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The UK forensic science regulator: Fit for purpose?

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Abstract

The role of Forensic Science Regulator (FSR), created in 2007, was established to assure the achievement and maintenance of forensic science service (FSS) provision that commands public confidence. The FSR works at an organizational level, to assure, and improve the quality of forensic service provision and manage the risks of quality failures by Forensic Service Providers (FSPs). Despite this apparent introduction of "regulation," forensic science provision in the United Kingdom has continued to receive a critical assessment. FSPs are meant to voluntarily adopt the Regulator's quality standards, achieve and maintain accreditation, and comply with regulatory requirements and guidance, including reporting complaints and quality failures to the Regulator. The effectiveness of the FSR thus cannot be gauged by examination of the actions of the Regulator alone, but also requires evidence of impact upon FSPs. Using public data, supplemented by interviews with FSS providers, to facilitate an initial assessment of whether the FSR's role is "fit for purpose," we outline five demands made of FSPs in delivering FSSs to the criminal justice system and the five objectives of the FSR to support and enhance the ability of FSPs to meet these demands. We provide a prefatory commentary on whether the FSR is able to effectively fulfill this purpose. It is argued that the FSR role in its current form cannot be considered "fit for purpose" when evidence of the impact of regulation is lacking. Finally, we briefly summarize "inhibitors" that prevent the FSR from being more effective.

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KEYWORDS

accreditation, forensic science providers, forensic science quality, forensic science regulation, quality standards

1 | INTRODUCTION

The need for forensic science to be regulated (should be) widely accepted once the vulnerabilities inherent in forensic science are recognized, and their deleterious impact on the criminal justice system (CJS) acknowledged. These include activities that present opportunity for risks of errors and mistakes during the analysis and testing of evidential materials

and/or the interpretation of the resulting evidence, such as misconduct and negligence of forensic practitioners, inconsistent laboratory practices, and misinterpretation of test and analytical results (Gabel, 2014). While internationally there may have been reluctance and hesitation to introduce forensic science regulation,[1] where it has been instigated, there have been different approaches taken or recommended (Butler, 2017; Tontarski Jr, Houck, Grose, & Gialamas, 2012). In 2007, the UK government created the role of the Forensic Science Regulator (FSR).[2] The FSR is a progeny of various recommendations aimed at preventing errors and quality failures, which may lead to miscarriages of justice, unjustified acquittals, or flawed/failed criminal investigations. Despite this innovation, and the hopes that seemingly intractable problems with forensic science would now be addressed, forensic science provision has continued to attract criticism (House of Lords, 2019). Ascertaining the effectiveness of the FSR is thus necessary to determine the contribution of the FSR to the aim of an effective criminal justice process, albeit, it is highly unlikely that a single regulatory solution would be capable of addressing all of the diverse vulnerabilities present when forensic science interacts with the criminal process. Any assessment must appreciate that solutions to certain problems might simultaneously create or exacerbate other tensions elsewhere in this complex interdependent system (Roberts, 2015), and "inhibitors" may impede or annul regulatory efforts.

Quality assurance regulators will primarily aim to either "assure" or "improve" the quality of service. If the main purpose is to provide assurance, then quality standards are expected to be set at a minimum acceptable level of quality and a level that will be easily attainable by most (if not all) organizations. However, if the improvement of quality is the main purpose, standards and targets will be set to challenge the status quo and help organizations identify areas for development (Sutherland et al., 2006). We argue that, given the many criticisms of forensic science that provoked the creation of the FSR role, the effectiveness of the FSR role in achieving their purpose should be assessed within this dual assurance/improvement framework. In respect of the FSR role, the success, or otherwise, of the FSR in achieving these dual objectives has previously been interrogated by studying the work of the FSR via reports and publications primarily emanating from the FSR's office (McCartney & Amoako, 2018, 2019). But whether the role is fit for purpose is dependent upon both the ability of the Regulator to execute the role (duties) of the FSR and the correlation between these duties and the achievement of the aims of regulation. Whether the FSR is effective or not can thus be gauged by examination simply of the actions of the Regulator alone but rather whether those actions achieve outcomes against the purpose for which regulation was created.

Scrutiny of the work of the Regulator is thus insufficient to gain evidence of regulatory effectiveness, it requires evidence of impact upon the work of individual FSPs. For instance, has the regulation led to FSPs adopting the FSR codes,[3] and gaining and maintaining accreditation? Are quality failures now minimized, and reported upon and remedied when they do occur? Are improvements to quality service provision taking place through validation of forensic science methods? Have FSPs sought to improve their service delivery in response to regulation? To supplement public documents and publications, forensic scientists and other stakeholders were interviewed ($n = 18$), reporting that both the role and restrictions on the Regulator in executing the role, as well as external pressures, means that reforms are necessary to improve the effectiveness of regulation.

2 | THE FSR ROLE

2.1 | Rationale for the creation of the FSR role

Recommendations for regulating forensic science in England and Wales date back to, at least, the early 1990s. Some wrongful conviction cases in the 1970s and 1980s in which unreliable forensic evidence had played a part and had undermined public confidence in the criminal justice process led to the establishment of a Royal Commission on Criminal Justice in 1991. With respect to the role of forensic science and other expert evidence, chapter nine of the Commission's report in 1993 recommended the establishment of a Forensic Science Advisory Council (FSAC) with a broad range of responsibilities. These responsibilities included overseeing the training of, and accreditation forensic scientists, as well as creating a Code of Practice (Royal Commission on Criminal Justice, 1993, p. 144). After a series of reports by experts and government Working Groups further raised the need for regulation (Black, 2003; Kershaw, 2000), and following further forensic "failures," in particular in the Damilola Taylor investigation and prosecution, which led to widespread criticism, and further recommendations for forensic regulation (Rawley & Caddy, 2007), the Council for Registration of Forensic Practitioners (CRFP) was eventually established in 1999. The CRFP encountered significant problems, and in 2005, a House of Commons Science and Technology Committee again recommended the creation of

an FSAC to "oversee the regulation of the forensic science market and provide independent and impartial advice on forensic science." (House of Commons Science and Technology Committee, 2005, p. 28). This was also prompted by the increasing commercialization of forensic science which had been initiated by two key changes in forensic service provision in England and Wales in the 1990s. These were the conversion of the Forensic Science Service (FSS) as an executive agency of the Home Office and the introduction of direct charging for FSSs which led to competition between the FSS and private FSPs for forensic service supply to police forces. The Government in 2007, rejected the recommendation for an FSAC and instead created the FSR as an independent regulator for the quality of forensic service provision. Even though the Regulator was never created with the capacity or remit to regulate the forensic "market," it was welcomed as an improvement on the CRFP, which alone was insufficient to regulate the evolving and changing forensic science landscape, and was closed down soon after in 2009. The view in support of the introduction of the FSR role explained that:

> "Modern regulation of practitioner competence must take place in...the quality standards framework that is being developed to regulate quality standards at three levels: provider (all law enforcement and commercial suppliers of forensic services), practitioner and method (forensic science techniques). Assessment of practitioner competence is best achieved as part of an assessment of standards across-the-board, not as a stand-alone evaluation. The recommendation is for regulation of practitioner competence to be integrated into the accreditation of broader standards." (Forensic Science Regulator, 2009, p. 6)

While some had argued that the registration of practitioners did create, maintain, and promote public confidence in the use of forensic science (Jamieson & Kershaw, 2000), the CRFP register could never wholly achieve this purpose however, due to the voluntariness of registration and ultimately, lack of sufficient funding, as hopes for the Council to become financially independent could not be realized through membership registration fees (Flanagan, 2018; Sommer, 2011). The CRFP's focus on "regulating" individual forensic science practitioners but not the organizations and the delivery of forensic science, stemmed from a belief that once the standards and values of individual forensic practitioners are set (and stay) high, the way an employer organizes and manages work becomes a secondary issue (Jamieson & Kershaw, 2000). This belief is perhaps understandable given that historically, criticisms of forensic science failings have focused on individual practitioners. However, as the landscape of forensic service provision was expanding and changing, it became clear that the CRFP was alone insufficient as a regulatory framework.

Expert reviews made recommendations about the remit, responsibilities, and management of the FSR (Rawley & Caddy, 2007). The FSR has been given a broader remit, encompassing oversight for the processes carried out within FSPs which affect the quality of the FSSs provided and new scientific techniques introduced in or adopted by FSPs before those techniques are introduced. In the complex landscape of FSS provision in the United Kingdom, comprising police forces, private FSPs, (from multi-national companies to sole traders/consultants), and other public organizations (public laboratories/universities, etc.), it is the role of the FSR to ensure that all providers are bound by the same regulatory requirements regardless of status. The vision of the FSR, as of 2009, was for forensic science to be delivered to the CJS that consistently meet high-quality standards and integrity expected by the courts and the general public. To achieve this, the Regulator was to provide direction and unity of approach to achieving forensic science quality standards across the United Kingdom; place quality at the center of all forensic science activities; and create a quality standards framework around the full range of forensic processes (Rennison, 2009).

3 | HOW TO ASSESS WHETHER THE FSR IS "FIT FOR PURPOSE"?

The first business plan of the FSR stated that "the purpose of the FSR is to support and enhance the important contribution made by suppliers of forensic science services to the effectiveness of the [CJS]" (Rennison, 2008, p. 1). In our opinion, this was in line with the FSR's vision and was commensurate with the fact that in the delivery of FSSs to the CJS by FSPs, the Regulator can only support FSPs to ensure that the services they deliver will meet the required level of quality. This view has recently been reiterated that "to ensure we have effective scrutiny [of scientific evidence] and to ensure that the public retains confidence in the [criminal justice] system we must make sure we see the regulations and rules as supportive not superfluous".[4] In what appears a slight variation in the purpose of the FSR, the second appointed Regulator in her first annual report recorded that "[t]he post of Forensic Science Regulator was established in order to ensure that the provision of forensic science and forensic pathology across the Criminal Justice System (CJS)

of England and Wales is subject to an appropriate regime of scientific quality standards" (Tully, 2015, p. 4). Thus, what was initially recorded as the vision of the FSR is presently recorded as the purpose of the FSR.

Despite this slight variance, it is clear that the quality of forensic science is central to the FSR role, for which reason FSPs are required to comply with the regulator's quality standard requirements and guidelines. Quality is defined in the FSR Codes as the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs (The Forensic Science Regulator, 2020). To ascertain whether the FSR is achieving this "quality assurance" purpose will, therefore, require the knowledge and understanding of the stated or implied needs that forensic science (or FSPs) are expected to fulfill, ultimately, in the CJS and how this may have been affected by regulation.

In 2008, the Regulator set out the objectives of the CJS as far as the delivery of forensic services by all FSPs is concerned (Table 1). According to the FSR, the objectives of the FSR set by the Secretary of State for the Home Department (Table 2) were in support of these overarching objectives (Forensic Science Regulator, 2013; Rennison, 2008). In our opinion, despite the slight amendment of the purpose of the FSR in recent years, this has not made the objectives for forensic service delivery originally set out by the FSR any less relevant. As far as the objectives of the Criminal Procedure Rules (CPR) for expert evidence (Part 19) and (efficient) case management (Part 3) are concerned, the information in Table 1 is far-reaching and as relevant as today in setting objectives for FSPs. Most importantly, the FSR Codes and other regulatory guidelines set the requirements for how FSPs should meet these criminal justice objectives, including professional standards and conduct; reliability; integrity; impartiality; and accuracy of the work of FSPs throughout the process of forensic service provision. This relationship between the FSR role and the information in Table 1 makes the latter a relevant benchmark for tracing the impact of the Regulator's programme of work on the quality of forensics science at the level of individual FSPs.

However, it is noted that the FSR role was never intended to singularly deliver all forensic science quality objectives. Where structures, processes, and organizations existed to deliver any of the objectives of the FSR, the expectation was for the FSR to work through support and coordinated activities, where appropriate to achieve these objectives (Forensic Science Regulator, 2013; Rennison, 2008). Therefore, the impact of any agency or existing structures that deliver some of the objectives in Table 1 should be considered when gauging the effectiveness of the FSR role. This includes the impact of the

TABLE 1 Requirements of the CJS of FSPs and the FSR capacity to enhance/support FSPs

The CJS Requires, of all FSPs	Is the FSR Role Effective in Enhancing/Supporting FSPs?
1. The delivery of forensic science services, using the appropriate available scientific techniques, according to the highest professional standards	The FSR has established uniform quality standards (FSR codes). However, neither the Regulator nor UKAS instruct FSPs as to which scientific technique (method/procedure) is "most appropriate," so different FSPs can be accredited for the same work but use different techniques
2. With efficiency, integrity, impartiality, and accuracy at every stage throughout the process	The FSR can only establish and monitor quality standards at an organizational level; has limited remit over all the stages of the process; and has limited influence over "efficiency" as variables are outside FSR remit. FSPs are expected to develop their own procedures to ensure integrity, impartiality, and accuracy. We do not know whether these are effective because no evidence on the impact of the codes, but failures continue to be reported
3. At a cost that represents best value for money, within timescales that meet operational needs	The FSR has no input over contracting so limited influence over cost or time-scales. However, the requirements of accreditation place a cost burden on all FSPs which also impacts upon costs and timescales of individual FSPs. Thus, the cost of accreditation is a serious consideration and some FSPs have found it prohibitively expensive
4. Reflecting an understanding of the needs of the specific customer and the requirements of the CJS as a whole	The "needs" of the CJS can be overborne by contractual requirements (most often with police forces who set their requirements as "customer"). May not be alignment between the customer and CJS needs and police procurement of commoditized forensic analysis indicates a divergence between the needs of the customer and the requirements of the CJS
5. Maintaining and enhancing public confidence in the quality and reliability of forensic science in the CJS	Meeting the first four requirements should secure public confidence. The FSR role cannot assure quality/reliability by simply establishing and monitoring standards and "persuading" FSPs to seek and maintain accreditation. Structural defects in the current marketplace, from the crime scene to court, may militate against the quality of forensic science more than the Regulator's role can counteract

TABLE 2 The objectives of the FSR and whether the role enables the FSR to meet these objectives

Objectives of the FSR	Can the Regulator Fulfill These Objectives?
1. To establish, and monitor compliance with, quality standards in the provision of forensic science services to the police service and the wider CJS	Has established quality standards (at organizational level) for many disciplines/techniques, but some forensic science provision continues without adherence to FSR standards
2. To ensure the accreditation of those supplying forensic science services to the police, including in-house police services and forensic suppliers to the wider CJS	Currently, no powers to enforce accreditation so FSPs can operate outside of regulation
3. To set and monitor compliance with, quality standards applying to national forensic science intelligence databases, beginning with the National DNA Database (NDNAD) and the National Ballistics Intelligence System (NBIS) and extending to others as they arise	FSR does have standards for forensic DBs, but the role entails some overlap with other bodies involved in oversight of these forensic DBs, delineation of exact roles lacking clarity in some instances which can lead to confusion
4. To provide advice to ministers, CJS organizations, suppliers and others as seems appropriate, on matters related to quality standards in forensic science	FSR provides advice, but confusion over role and frustration at apparent inability to address all concerns over forensic science quality since inception
5. To deal with complaints from stakeholders and members of the public in relation to quality standards in the provision of forensic science services	FSR role (now) improved capacity (whistle-blower line) but the unclear extent of under-reporting. "Scandals" demonstrate quality still an issue. Efforts to address with "lessons learnt"

forensic science marketplace which (may) deliver cost and service delivery objectives. The Crown Prosecution Service has also established five key requirements that demand FSPs to comply with the FSR Codes, accreditation, and other guidelines for efficient case management as required by the CPR, such as Disclosure and Streamlined Forensic Reporting (SFR) (The Crown Prosecution Service, n.d.). These requirements overlap with those set in the FSR Codes and other regulatory guidelines, such as the Regulator's Legal Obligation Guidance (Forensic Science Regulator, 2020). In our opinion, even though multiple requirements for FSPs set by different agencies pose difficulties, in terms of identifying and selecting the relevant benchmark to assess the quality of forensic science, overlaps between requirements reinforce the fact that several bodies have a role to play (including supporting the FSR role) to ensure that forensic services provided by FSPs will continually meet the needs of the CJS.

Assessing whether the FSR is fit for purpose is, therefore, complicated. Even where there are some agreed benchmarks or indicators for effective regulation, contentions arise with different assessments of their weight and relevance. One method commonly used for assessing regulatory effectiveness is "input-based" assessment. This probes issues such as how the FSR initiates and implements programmes and actions and the resources devoted to them. Stakeholder reports, including the FSR annual reports, provide information about the extent to which the Regulator is undertaking duties that may assist in achieving their objectives. Secondly, process or compliance-based assessments measure how individual FSPs comply with quality standard requirements, regulatory guidelines, and recommendations. While such measures are important, they are insufficient to demonstrate that the quality of forensic service provision has improved as a result of the regulation. What is lacking is an assessment of the extent to which the regulatory programmes (quality standards, accreditation, and investigation of quality failures) are achieving outcomes at the level of forensic science provision across all FSPs, and the extent to which these outcomes fulfill the purpose of the FSR. Less commonly undertaken, these outcome-based assessments are vital in linking regulatory outcomes to regulatory purposes, stressing the connection between regulatory action and effect on the ground (Baldwin, Cave, & Lodge, 2012). There is currently a gap in knowledge about the impact that forensic regulation in the United Kingdom is actually having on the quality of forensic science (Tully, 2019). Using public data, supplemented by interviews with FSS providers, we outline here the five demands made of FSPs in delivering FSSs to the CJS and the five objectives of the FSR to support and enhance the ability of FSPs to meet these demands, as set out in this first FSR business report. We provide a prefatory commentary on whether the FSR is "fit for purpose". Finally, we summarize brief note "inhibitors" that are preventing the FSR from being more effective.

3.1 | Does the FSR assist FSPs in meeting their demands?

Table one details what the CJS requires of FSPs, as set out in the first FSR business plan, and considers whether the FSR can support and enhance the ability of FSPs to meet these requirements.

3.1.1 | The delivery of forensic science services, using the appropriate available scientific techniques, according to the highest professional standards

Any measure of effectiveness must capture the extent to which the FSR is impacting the development, and use of appropriate scientific techniques across FSPs. Although the FSR Codes have been developed, these set the requirements for quality management systems for FSPs, these are not "best practice" procedures, protocols, or methods for forensic service provision (Wilson-Wilde, 2018). Individual FSPs can develop their own "standard operating procedures" (SOPs) that conform to the relevant requirements in the Codes, however, their accreditation by United Kingdom Accreditation Service (UKAS) does not necessarily mean that an individual FSP is using the "most appropriate" scientific technique. Different FSPs providing the same FSS can be accredited to the same quality standard but use different validated methods and procedures. Whether FSPs are reaching the "highest professional standards" would require ongoing monitoring and regular inspections and peer review of processes, which are beyond the capacity of the FSR.

3.1.2 | With efficiency, integrity, impartiality, and accuracy at every stage throughout the process

Neither quality standards nor accreditation to the FSR Codes is reliably indicative of the "efficiency, integrity, impartiality, and accuracy" of forensic science. The FSR can only establish standards at an organizational level and has very limited remit over all stages of the process (i.e., does not yet cover crime scene analysis, submissions, expert evidence presentation at court, or many other important elements of the "process"). The FSR also has limited influence over "efficiency" as variables that dictate this are again outside FSR remit. FSPs are expected to develop their own procedures to ensure integrity, impartiality, and accuracy, and oversee the work of their employees. Given reports of management failings within police forces (Evans, 2018) and at Randox Testing Service (BBC News, 2018), we know that failures to supervise staff occur even within accredited organizations. While the Regulator has this as a high-priority area to look into, failures continue to be reported.

3.1.3 | At a cost which represents best value for money, within timescales which meet operational needs

The FSR has no input into the procurement of FSSs in the marketplace, and, so has limited influence over the cost or timescales of forensic service delivery. However, the cost of accreditation impacts the delivery costs of FSPs, and private FSPs may not be achieving a return on investment, forcing them to leave the market or ceasing some services. Accreditation has thus added to the financial costs of FSPs, many of whom have left the market and others who continue to face significant financial problems (mitigating regulatory actions improving quality).

3.1.4 | Reflecting an understanding of the needs of the specific customer and the requirements of the CJS as a whole

The FSR Codes and other regulatory guidance documents, such as the "Legal Obligation Guidance" have been developed in line with the requirements in the Criminal Procedure Rules and Criminal Procedure Directions (Part 19). Hence, these documents may reflect the "needs" of the CJS. However, the "needs" of the CJS can be largely overborne by contractual requirements, most often with police forces who will set out their requirements as the "specific customer." There may not always be alignment between this "customer" and CJS needs, which encompasses more interested parties than simply the police

(i.e., the defense). For example, defects in SFR and police procurement of commoditized forensic analysis indicates a clear divergence between the needs of customer and the requirements of the CJS (see McCartney & Amoako, 2019).

3.1.5 | Maintaining and enhancing public confidence in the quality and reliability of forensic science in the CJS

Overall, meeting these four objectives above should secure public confidence forensic science in the CJS. Yet the FSR role cannot assure quality and reliability by simply establishing and monitoring standards and "persuading" FSPs to seek and maintain accreditation (McCartney & Amoako, 2019). It can be seen in respect of the first four requirements, that the FSR is often poorly placed to enhance and support FSPs to meet all these requirements. Structural defects in the current marketplace provision of forensic service, from the crime scene to court, militates the regulatory actions to improve the quality of forensic science, perhaps making more of an impact than the Regulator's role can counteract. For instance, according to the Regulator, service provision contracts that require FSPs to include abbreviated reports without additional charge pose risks where scientists are summoned to give evidence without having had the opportunity to go through the formal process of developing a scientifically supported inference that has been appropriately peer-reviewed (Tully, 2019, p. 35).

3.2 | Does the FSR meet their objectives?

3.2.1 | To establish, and monitor compliance with, quality standards in the provision of forensic science services to the police service and the wider CJS

Prior to the creation of the FSR, quality standards for forensic service provision were managed through different approaches (House of Commons Science and Technology Committee, 2011, p. 168). In addition to the registration of some forensic practitioners by the CRFP, the FSS and the major private laboratories by then had their own quality assurance systems incorporated into accreditation by the UKAS. However, UKAS did not require the specified standards, such as for the accuracy and precision in analytical measurement and activities outside the laboratory, and each laboratory defined its own standards, resulting in no uniform standard for forensic analysis across the board of FSPs (Gough, 1997). Thus, establishing the FSR Codes of Practice and Conduct as a single framework of quality standard requirements for the accreditation of all FSPs is a positive achievement, as it creates a level playing field for accreditation and standards for forensic service provision. Yet failures to achieve full accreditation across the board have continued to cause the FSR problems, with some FSPs providing forensic services without being accredited to the FSR standards, and some areas remaining without specific standards (e.g., digital forensics). The FSR annual reports show that the number of FSPs gaining or maintaining accreditation is increasing but satisfactory progress against accreditation deadlines has been difficult. This is being partially addressed over time, but still fuels the demand for statutory powers to make accreditation mandatory and the FSR has (partial) enforcement powers in the Forensic Science Regulator Bill.[5] There are also increasing numbers of quality failures being reported to the FSR, showing that some FSPs are compliant with regulatory requirements to report, albeit failures are still occurring.

3.2.2 | To ensure the accreditation of those supplying forensic science services to the police, including in-house police services and forensic suppliers to the wider CJS

The benefit of accreditation to ISO quality standards is derived from how the accreditation process can be used to drive improvements across the organization, including positive impacts on customer satisfaction, employee satisfaction, laboratory performance, and competitive advantage (Karthiyayini & Rajendran, 2017). The impact on laboratory processes can be ascertained through laboratories' throughput time; technical flexibility; coordination of activities; quality of product specifications; internal delivery performance; external delivery performance; and efficiency (Singels, Ruël, & Water, 2001). Performance indicators based on crime scene activities and evidence dissemination to customers are also suggested (King & Maguire, 2009). These include FSPs ability to properly examine crime scenes and process evidence; produce accurate forensic analysis and results; and disseminate forensic results in a clear digestible manner.

However, evidence of effectiveness that the FSR Codes are ensuring consistency of quality, and the maintenance of high-quality general and discipline-specific forensic science procedures across FSPs are still scarce, and the Codes are not comprehensive across the entire criminal process. With recent cases of quality failures occurring even in accredited FSPs, assessment of the effectiveness of the FSR should determine whether or not FSPs may be complying with the FSR accreditation requirements for their instrumental value (to secure contracts) rather than (or in addition to) the substantive value for changing operations and procedures to improve service delivery performance (King & Maguire, 2009).

The accreditation process is undertaken by UKAS (not the FSR directly), and can be prohibitively expensive, and time-consuming. Accreditation in general provides a snapshot of a laboratory's operations at a specific point in time and cannot guarantee that the quality of work would be produced at the same level of standard—the level can improve, remain the same or reduce (Jones, 2016). However, where accreditation is maintained for several cycles, this should ensure that a minimum standard of practice is established and that methods are properly documented, properly performed, and reliably reported (Jones, 2016). Thus, in addition to counting the number of FSPs gaining accreditation, the measurement of effectiveness should also capture a much broader range of variation in the work of FSPs over time, to verify claims of the importance of quality standards and accreditation, such as providing transparency of and confidence in the systems, services, and products of FSPs (Ross & Davey, 2016).

In addition, FSPs abiding by the same quality standard requirements is not an end of itself but rather a means of achieving the goal of quality forensic service provision. How they fulfill the requirements can also vary (see Section 3.1.1). Whether voluntary or mandatory, backed up by statutory penalties, regulation, and enforcement of accreditation is expected to promote good practice for FSPs, including a positive influence on organizational culture and the individual work ethos of FSPs. However, if regulation and accreditation are too onerous, expensive, and not viewed as necessary, then the cost of accreditation can be prohibitive such that it will risk the importance of accreditation as a means to invoke learning and promote continuous improvement (Rankin & Thompson, 2016; Wilson, Gahan, Robertson, & Lennard, 2018).

3.2.3 | To set and monitor compliance with, quality standards applying to national forensic science intelligence databases, beginning with the National DNA Database (NDNAD) and the National Ballistics Intelligence System (NBIS) and extending to others as they arise

The FSR does have standards for these forensic databases, but this role entails some overlap with other bodies involved in oversight of these, and delineation of exact roles is lacking clarity in some instances.

3.2.4 | To provide advice to ministers, CJS organizations, suppliers and others as seems appropriate, on matters related to quality standards in forensic science

The FSR continues to provide advice and has fed into major inquiries on forensic science, as well as other matters touching upon forensic science. There is still apparent confusion over the FSR role, however (such as whether the FSR should be involved in issues around areas such as Automated Facial Recognition) and frustration at the apparent inability of the FSR to address all concerns over forensic science quality. This frustration was made clear in the House of Lords 2019 inquiry, where it was made evident that the FSR role was limited, requiring many more witnesses and experts to provide evidence to the inquiry committee.

3.2.5 | To deal with complaints from stakeholders and members of the public in relation to quality standards in the provision of forensic science services

The FSR role now has improved capacity with the introduction of a "whistle-blower hotline," but it remains unclear the extent of under-reporting of failures, even though reports continue to increase (which could show a positive willingness to report—which is a good outcome—or could show that regulation is failing to improve standards as failures are increasing—a bad outcome). Recent "scandals" have demonstrated that quality failures are still an issue albeit the FSR

is addressing failures with the addition of public "lessons learnt"; reports on failure investigations and how lessons should be shared across FSPs.

4 | THE EFFECTIVENESS OF THE REGULATOR: INHIBITORS

In the United Kingdom, the demand for "quality forensic science" by the CJS, should be a yardstick for assessing whether the work of FSPs is of good quality (in addition to scientific validity/reliability criteria). Given that the FSR plays an intermediary role for this achievement of quality across FSPs, the effectiveness of the FSR should be evidenced by how its programme of work impacts the delivery of forensic service by FSPs. As we saw in the previous section, effectiveness in this regard is often limited. This gap persists despite expectations of the FSR, including to reduce the risk of quality failings impeding or preventing the identification, prosecution, and conviction of offenders, by establishing, and enforcing, quality standards for forensic science used in the investigation and prosecution of crime (Rennison, 2008, p. 19). Interrogation of the role reveals a worrying lack of data about the impact of the FSR quality standards on the quality of forensic science. The knowledge about the capacity of the FSR to exert a powerful influence over the ability of FSPs to meet the demands of the CJS is still lacking.

More often, there are external drivers that may have a greater impact on FSPs. For instance, SFR which was introduced as a solution to delays and cost is reportedly achieving cost purpose, however, this simultaneously introduces new risks of misrepresentation, misunderstanding, and mistakes of forensic evidence (Edmond, Carr, & Piasecki, 2018). The adverse implications of SFR on the quality and the interest of the FSR role are extensively discussed by the FSR (Tully, 2017, 2020). While new guidance for SFR has been introduced to address some challenges, overall, the adverse impact of SFR exemplifies a situation where solutions to certain problems simultaneously create other tensions elsewhere in the complex interdependent system of the CJS. A critical aspect of the capacity of the appointed Regulator to perform the role is the institutional design, funding, and workforce devoted to the FSR. However, the Regulator has regularly faced budget cuts, despite facing an ever-greater number of quality-related referrals and ongoing support required for FSPs working toward achieving the quality standards (Tully, 2020). Appropriate workforce capacity, institutional structures and a remit that stretches from end-to-end of the forensic process, and adequate funding are essential if the FSR is expected to improve the quality of forensic science.

Most importantly, the impact of the forensic marketplace to date has largely been detrimental to the quality of forensic science in the United Kingdom and continues to threaten quality, annulling the interest in, and the work of the FSR. For instance, even though it is in the interests of the FSR that FSPs or practitioners who have not adopted the relevant quality standards will not be routinely instructed, reports suggest otherwise (Tully, 2018, p. 23). In its review of FSS provision in 1993, the Royal Commission on Criminal Justice foresaw competition in forensic service provision as a way of ensuring that the charges made by public sector laboratories were reasonable and the services met customer needs. In recommending the creation of an FSAC, one of the remits of a Council would have been to ensure that undue competitiveness did not lead to a diminution in standards (Royal Commission on Criminal Justice, 1993, p. 148). However, the role of the FSR "concerns only quality standards...and have no remit to regulate the market for forensic science" (Tully, 2018, p. 29). The regulation of the forensic "market" is left to the dynamics of police procurement frameworks, charging mechanisms, and competition between private FSPs. Police forces, either individually or as part of regional consortia, are expected to demand higher standards as part of their procurement processes when purchasing forensic services (House of Commons Science and Technology Committee, 2005, p. 28). During procurement, there is often a requirement for FSPs to be accredited to relevant standards, thus FSR quality standards can influence contracting, but accreditation is not always a requirement and there are reports of some FSPs and individual practitioners who have not adopted the relevant quality standards being instructed to provide services. Continuing cuts to police spending means FSSs are commissioned as commoditized products, driven by price. Several reviews of the forensic marketplace indicate that more forensic services have been moved by police "in-house" where accreditation is rarer (Lawless, 2010, 2011).

The forensic science marketplace is also increasingly fragile. Competition between FSPs has resulted in price reductions of forensic analyses, improvements in the turnaround times for forensic tests, and improvements in the quality of the work (Bandy & Hartley, 2018). However, others express a contrary view that commercialization has led to a decline in standards (Doyle, 2020) and threatens the collapse of private provision entirely if FSPs cannot be financially sustained. Consequently, the market is unattractive to potential investors, and "bargain basement" forensics work against high-quality forensic services (Walport, 2015). There are also quality-related consequences due to wider

structural failings, such as the introduction of SFR and the cuts to Legal Aid both of which negatively impact upon primarily defense forensic science. A question remaining, therefore, is whether the FSR role allows the appointed Regulator to meet their objectives given these external pressures. Careful consideration should be given to how the framework of the FSR is integrated into the end-to-end criminal justice process. Providing statutory regulatory powers for the FSR to enforce accreditation is arguably only a partial answer. The environmental conditions of forensic service provision should ensure that relevant reforms to the FSR that ensure the sustainability of FSPs and not further risk their survival in the market, and encourage high-quality provision.

5 | CONCLUSION

To contribute to the provision of forensic science service that meets the requirements of the CJS, the FSR requires all FSPs to comply with the FSR Codes and guidelines. The FSR should thus be able to demonstrate the extent to which regulatory actions are impacting forensic service delivery. Yet information on the outcome-oriented impact of the FSR is scarce and often only indirectly related to the actual work of the FSR, while scrutiny of the work of the Regulator via their annual reports is insufficient to gain evidence of regulatory effectiveness. Notwithstanding, determining the effectiveness of the FSR is vital. Based on the CJS' requirement for quality forensic science, measures of regulatory effectiveness should shift from input and compliance-based assessment to outcome-based assessment. From this, relevant benchmarks and indicators must be identified that enable assessment of whether the FSR is able to assure and improve the quality of forensic science. Evidence of outcome-oriented impact should also provide support for the necessity of regulatory activities and any potential reforms to improve regulation (such as the FSR Bill). Bare numbers of quality standards developed, and FSPs gaining accreditation, whether they show an increase or decrease, hides a far more complex picture about the quality of the work of FSPs and the effectiveness of the FSR. The prefatory commentary here aims to throw some light on whether the quality standard requirements and regulatory activities are able to make an impact. The effectiveness of the Regulator should also then inform how the FSR role is best framed, and resourced, including the capacity to counteract the negative effects of structural defects in the forensic science sector which impact upon quality. These structural defects and external pressures, in addition to the limitations of the Regulator's role means there is only limited capacity to execute the role in an effective manner. Wider reforms are thus necessary to improve the effectiveness of regulation.

AUTHOR CONTRIBUTIONS

Emmanuel Amoako: Conceptualization; formal analysis; investigation; methodology; project administration; writing-original draft; writing-review and editing. **Carole McCartney:** Conceptualization; methodology; supervision; writing-original draft; writing-review and editing.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

CONFLICT OF INTEREST

The authors have declared no conflicts of interest for this article.

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ENDNOTES

[1] We use the term “forensic science regulation” very broadly and not simply as a synonym for the FSR.

[2] The FSR role is confined to England and Wales. However, both Scotland and Northern Ireland, through their respective forensic science authorities have agreed to adopt the Regulator's quality standards; and collaborate with the Regulator in the establishment of the quality standards. The respective authorities from both jurisdictions have joined the advisory groups of the regulator.

[3] The FSR Codes of Practice and Conduct (the Codes) detail the standards and norms of practice that should be adhered to by all forensic science practitioners.

[4] See Rt Hon Sir Brian Leveson's (President of the Queen's Bench Division and Head of Criminal Justice) speech at the Forensic Science Regulator's 2018 Annual Conference. Available at: https://www.gov.uk/government/speeches/sir-brian-leveson-speech-at-the-forensic-science-regulator-annual-conference.

[5] This Bill is not discussed here, albeit it would potentially alter the effectiveness of the FSR, were it to come into effect. However, the real impact is unclear and remains questionable, and may have other negative consequences.

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