Council—NPCC, 2020), making DF the most commonly used forensic discipline, with demand increasing by 229%

between 2017 and 2020 (Transforming Forensics Business Case Digital, 2019, p. 21). DF is also relevant to activities, organizations and industries beyond policing, prompting some commentators to suggest that the term DFIR (DF incident response) may convey more comprehensively the breadth of the field, and the "broader use and interpretation of a traditional digital forensic skillset" (Morris et al., 2023, p. 3).

Harmonization and standardization of practices and quality control in DF have been at the forefront of practitioner debates, in the United Kingdom and elsewhere (e.g., Casey, 2004, 2019; Horsman, 2021; Sommer, 2011). Almost 20 years ago, in the inaugural issue of the journal *Digital Investigation*, Casey's editorial highlighted the unequal development of guidelines and training across DF communities. Noting how a lack of standards "allows weaknesses to persist, resulting in incomplete evidence collection, documentation and preservation as well as errors in examination and interpretation of digital evidence" (Casey, 2004, p. 2), he called for the need to share knowledge and unify best practices. A few years later, Garfinkel remarked in a similar vein that "forensic researchers and tool developers need to hold themselves to a level of scientific testing and reproducibility that is worthy of the word 'forensic' and should work to develop digital forensic techniques that produce reportable rates for error or certainty" (2010, p. S71). This suggests that DF should aim to achieve a similar gold standard as that of forensic genetics, unify practices across its field and through accreditation and the identification of best practices "increase the level of confidence in these activities and in the resulting information" (Jaquet-Chiffelle et al., 2018, p. 11). To date, this agenda is still to be fulfilled.

These concerns are not unique to DF. Several reports in different national jurisdictions questioned the lack of standardization of operational principles and procedures for many forensic science activities (e.g., National Academy of Science, 2009) and highlighted the need to increase the reliability and validity of forensic science results across most specialisms. Responding measures have focused mainly on strengthening the quality controls of forensic processes. In DF, the introduction of standards has been sought both to increase the admissibility, reliability, and validity of DF evidence and to stabilize the field. This task is complicated by differences in practices and resourcing at local, national, and international levels, the numerous commercial entities that produce the hardware, software and tools used in DF, and their competing interests. In one recent example, the lack of European minimum standards regarding digital evidence has led to courts accepting this type of evidence without scientific validation of the methodology and tools used, as the recent Encrochat prosecutions demonstrate (Stoykova, 2021). In response, legislative intervention, pre-trial reliability evaluation and formal verification of forensic procedures by the court have been proposed to address these limitations (idem). Globally, improved confidence in DF has been sought through "transdisciplinary strategies" including closer collaboration between industry and government, centralized research development, streamlined mechanisms for DF such as tool accreditation and validation, and better knowledge sharing across national borders (Casey, 2019; Casey et al., 2018). While not a silver bullet, accreditation can provide an internationally recognized platform for ensuring the accuracy and technical competency behind the extraction, analysis, and interpretation of digital evidence. Furthermore, standardization can help increase public confidence in forensic science outcomes and the international forensic science community has been called to assist "in creating and upholding a uniform ideology" (Interpol, 2013, p. 140) based on shared standards and quality measures (Brandi & Wilson-Wilde, 2013).

Below we focus on a national approach to standards in DF and examine how the implementation of ISO/IEC 17025 and the process of accreditation in England and Wales have been discussed in the DF community. It is not our intention to analyze the standard here, as other accounts have covered this issue far more comprehensively (see Doyle, 2020). Neither it is to enter the "right" or "wrong" standard debate or propose a new standardization model (Horsman, 2021). Instead, we examine how the introduction of this standard has been both reflected in DF scholarship and experienced in practice. Drawing on academic literature and practitioners accounts on accreditation in DF we scrutinize the scientific, professional, and organizational tensions introduced by this development and the ways in which the place of DF in investigative practices, the nature of DF as a discipline (or set of disciplines) and the expertise of its practitioners are reflected in these sources. We argue that the recent drive to introduce the ISO/IEC 17025 standard for laboratories undertaking DF procedures in England and Wales brought to light the challenges encountered by the DF community as it seeks professional stabilization and wider recognition by more established forensic disciplines, law-enforcement agencies, and criminal justice stakeholders. While our focus is not representative for other national jurisdictions, some of the issues discussed may resonate with DF communities and relevant stakeholders more widely and provide useful insights into the challenges of this process.

Our analysis complements discussions about the use of standards in forensic science in this journal (e.g., Doyle, 2020; Horsman, 2021) and elsewhere (e.g., Brandi & Wilson-Wilde, 2013; Doyle, 2018; Evison, 2018; McCartney & Amoako, 2019; Page et al., 2019; Tully, 2018, 2020; Tully et al., 2020; Willis, 2011; Wilson-Wilde, 2018), and offers an insight into the tensions DF forensic science providers experience in achieving compliance with ISO/IEC

17025 and in updating their existing practices, processes and systems. The article is organized as follows: the next section briefly introduces the context of forensic science services in England and Wales, the role of the Forensic Science Regulator and the adoption of ISO/IEC 10725. Section 3 examines how DF academics and practitioners discuss standards in their field. In Section 4, we thematize practitioners' views on how the process of accreditation has been implemented and discuss its challenges. Our concluding remarks reflect on these debates and call for better communication between academic and practitioner communities across forensic disciplines. We start with a brief introduction to the forensic science support context in England and Wales.

2 | THE ADOPTION OF ISO/IEC 10725 FOR DF IN ENGLAND AND WALES

In England and Wales, DF practices are overseen by quality control mechanisms and most recently by ISO requirements introduced by the Forensic Science Regulator, which aim to offer assurance mechanisms to achieve fair criminal justice outcomes. This development must be understood in the context of wider changes in the organization and governance of forensic science support services. In the last decade, "(s)imultaneous budget cuts and reorganisation, together with exponential growth in the need for new services such as digital evidence" (HoLSTC, 2019, p. 3), have shaped the landscape of forensic science provision. While DF was not one of the major services offered by the Forensic Science Service (FSS), the closure of the FSS in 2012 affected adversely the development of DF through the unstable and fragmented forensic market it foregrounded. Potentially more disruptive was the assimilation of the Police Central E-Crime Unit (PCeU) into the then newly formed National Crime Agency in 2013. The PCeU had been part of the central infrastructure overseeing the development and operation of DF units, alongside the National Fraud Intelligence Bureau and the Child Exploitation and Online Protection Centre. In the years that followed, a lack of foresight in strategic DF development and governance, de-centralization and limited investment also impacted on DF delivery. Since then, building on the priority areas outlined in the National Police Chiefs Council Digital Forensic Strategy (NPCC, 2020), the Transforming Forensics Programme (2018–2020) has sought to fill in the funding gaps and help optimize quality management and accreditation processes in forensic science support services more generally. Its success however has been questioned in the recent Strategic Review of Transforming Forensics and Forensic Capability Network commissioned by the NPCC in 2021. The Review concluded that the Programme failed to successfully translate its "vision into specific outcomes at operational and tactical levels in forces" (NPCC, 2021, p. 4). Commenting on DF provision in particular, it further noted how planned work "remains at an early stage" (NPCC, 2021, p. 4), with forces reporting "real challenges in relation to both capability and capacity" (NPCC, 2021, p. 7).

Processes of accreditation must also be understood in their organizational contexts. Like fingerprints, which are the remit of examiners based in the forensic science support teams of police forces, most digital evidence is extracted and analyzed in-house. Most police forces have outsourced work to reduce the size of their backlogs, with a typical split between in-house and external provision of 80/20 (HoLSTC, 2019). A small number of forces use exclusively either one of the three main commercial forensic science providers (FSPs) firms, or smaller independent companies that specialize exclusively in DF for their DF analysis (McCartney & Shorter, 2020; Tully, 2018). Given the prevalence of digital evidence for an increasing number of cases and escalating demand, in most forces less complex analysis has been provided by police officers trained in basic extraction techniques of mobile phone data. The increased demand for and complexity of DF, and the use of non-specialist staff for some DF techniques have led to the integrity and quality of DF outcomes being increasingly scrutinized.

To address concerns about the quality of forensic science and expert evidence, the role of the Forensic Science Regulator (FSR) was proposed in 2007, adopted in 2008 and recently enhanced by statutory powers through the Forensic Science Regulator Act 2021 (HM Government, 2021). The function of the FSR is to issue guidance and set regulatory standards for forensic science practices and advise the Government and the criminal justice system on quality standards in the provision of forensic science (Tully, 2018). Codes of Practice and Conduct oversee this process for all forensic provision and full compliance with appropriate quality standards and "systematic assurance" (Tully, 2018, p. 146) must be observed by all organizations and individuals offering forensic science support services to the criminal justice system. This is necessary for a shared understanding of quality among all the stakeholders. It is also key to establish a "mature 'quality culture' amongst practitioners, managers and agencies," which recognizes the changing nature of forensic practices and the need for quality assurance in the admissibility of evidence (Tully, 2018, p. 134). The consistent application of ISO standards aims to reduce practitioner and instrument error and the possibility of challenging the reliability and validity of the forensic evidence used. The Codes provide competence requirements for laboratory activities including

sampling, laboratory examinations and tests, and the provision of expert testimony, including relevant legal and regulatory information. DF laboratories that carry out examinations must both attain ISO/IEC 17025 accreditation and ILAC G19, which is used by UKAS, the UK Accreditation body to interpret the accreditation criteria within a forensic context and assess these laboratories. Recently gained statutory powers allow the FSR to close those laboratories that do not meet the required standards.

While the Codes of Practice and Conduct and associated guidance announced the process for the validation of forensic science methods in 2011, the Codes of Practice and Conduct required formal external accreditation to ISO/IEC 17025 in DF from October 2017. Compliance has been initially slow: the deadline for achieving quality standards in DF passed with only 19 organizations accredited to the Codes. By February 2020, 42 organizations both public and private gained such accreditation (Tully, 2020). Difficulties of accreditation have been attributed to validation issues caused by rapid technological change in the digital space and the costs involved in ensuring it through multiple software updates (Tully, 2020). An impact evaluation suggested that following the introduction of accreditation "those who have succeeded found themselves to be reluctant converts" (Tully, 2018, p. e30). It was reported that the introduction of accreditation led to improvements across all aspects of DF (Tully et al., 2020), for instance, by providing a better understanding of the limitations of software used for data extraction (Tully, 2020). Notwithstanding, the introduction of the ISO/IEC 17025 in DF has encountered some resistance with concerns around the standard adopted and the process of implementation have been less documented.

In the sections that follow, we adopt a social science perspective to examine how resistance to the standard has been expressed in academic and practitioners' views on this issue. This perspective sensitizes us to in situ practices, helps contextualize ground concerns and brings to fore the experiences of practitioners themselves. Thinking both in terms of the structure of DF and its routine implementation, we argue that accreditation debates in DF illustrate the tensions around the professional recognition and stabilization of the DF in a broader forensic landscape. We further contend that processes of accreditation and their outcomes must be understood in the context of their organizational implementation (Box 1).

3 | DIGITAL FORENSICS—A FIELD APART?

Opinion on the ways in which forensic science practices, including DF, could be accredited has changed. A decade ago, most DF scholars supported the accreditation of practitioners rather than that of organizations, in line with wider practices in forensic science at the time (Bem et al., 2008; Sommer, 2011). Given the reactive state in which DF practitioners work and the speed with which digital devices are developed, the recognition of individual specialist competence (Horsman, 2019), including frequent and updated training to respond to demand for analysis and new technical skills to process large volumes of data from evolving devices, operating systems and platforms (Beckett & Slay, 2011; Sheldon, 2005), was perceived as key.

Since then, the focus of accreditation and quality control shifted from that of practitioners themselves to that of environments (Sommer, 2018) and "the systems in place in the organisation to ensure competency and reliability of all

BOX 1 Stabilizing forensic expertise: Lessons from the field of forensic genetics

Social science scholars have long noted how validated knowledge is used to manage the inherent uncertainty of forensic practices. This is achieved by doing certain things in a particular order and documenting them in a specified way. Precedents from the forensic genetics field suggest that the accreditation and standardization of practices can strengthen the ways in which scientific claims to validity are made. Derksen, for instance (2000, 2010) observed the deliberations surrounding the standardization of DNA analysis as a method of identification, noting how similar ways of doing DNA analysis and reporting DNA profiles helped to quantify results, legitimize DNA use and strengthen the status and authority of forensic genetics scientists. Having "the administrative forms of accountability that testify to the bureaucratic regularity, routine competence, impersonality and disinterestedness in the way materials are handled" (Lynch et al., 2008, p. 135), also helped produce admissible evidence for court.

the work undertaken within defined parameters" (Tully, 2018, p. 146). As such, individual competence has come to be seen increasingly as part of organizational competence and a process of quality management that provides a "greater systematic reassurance to the criminal justice system" (Tully, 2018, p. 147). Underpinning the formal recognition of DF as a forensic discipline, this reflects the wider adoption of forensic science methods of interpretation and evaluation of evidence to mitigate against problems of cognitive bias and unscientific practice in DF.

Despite this alignment, DF has been largely self-governing, "determin[ing] its own level of acceptable review internally" (Page et al., 2019, p. 88) and establishing and maintaining standards in the digital field has been particularly complex. While DF could have learned how to introduce robust quality management procedures from more established forensic disciplines (Page et al., 2019), such cross-fertilization did not happen, despite shared goals in terms of producing reliable and valid forensic results and serving the criminal justice system effectively. This tension is visible in discussions on the choice of specific standards. In the United Kingdom, several international standards have been adopted by forensic science support providers, with ISO/IEC 17025, the standard for "testing and calibration of laboratories" (ISO, 2021), being the most common. This development led to questions whether ISO/IEC 17025 was the most suitable means of accrediting all aspects of DF practice. DF practitioners survey responses received by Wilkinson and Gwinnett (2019) and discussions on Forensic Focus online forum (2016, 2020), suggested different ISO standards would be more suitable such as ISO17020 (used in crime scene investigation) and ISO27037, 41, 42, and 43. Related concerns linked to meeting the requirements of ISO/IEC 17025 in the fast-moving DF technological field and the interpretation of the standard. Marshall (2022), for instance, argues that the current regulatory regime for DF work in England and Wales is based on a fundamentally flawed interpretation and implementation of the standards chosen. He takes issue with the design and validation of standard operating procedures, arguing that the FSR's ambiguous formulations may result in DF laboratories interpreting validation as a way of offering assurance that technical requirements are being satisfied and that evidence of verification can be made available to solve this problem, without requiring full disclosure of commercially sensitive or secret methods.

Aligned to these concerns are views of the DF field as different from other forensic science disciplines. It has been argued that unlike other forensic disciplines, DF does not focus on a single piece and/or type of evidence (such as a blood deposit or fingerprint mark) or the completion of standardized and established analyses such as those used in DNA profiling or fingerprint comparison. Supporting this distinction between DF and other forensic disciplines are arguments that DF is better aligned to engineering rather than more traditional, established, "wet" forensics techniques (Marshall & Paige, 2018, p. 27) especially in light of its reliance on the reverse-engineering of decisions and implementations made by commercial developers (Garfinkel, 2010). Many such decisions "(e.g. hard disc firmware, filesystem implementations, data caching) are not published or reviewed as they are commercially sensitive and/or there is no need for the majority of users/customers to have any particular interest in the low-level implementational detail which is of particular interest to a digital forensic examiner or analyst" (Casey et al., 2018, p. 1).

In addition, proprietary concerns make many DF tools black boxes, and lengthy and costly empirical methods are needed to show that DF tools are actually correct (Casey, 2019). The ongoing development of DF tools further complicates validation (Horsman, 2019). Validating commercial tools against each other adds to these difficulties, as underlying algorithms are invisible, and evaluators could be using a tool with the same algorithm or source code to validate processes (Jones & Vidalis, 2019). This process has been considerably different from similar efforts in forensic genetics, where PCR machines have been validated and the process has largely remained the same (Marshall & Paige, 2018). Given these complexities, the focus of accreditation should be on universal operating practices, instead of developing scientific methodologies for standardizing DF practices in local settings (Sommer, 2011, p. 99).

Furthermore, partly due to the speed of technological change in DF analysis, it has been argued that validation in DF cannot be compared to that occurring in other forensic disciplines, where processes are rigorously tested and peer reviewed (Page et al., 2019; Sommer, 2011). Peer review, the typical method of academic oversight and consensus, is comparatively slower that the pace with which technology develops in DF, and more complex than that undertaken for single evidence types, making it challenging and even unpractical (Page et al., 2019; Sommer, 2011). As a quality control option, peer review delays the timely publication of latest technological advances, especially when considering the increasing number of different objects for DF analysis (Horsman, 2019). Furthermore, it represents only the first step in the validation of academic work—it is then subject to the scrutiny of the wider community, further lengthening the process of general acceptance. In DF, as equipment and software are updated by the commercial providers, comprehensive reviews are challenging, if not impossible (Casey, 2019; Guttman et al., 2022; Tully, 2020). Moreover, peer review may fail to identify any underlying issues, particularly in terms of missed or misinterpreted data identified, which led to calls for alternatives to this process. Horsman and Sunde (2020) and Sunde and Horsman (2021) for instance, advocate

for a more holistic approach where "critical friend/s" and colleague/s reviews are used to identify and rectify errors early in the investigation and offer another mechanism for quality control. However, this approach can underestimate the labor involved and considering backlogs and ongoing casework demands, generate further delays. Other quality assurance mechanisms have also been proposed: Horsman (2020a), for instance, suggests a framework for the verification and interpretation of digital evidence (VODE) and a platform to facilitate knowledge sharing and communicate DF outcomes more clearly between different stakeholders (Horsman, 2020b). While useful for capturing the necessary steps in ensuring the reliability and validity of digital evidence, such models remain to be adopted in practice, with most DF forensic service providers struggling to meet the requirements set by the FSR. At a practical level, validation was reported to become more challenging because of frequent changes in software, reducing thus the opportunities for risk mitigation (Amoako, 2020, p. 140). DF practitioners, whether working for private firms or law enforcement agencies reported similar difficulties in validating DF methods and delays in meeting accreditation requirements, which were in part attributed to evolving digital technologies and partly to the lack of funding and resources. In the next section, we examine the ways in which DF practitioners' accounts capture these concerns.

4 | PRACTITIONER PERSPECTIVES

Data on and analysis of DF practitioners' views and experiences of accreditation are limited. The practitioner community itself is varied and specialists work within or outside police forces. Existing research provides a picture of the many complexities of *implementing* ISO/IEC 17025 into DF. As noted above, it has been reported by the former FSR that practitioners who undertook accreditation have been generally positive about the process. Points of concerns were that tool validation was prioritized over methods validation, as Tully et al. (2020) report in their initial and assessment visit. Furthermore, at the organizational level the burden and cost of accreditation were noted. Practitioner accounts add further context and analytic texture to these observations.

The largest of the data sets available was compiled by Beardmore et al. (2017) who surveyed 180 practitioners on their concerns about the adoption of the standard. 64.2% of participants were DF examiners and investigators who worked in police forces, 13.6% worked in the private sector with law enforcement contracts and 16.5% were from the private sector with no law enforcement contracts. The remaining 5.7% included academics, litigators, and other police investigative staff. Below we present some of the challenges identified by these attempts to capture opinion in the DF community.

4.1 | Duplication

The organization of accreditation processes at individual police force levels have been questioned. Many DF practitioners stressed the duplication of activities undertaken in preparation for accreditation, the validation work required and the paperwork it brought. Some police forces considered collaborating in their accreditation work (Wilkinson & Gwinnett, 2019) hoping that shared practices may facilitate accreditation (Beardmore et al., 2017; Forensic Focus, 2016). However, "standards do not specify how investigations should be undertaken (and) the methods used can be provider specific as long as they are appropriately validated according to these standards" (Page et al., 2019, p. 85). As such, determining the overlaps and distinctions in requirements for participating police forces can be a lengthy and complex exercise in the absence of instructions for practitioners on how to carry out certain processes or use specific tools. Given the emphasis on local validation and documentation of processes, tools and DF methods, these collaborations work best if forces have similar investigative arrangements and use the same software (down to the same versions). However, as forces join the process of accreditation at different times and with dissimilar levels of preparedness and allocated resources, such differences contribute to the duplication of accreditation work, despite the assistance of the recently established Forensic Capability Network with such matters.

4.2 | Changes to innovation and expertise

Some practitioners noted how accreditation made DF practices more bureaucratic and increasingly procedural rather than investigative and innovative, as one examiner explained:

> I came into forensics a year before ISO/IEC 17025 came into place and what I've seen is a real change of culture in our workplace, from what is supposed to be investigative forensics (finding one piece of evidence leading to another, like a chain reaction) into following ISO standards where we can no longer chase down the chain and instead stop where our standard operating procedures tell us to stop.
>
> (Beardmore et al., 2017, p. 39)

Similar sentiments were expressed by others who described how working toward accreditation stifled innovation in the field and limited the choice of methods to only those validated. Such concerns echo similar points made in broader discussions of standards: Willis (2011) for instance, notes that overemphasis on standards and documentation can lead to more rules and the removal of judgment.

4.3 | Cost and scale

Concerns about the amount of time and the administrative burden of accreditation at police force level have also been noted. While the recent His Majesty's Inspectorate of Constabulary and Fire & Rescue Service (HMICFRS) (2022) report acknowledges how accreditation processes can be both bureaucratic, as noted above, and costly, practitioner perspectives provide real-world accounts of what accreditation requires of DF providers. Participants with managerial duties observed that the accreditation process required at a minimum: a full-time quality manager for 2 years, an ISO technical lead working "20 hours per week × 2 years, practitioners involved in testing, creating case management systems 2 [...] 20 hours per week × 2 years, technical manager 10 hours per week × 2 years" (Wilkinson & Gwinnett, 2019, p. 49). Although few practitioners provided information on the cost of the work to gain accreditation, Wilkinson and Gwinnett's participants estimated 18,720 h spent on accreditation processes and an overall cost ranging between £250,000 and £500,000 over 3 years (2019, p. 48).

Similar financial estimates were given by respondents in Beardmore et al.'s survey, who further noted accreditation led to the replacement of analyst positions with positions for quality managers to oversee the changes. In one case, the entire yearly training budget of a DF unit:

> was swallowed up by costs of accreditation and we also had to cut back on the number of licences we had for some tools where we really need to have one licence per examiner analysts we found our productivity dropped with most analysts doing about 70% of the number of cases per year that we used to complete. The only way to get that number of cases back up was to do a less thorough investigation than we used to do. I don't believe small companies and "one man bands" will be able to afford ISO/IEC 17025 and this describes the majority of defence experts.
>
> (Beardmore et al., 2017, pp. 15–16)

These accounts highlight the effects of accreditation work, most significantly in terms of reducing productivity in delivering DF analyses to investigators and increasing backlogs, as well as the invisible costs of accreditation. These extracts from the survey responses illustrate the scale of disruption introduced by accreditation processes, complicated further by the fact its preparation occurs alongside routine case work. Further concerns have been raised about defendants unable to find a suitable expert and the potential dangers of miscarriages of justice (McCartney & Amoako, 2019).

4.4 | Small independent DF providers

The implications of accreditation as an administrative burden and cost have been raised also in relation to smaller private DF providers for whom accreditation may not be affordable, which in turn means that they are unable to assist both police investigations and defense teams (Beardmore et al., 2017; Forensic Focus, 2021; Wilkinson & Gwinnett, 2019).

These concerns have also been reflected in academic literature, with Amoako (2020) reporting that the small scale, private providers he interviewed found costs for gaining ISO/IEC 17025 certification and maintaining requirements through regular renewals prohibitive. For a small-scale FSPs with a turnover of less that £100,000, the £10,000–30,000 official estimate for accreditation processes may be more than what these providers can afford. Consequently, some of

the small-scale DF providers and experts reported being selective and providing services for which accreditation is not required. Others talked about switching from the forensic marketplace into other sectors where they can practice without the ISO/IEC 17025 accreditation. As an alternative to costly accreditation, small-scale providers were reported to follow other regulatory requirements in order to provide quality assurance to their clients, such as complying with the FSR requirements to include a declaration of non-compliance with accreditation in their expert report to the court. Other DF practitioners in police forces that had not achieved accreditation, also noted this practice for some of the in-house DF work they carried out (Amoako, 2020).

4.5 | Dis-incentivization

Tully (2018) and Amoako (2020) note how police forces had commissioned DF services from unaccredited FSP providers. This approach reportedly dis-incentivized FSPs to invest into accreditation and operate to the required quality standards. Other dis-incentives are present: the defense experts Amoako interviewed noted how they were never asked about accreditation in court, and their use of non-accredited methods was never questioned. In a similar vein, Marshall (2022) notes how in court proceedings there is a lack of interest in method validation and the FSR guide. Similarly, Wilson-Kovacs et al.'s (2023) observed how accreditation requirements and the FSR codes were of little concern to the criminal defense lawyers they interviewed, who seldom interrogated the reliability and acceptability of digital evidence in relation to quality standards, or questioned the tools, methods and procedures systems used to analyze digital information.

5 | CONCLUDING REMARKS

This article discussed how DF scholarship and practice has reflected on the topic of accreditation, and more specifically on the Forensic Science Regulator's introduction of ISO/IEC 17025 standard in DF in England and Wales. The standard itself has been questioned on different grounds: from its choice and timing (Willis, 2011) to its formulation (Marshall, 2011), the organizational approach to accreditation, the lack of support for small and medium companies (McCartney & Amoako, 2019), and the implications for the position and role of independent experts and the longer-term repercussions for innovation in investigative practices (Doyle, 2018; Sommer, 2018). In addition, many practitioners have noted that the process of accreditation is administratively and organizationally burdensome, time consuming and expensive and little understood by senior police managers.

Our review highlights how concerns about the standard must be understood in the context of its organizational implementation and the current state of DF provision. It illustrates how processes of accreditation are embedded in organizations and reflect their preparedness. Flaws in organizational cultures and the planning of quality management support have impacted on processes of accreditation. We further contented that accreditation debates in DF illustrate the tensions around the recognition and stabilization of this community of practice in a broader forensic landscape and call for better communication between academic and practitioner communities across forensic disciplines. The preservation, extraction, analysis and interpretation of digital traces must follow a scientific approach, analytical rigor and reliable measurements. Standards and a quality management system are fundamental to such an approach but cannot replace it. The emphasis on the recovery, preservation, analysis and interpretation of trace also highlights the boundary between the forensic scientific community and "non-scientists (police, lawyers, jurists)" and serves as a reminder of the "fundamental foundation on which forensic science is built" (Roux et al., 2022, p. 8). Likewise, contesting approaches to DF accreditation can be understood as attempting to establish the boundaries of DF, as a distinct forensic field and its wider recognition. In DF, the risks of ineffective practice are not confined to the DF laboratory but are present throughout the journey of data within the criminal justice system. For instance, the extraction and examination of data from mobile phones often take place outside the digital forensic units and are typically performed by police officers with minimal training and little awareness of digital forensic principles (Wilson-Kovacs et al., 2023). With the recent HMICFRS (2022) report suggesting front line staff need more training in DF and digital investigations, the remits and limits of the DF practitioner's expertise become increasingly blurred. So too do their ownership of and accountability for DF work, especially in relation to mobile devices, which can lead to evidence being contested in court (Anderson et al., 2021).

More than tool testing and validation, accreditation offers wider assurance, accountability, and risk management, and contributes to the production of robust evidence. While it cannot avert errors (Tully et al., 2020, p. 10), safeguard

against inadequate organizational cultures (Evison, 2018) or prevent miscarriages of justice (Willis, 2011), it is a necessary step in ensuring fair criminal justice outcomes and addressing the dangers of mishandling, misinterpreting and manipulating digital information (Tully, 2020). Our discussion underlines both the need for robust quality management systems and the difficulties in standard adoption. Using a social science perspective helps bring to fore the professional tensions accreditation engenders, highlighting disciplinary resistance and organizational tensions generated by restricted budgets and in the case of policing, by inadequate resourcing of digital forensic laboratories, quality management teams and forensic science support. Debates questioning the suitability of the standard and practitioner attempts to distinguish their practices from those of more established forensic disciplines, instance this resistance and illustrate how despite the formal recognition of DF as a forensic discipline, its stabilization is ongoing and ambiguities about the ways in which digital (forensic) expertise is understood and defined remain. Alongside tensions around establishing consensus through debate and agreement in DF, at a practical level, the process of accreditation uncovers the precarious position of DF as a community of practice and the perceived threat to the expertise it provides.

While DF's position within forensic science in general may be contested, a way forward is needed to supports robust and standardized DF practices and meet the needs of police investigations and the criminal justice system. Although accreditation goes some way in standardizing and elevating DF practices for such uses, it is only through the ongoing dialogue between academic and practitioner communities, tool developers, and the broader forensic sciences that the aim of facilitating the admissibility, reliability and validity of all DF evidence will be achieved. As technologies change so too will DF techniques and processes and their adoption and use by law enforcement agencies. Finding ways to break down the silos between disciplinary and occupational groups and sharing knowledge across DF communities is paramount to the stabilization of DF as a scientific forensic discipline. While accreditation has been a "long journey of resistance to acceptance," the work of maintaining the integrity of DF evidence is an ongoing endeavor.

AUTHOR CONTRIBUTIONS

Dana Wilson-Kovacs: Conceptualization (lead); funding acquisition (lead); writing – original draft (equal); writing – review and editing (lead). **David Wyatt:** Data curation (equal); writing – original draft (equal).

ACKNOWLEDGMENTS

We wish to thank our participants for their time and input and to our reviewers for their helpful suggestions.

FUNDING INFORMATION

The support of the Economic and Social Research Council (Research Grant ES/R00742X/1) is gratefully acknowledged. For the purpose of open access, the author has applied a 'Creative Commons Attibution (CC BY) licenceto any Author Accepted Manuscript version arising'.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

ORCID

Dana Wilson-Kovacs https://orcid.org/0000-0001-5861-3617
David Wyatt https://orcid.org/0000-0001-5859-7389

RELATED WIREs ARTICLES

A review of the current quality standards framework supporting forensic science: Risks and opportunities
We're making a list and we're checking it twice, gonna find out what makes digital forensic examiners suffice

FURTHER READING

Casey, E. (2011). A unified voice: The need for an international digital forensic convention. *Digital Investigation*, *8*(2), 89–91.
Collie, J. (2018). Digital forensic evidence—Flaws in the criminal justice system. *Forensic Science International*, *289*, 154–155.
Henseler, H., & van Loenhout, S. (2018). Educating judges, prosecutors and lawyers in the use of, educating judges, prosecutors and lawyers in the use of digital forensic experts. *Digital Investigation*, *24*(March Supplement), S76–S82.

Julian, R., Howes, L., & White, R. (2021). *Critical forensic studies*. Routledge.
Kruse, C. (2016). *The social life of forensic evidence*. University of California Press.
Wilson-Kovacs, D., & Wilcox, J. (2022). Managing policing demand for digital forensics through risk. Assessment and prioritization in England and Wales. *Policing: A Journal of Policy and Practice*, *23*, 1–12. https://doi.org/10.1093/police/paac106

REFERENCES

Amoako, E. N. (2020). *The regulation of forensic science in England and Wales* (Unpublished PhD thesis). University of Northumbria at Newcastle (United Kingdom).
Anderson, P., Sampson, D., & Gilroy, S. (2021). Digital investigations: Relevance and confidence in disclosure. *ERA forum. Journal of the Academy of European Law*, *22*, 587–599. https://doi.org/10.1007/s12027-021-00687-1
Beardmore, P., Fellows, G., & Sommer, P. (2017). *UK ISO 17025 Digital Forensics Survey April 2017*. http://digitalevidence.expert/UK%20ISO%2017025%20Digital%20Forensics%20Survey%20April%202017.pdf
Beckett, J., & Slay, J. (2011). Scientific underpinnings and background to standards and accreditation in digital forensics. *Digital Investigation*, *8*(2), 114–121.
Bem, D., Feld, F., Huebner, E., & Bem, O. (2008). Computer forensics—Past, present and future. *Journal of Information Science and Technology*, *5*(3), 43–59.
Brandi, J., & Wilson-Wilde, L. (2013). Standard methods. In J. Siegel & P. Saukko (Eds.), *Encyclopedia of forensic sciences* (pp. 522–527). Academic Press.
Casey, E. (2004). The need for knowledge sharing and standardization. *Digital Investigation*, *1*(1), 1–2.
Casey, E. (2019). The chequered past and risky future of digital forensics. *Australian Journal of Forensic Sciences*, *51*(6), 649–664.
Casey, E., Geradts, Z., & Nikkel, B. (2018). Transdisciplinary strategies for digital investigation challenges. *Digital Investigation*, *25*, 1–4.
Derksen, L. (2000). Towards a sociology of measurement: The meaning of measurement error in the case of DNA profiling. *Social Studies of Science*, *30*(6), 803–845.
Derksen, L. (2010). Micro/macro translations: The production of new social structures in the case of DNA profiling. *Sociological Inquiry*, *80*(2), 214–240.
Doyle, S. (2018). *Quality management in forensic science*. Academic Press.
Doyle, S. (2020). A review of the current quality standards framework supporting forensic science: Risks and opportunities. *Wiley Interdisciplinary Reviews: Forensic Science*, *2*(3), e1365.
Evison, M. (2018). Regulation: What is there not to like? *Science & Justice*, *58*(4), 300–301.
Forensic Focus. (2016). *ISO17025—Digital forensics struggles*. https://www.forensicfocus.com/forums/general/iso-17025-digital-forensics-struggle/
Forensic Focus. (2021). *Lessons learned in digital forensics standardization: United Kingdom*. https://www.forensicfocus.com/articles/lessons-learned-in-digital-forensics-standardization-united-kingdom/
Garfinkel, S. L. (2010). Digital forensics research: The next 10 years. *Digital Investigation*, *7*, S64–S73.
Guttman, B., Laamanen, M. T., Russell, C., Atha, C., & Darnell, J. (2022). *Results from a black-box study for digital forensic examiners*. https://nvlpubs.nist.gov/nistpubs/ir/2022/NIST.IR.8412.pdf
His Majesty's Inspectorate of Constabulary and Fire & Rescue Services (HMICFRS). (2022). *Digital forensics: An inspection into how well the police and other agencies use digital forensics in their investigations*. https://www.justiceinspectorates.gov.uk/hmicfrs/publication-html/how-well-the-police-and-other-agencies-use-digital-forensics-in-their-investigations/
HM Government. (2021). *Forensic Science Regulator Act 2021*. https://www.legislation.gov.uk/ukpga/2021/14/contents/enacted
Horsman, G. (2019). Tool testing and reliability issues in the field of digital forensics. *Digital Investigation*, *28*, 163–175.
Horsman, G. (2020a). Part 1: Quality assurance mechanisms for digital forensic investigations: Introducing the verification of digital evidence (VODE) framework. *Forensic Science International: Reports*, *2*, 100038.
Horsman, G. (2020b). Part 2: Quality assurance mechanisms for digital forensic investigations: Knowledge sharing and the capsule of digital evidence (CODE). *Forensic Science International: Reports*, *2*, 100035.
Horsman, G. (2021). Standardizing digital forensic examination procedures: A look at Windows 10 in cases involving images depicting child sexual abuse. *Wiley Interdisciplinary Reviews: Forensic Science*, *3*(6), e1417.
Horsman, G., & Sunde, N. (2020). Part 1: The need for peer review in digital forensics. *Forensic Science International: Digital Investigation*, *35*, 301062.
House of Lords Science and Technology Committee (HoLSTC). (2019). *Forensic science and the criminal justice system: A blueprint for change. HL Paper 333*. https://publications.parliament.uk/pa/ld201719/ldselect/ldsctech/333/333.pdf
International Organization for Standardization (ISO). (2021). *ISO/IEC 17025 testing and calibration laboratories*. https://www.iso.org/ISO-IEC-17025-testing-and-calibration-laboratories.html
Interpol. (2013). *17th Interpol International Forensic Science Managers Symposium*, Lyon. Review papers.
Jaquet-Chiffelle, D. O., Casey, E., Pollitt, M., & Gladyshev, P. (2018). *A Framework for Harmonizing Forensic Science Practices and Digital/Multimedia Evidence (No. 0002). OSAC/NIST*.
Jones, A., & Vidalis, S. (2019). Rethinking digital forensics. *Annals of Emerging Technologies in Computing*, *3*(2), 41–53.
Kaufmann, M. (2023). DNA as in-formation. *Wiley Interdisciplinary Reviews: Forensic Science*, *5*(1), e1470. https://doi.org/10.1002/wfs2.1470

Lynch, M., Cole, S. A., McNallly, R., & Jordan, K. (2008). *Truth machine: The contentious history of DNA fingerprinting*. University of Chicago Press.

Marshall, A., & Paige, R. (2018). Requirements in digital forensics method definition: Observations from a UK study. *Digital Investigation*, *27*, 23–29.

Marshall, A. M. (2011). Standards, regulation & quality in digital investigations: The state we are in. *Digital Investigation*, *8*(2), 141–144.

Marshall, A. M. (2022). The unwanted effects of imprecise language in forensic science standards. *Forensic Science International: Digital Investigation*, *40*, 301349.

McCartney, C., & Amoako, E. N. (2019). Accreditation of forensic science service providers. *Journal of Forensic and Legal Medicine*, *65*, 143–145.

McCartney, C., & Shorter, L. (2020). Police retention and storage of evidence in England and Wales. *International Journal of Police Science & Management*, *22*(2), 123–136.

Morris, S., Hadgkiss, M., David, A., Guinness, J., & Frewin, C. (2023). We're making a list and we're checking it twice, gonna find out what makes digital forensic examiners suffice. *Wiley Interdisciplinary Reviews: Forensic Science*, *5*, 1487. https://doi.org/10.1002/wfs2.1487

National Academy of Sciences (NAS). (2009). *Strengthening forensic science in the United States: A path forward*. National Research Council of the National Academies, National Academies Press.

National Police Chiefs Council (NPCC). (2020). *Digital forensic science strategy*. https://www.npcc.police.uk/Digital%20Forensic%20Science%20Strategy%202020.pdf

National Police Chiefs Council (NPCC). (2021). *Strategic review of transforming forensics and forensic capability network*. https://www.npcc.police.uk/SysSiteAssets/media/downloads/publications/disclosure-logs/operations-coordination-committee/045-2022-npcc-independent-review-forensics-council-copy.pdf

Page, H., Horsman, G., Sarna, A., & Foster, J. (2019). A review of quality procedures in the UK forensic sciences: What can the field of digital forensics learn? *Science & Justice*, *59*(1), 83–92.

Roux, C., Bucht, R., Crispino, F., De Forest, P., Lennard, C., Margot, P., Miranda, M. D., NicDaeid, N., Ribaux, O., Ross, A., & Willis, S. (2022). The Sydney declaration—Revisiting the essence of forensic science through its fundamental principles. *Forensic Science International*, *332*, 111182. https://www.sciencedirect.com/science/article/pii/S0379073822000123

Sheldon, A. (2005). The future of forensic computing. *Digital Investigation*, *1*(2), 31–35.

Sommer, P. (2011). Certification, registration and assessment of digital forensic experts: The UK experience. *Digital Investigation*, *8*(2), 98–105.

Sommer, P. (2018). Accrediting digital forensics: What are the choices? *Digital Investigation*, *25*, 116–120.

Stoykova, R. (2021). Digital evidence: Unaddressed threats to fairness and the presumption of innocence. *Computer Law & Security Review*, *42*, 105575. https://www.sciencedirect.com/science/article/pii/S0267364921000480

Sunde, N., & Horsman, G. (2021). Part 2: The phase-oriented advice and review structure (PARS) for digital forensic investigations. *Forensic Science International: Digital Investigation*, *36*, 301074.

Transforming Forensics Programme. (2019). *TF business case—Digital*. https://pds.police.uk/tag/transforming-forensics/

Tully, G. (2018). Regulating forensic science. In P. Roberts & M. Stockdale (Eds.), *Forensic science evidence and expert witness testimony*. Edward Elgar Publishing.

Tully, G. (2020). *Forensic Science Regulator annual report 2018–2019*. Home Office. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/877607/20200225_FSR_Annual_Report_2019_Final.pdf

Tully, G., Cohen, N., Compton, D., Davies, G., Isbell, R., & Watson, T. (2020). Quality standards for digital forensics: Learning from experience in England & Wales. *Forensic Science International: Digital Investigation*, *32*, 200905.

Wilkinson, L., & Gwinnett, C. (2019). *Transforming forensics digital: Impact of ISO 17025 accreditation work on UK digital forensic units*. Staffordshire University.

Willis, S. (2011). The highs and lows of accreditation. *Forensic Science Policy & Management: An International Journal*, *2*(2), 75–80.

Wilson-Kovacs, D., Helm, R., Growns, B., & Redfern, L. (2023). Digital evidence in defence practice: Prevalence, challenges and expertise. *The International Journal of Evidence & Proof*, *27*(3), 235–253.

Wilson-Wilde, L. (2018). The international development of forensic science standards—A review. *Forensic Science International*, *288*, 1–9.

How to cite this article: Wilson-Kovacs, D., & Wyatt, D. (2023). The long journey of resistance toward acceptance: Understanding digital forensic accreditation in England and Wales from a social science perspective. *WIREs Forensic Science*, e1501. https://doi.org/10.1002/wfs2.1501