



## Fit for purpose quality management system for military forensic exploitation



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### ARTICLE INFO

#### Article history:

Received 3 November 2017

Accepted 4 January 2018

Available online 12 January 2018

#### Keywords:

System failure

Standards

Accreditation

Competency

Quality culture

Innovation

### ABSTRACT

In a previous publication we described a systems approach to forensic science applied in the military domain. The forensic science 'system of systems' describes forensic science as a sub-system in the larger criminal justice, law enforcement, intelligence, and military systems, with quality management being an important supporting system. Quality management systems help to ensure that organisations achieve their objective and continually improve their capability. Components of forensic science quality management systems can include standardisation of processes, accreditation of facilities to national/international standards, and certification of personnel. A fit for purpose quality management system should be balanced to allow organisations to meet objectives, provide continuous improvement; mitigate risk; and impart a positive quality culture. Considerable attention over the last decades has been given to the need for forensic science quality management systems to meet criminal justice and law enforcement objectives. More recently, the need for the forensic quality management systems to meet forensic intelligence objectives has been considered. This paper, for the first time, discusses the need for a fit for purpose quality management system for military forensic exploitation.

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## 1. Introduction

In a previous publication [1] we outlined a systems approach to forensic science applied in the military domain. The forensic science 'system of systems' describes forensic science as a sub-system in the larger criminal justice, law enforcement, intelligence, and military systems. Supporting systems, such as quality management and risk management, are important components of the forensic science system of systems. An advantage of describing forensic science as a system of systems is that it has built-in redundancies, which provides a mechanism for organisations to mitigate against critical system failures. This paper expands on the system of systems approach and focuses on a fit for purpose military forensic quality management system.

### 1.1. Quality management systems

A quality management system is a set of policies, processes and procedures required for an organisation to meet its objectives and continually improve its capabilities [2]. The ISO 9000 series is the international standard that sets out the requirements for a quality management system and ISO 9001 sets out the quality management principles [3].

Critical system failures in the forensic science industry have resulted in miscarriage of justice and prompted reviews of forensic service delivery. These reviews have noted the importance of a forensic quality management system [4–13]. The National Academy of Science (NAS) Report on Strengthening Forensic Science in the United States: A Path Forward made 13 recommendations of which five related to quality management systems. Specifically, recommendation 8 was "that forensic laboratories establish routine quality assurance and quality control procedures to ensure the accuracy of forensic analyses and the work of forensic practitioners" [5].

A key recommendation from the NAS report was the establishment in the United States (US) of a National Institute of

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Forensic Science (NIFS) to address issues identified in the report [5]. While NIFS was never established due to financial constraints, some progress towards forensic quality management systems in the US has been made through the Subcommittee on Forensic Science, which operated until December 2012 [14], and the National Commission on Forensic Science (NCFS) from 2012 [15]. The US Attorney General has announced that the NCFS will not be renewed in favour of the appointment of a senior forensic adviser, efforts under an internal department crime task force, and a public comment period on advancing forensic science [16]. Until these new efforts have been articulated and implemented, it is unknown if they will address the recommendations in the NAS report.

The NAS report stressed that deficiencies in standardisation, certification of forensic practitioners and accreditation of facilities is impacting forensic quality [5]. A standard is “a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose” [17]. Standards are consensus documents that are not prescriptive and should not outline best practice, methodologies or set aspiration targets [18]. Application of ISO 9000 is not sufficient to meet forensic standards as there are additional forensic technical competencies that are not covered by the ISO 9000 series [19–23]. The most widely used standard in forensic science is ISO/IEC 17025 *General requirements for the competence of testing and calibration laboratories* [18,24]. The updated ISO 17025:2017 was published in November of 2017 [25] and the impact that the updated ISO 17025:2017 will have on the forensic industry will not be felt until the changes have been implemented and reviewed.

ISO/IEC 17020:2012 *Conformity assessment – Requirements for the operation of various types of bodies performing inspection* is applied to forensic crime scene investigation in some countries. The European Network of Forensic Science Institutes (ENFSI) has established guidelines for crime scene investigation based on ISO 17020 [26,27] and the United Kingdom (UK) Forensic Science Regulator is supporting implementation of ISO 17020 for the same discipline [28]. In Australia, accreditation to ISO 17020 was opposed by the forensic community due to the standard not covering assessment, which could occur at the crime scene or point of collection. The Australian accreditation body the National Association of Testing Authorities (NATA) does not accredit to ISO 17020 [24].

ISO 17025 and ISO 17020 are not specific to forensic science and have inherent limitations [18,24], which have been addressed by supplementary requirements produced by the International Laboratory Accreditation Cooperation (ILAC G19:08/2014) [24,29] and NATA [30]. In late 2000 in Australia, the now defunct Senior Managers of Australian and New Zealand Forensic Laboratories (SMANZFL) and the Australia New Zealand Policing Advisory Agency National Institute for Forensic Science (ANZPAA NIFS) pushed for Australian forensic science standards to further address the limitations of ISO 17025 when applied to forensic science [18,24]. The approach in Australia was to develop core forensic science standards, which includes Australian Standard (AS) 5388.1 Recognition, recording, recovery, transport and storage of material [19], AS 5388.2 Analysis and examination of material [20], AS 5388.3 Interpretation [21], and AS 5388.4 Reporting [22]. Under the Australian Standards forensic framework, the discipline specific standards refer to the core standards and do not repeat them [18,26].

The Australian approach to forensic science standards differs from the UK and US approach, which produce discipline specific standards [18]. In the US, a wide range of discipline specific standards have been produced by the ASTM International [31]. In the UK, the required quality standards for forensic science providers and practitioners in the criminal justice system are set out in detail in the codes of practice and conduct. The discipline

specific codes are practical guides on how to achieve the accepted standards. The codes of practice differ from standards in that they are not voluntary [32].

The UK House of Commons Select Committee Science and Technology Committee’s report “Forensic Science on Trial” recommended that a Forensic Science Advisory Council be established to act as a regulator of the forensic services market, and to provide a much needed overview of the process by which forensic science is used in the criminal justice system. This resulted in the creation of an independent forensic science regulator. The Science and Technology Committee urged the Government to provide the forensic science regulator with statutory powers to regulate and enforce forensic quality management systems. The UK Government has signalled its intent to provide statutory powers as soon as practicable [28,33]. The forensic science regulator has established timelines for all forensic service providers and practitioners in the UK to be compliant with the codes of practice through accreditation [32,34].

## 1.2. Accreditation

Accreditation of forensic science facilities is a voluntary program whereby a third party accreditation body reviews a facility’s quality management system. Accreditation bodies use standards documents to establish if the laboratory can competently perform the tests, examinations and measures for which accreditation is sought [35]. It is a means for formally recognising and promoting the competency of a forensic facility or field capability in relation to a specific activity. In Australia, NATA is the accreditation body and Australian forensic laboratories can now seek accreditation to ISO 17025 and AS 5388.1–4, with the Australian Federal Police (AFP) being the first organisation to be accredited against AS 5388.1–4. Under the NATA accreditation system, facilities must seek accreditation for all forensic tests that they conduct (i.e., it is a “one in, all in” approach) [36].

In Australia, forensic quality management has matured since the late 1990s, with the large majority of forensic providers to law enforcement and the criminal justice system being NATA accredited [24]. Reviews of the forensic industry [4–13] have recommended the need for forensic quality management systems; this recommendation is also applicable to the military forensic system. This provides the military with the opportunity to proactively review the need for fit for purpose forensic quality management systems, before there is a need as a result of critical system failures. The US Department of Defense has recognised the need to employ the highest forensic standards appropriate for the mission to ensure scientific objectivity, integrity, and quality [37,38]. The Australian Government Department of Defence does not currently conduct forensic exploitation operations under an integrated quality management system. The Defence Science and Technology (DST) Group has two laboratories at Fisherman’s Bend that are NATA accredited to ISO 17025. This includes the Air Division, Structures and Materials Test Centre, and the Land Division, Chemical Agents Analysis Facility [39]. The standards for these facilities are not integrated into the broader Australian Government Department of Defence (Defence) and there is a risk that if Defence does not operate under an integrated forensic quality management system then intelligence and potential prosecution objectives may be compromised.

Over the last decade, there has been considerable review of the need for quality management systems for forensic science delivery to law enforcement, the criminal justice system [4–13] and the intelligence system [40–42]. For the first time, this paper explores the need for a fit for purpose quality management system in the military domain to meet intelligence and potential prosecution objectives.

**2. Material and methods**

To inform a fit for purpose military forensic quality management system, data was collected through semi-structured interviews with relevant national and international organisations. Human research ethics to conduct the semi-structured interviews was approved by the University of Canberra Human Research Ethics Committee (HREC 16:178) and the Australian Government Department of Defence Low Risk Ethics Panel (DPR-LREP 032/16). A one-day table-top discussion exercise was held at DST Group on the 23rd February 2017, which explored an off-shore forensic operation. One of the key themes from the table-top discussion exercise was forensic quality management to support intelligence and potential prosecution objectives.

**3. Discussion**

In a previous publication [1], we proposed the need for military forensic exploitation to operate under a quality management system for forensic intelligence and potential criminal prosecution. This paper expands on this theme to articulate the characteristics of a fit for purpose forensic exploitation quality management system.

*3.1. Fit for purpose quality management system*

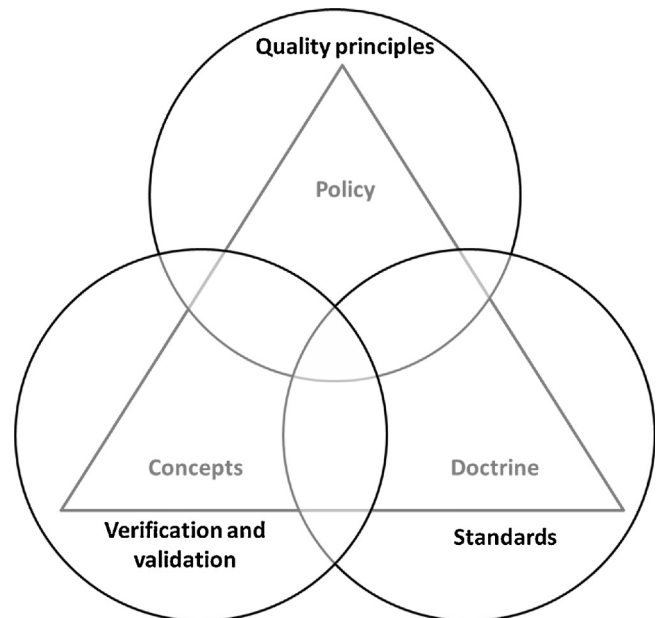
A fit for purpose quality management system should be balanced to allow organisations to meet objectives, provide continuous improvement, mitigate risk, and impart a positive quality culture. No organisation should implement an unachievable standard as this would ensure that the organisation never achieves its objectives. Overly complex and bureaucratic quality management systems can result in a negative impression of the quality management system and a negative quality culture within the organisation. When there is an appropriate balance between these elements then the quality management system should be fit for purpose (Table 1).

*3.2. Appropriate standards for military forensic exploitation*

The forensic standards landscape in Australia and internationally has focused primarily on the need for forensic quality management systems to support the criminal justice and law enforcement system. As such, the International and Australian standards do not consider military forensic principles and processes. Military organisations need to consider the appropriate standards to implement that enable them to achieve intelligence, law enforcement, and potential criminal justice objectives. The most appropriate standards for Defence to consider are ISO 17025

and AS 5388.1–4; however, these standards do not take into consideration military forensics and would need to be considered in the military context of strategic policy, doctrine and concepts.

Defence outlines the structure and management of the organisation in strategic policy, doctrine and concepts that meet established Government direction and military objectives. Defence strategic policy has legal standing and is prescribed in Defence Instructions. The purpose of policy is to state ‘what’ is to be done and not done, and informs the development of military concepts and doctrine. Military doctrine dictates fundamental principles by which military forces guide their actions in support of objectives [44]. Under a quality management system, doctrine sets the standards by providing the requirements, specifications, guidelines or characteristics that can be used consistently to support objectives [17]. Concepts are those untried and untested ideas about how the military thinks it may conduct operations in the medium to long term. A concept only becomes doctrine if it successfully completes a process of rigorous debate, systematic analysis and practical testing during both training and operations [44] (Fig. 1).



**Fig. 1.** Military quality management systems encompass policy, establish what should be done and should include quality principles. Doctrine, which outlines standard processes and concepts, are tested through verification and validation, often called testing and evaluation in the military context.

**Table 1**  
Fit for purpose quality management system.

Description	Fit for purpose	Not fit for purpose
Objective	Enables organisation to meet objectives.	Hampers organisation achieving its objectives.
Continuous improvement	Continuous improvement is one of the main principles of a quality management system. Implementation of a forensic quality management system that is flexible and adaptable will enable an organisation to be innovative.	Excessively complex and over engineered quality management systems are overly bureaucratic and impact on operational work. Gold-plating of standards prevents flexibility to respond to changes in the operating environment.
Risk management	Effective quality management systems work hand-in-hand with risk management and business planning processes [43]. Quality management systems should address appropriately identified risks.	A risk adverse culture can result in organisation risk avoidance rather than risk management and over reliance on the quality system as a risk treatment strategy.
Culture	Organisations with a mature quality culture ingrain quality into their day to day process and operations. Mature quality cultures do not require government enforcement and regulation. Organisations with a mature quality culture have sponsorship from the senior management (top down) and are implemented by relevant personnel (bottom up).	Quality management should not be a compliance exercise that is only addressed as part of an external accreditation process.

### 3.3. Is third party accreditation required in the military expeditionary context?

In Australia, the forensic science industry is not regulated by Government and quality management can be achieved in the absence of a formal third-party accreditation program. Organisations need to consider the cost/benefit from third-party accreditation to determine if accreditation will help them to achieve operational objectives and to continually improve capability. The cost/benefit of third-party accreditation needs to be assessed in line with relevant policy and legislation. For example, in Australia the requirement under section 1D of the *Crimes Act 1914* to be accredited in order to upload DNA profiles on to the National Criminal Investigation DNA Database (NCIDD) needs to be considered. If there is no cost/benefit to third-party accreditation of military forensic operations, then the organisation should consider implementation of a quality management system without third-party accreditation (Table 2).

### 3.4. Certification, proficiency testing, verification and validation

Irrespective of the accreditation status of a forensic facility, organisations need to be able to demonstrate quality through meeting the required standards, certification of personnel, proficiency testing, and implementation of a validation and verification programme.

The NAS Report recommended that certification be mandatory for forensic scientists and that no person should be allowed to practice or testify without certification. Certification is a process of peer review through which an individual practitioner is recognised as having attained the professional qualifications needed to practice in one or more disciplines and thus is an important component of a forensic quality management system [5]. Proficiency testing is part of the certification process to verify that the laboratory's technical procedures are valid and that the quality of work is being maintained [8]. Proficiency testing is required as part of a quality management system and should be conducted irrespective of the accreditation status of the facility.

The 2016 President's Council of Advisors on Science and Technology (PCAST) report noted that accreditation, certification, proficiency testing, and standardised protocols cannot substitute for validation and reliability of forensic evidence [6]. Validation of processes and procedures is required for all non-standard and laboratory developed methods, as well as standard methods used outside their intended scope. Validation provides objective evidence that the particular requirements for a specific intended use are fulfilled and the results can be relied on [9,23]. If a method has been validated in another organisation or at another facility

within an organisation then verification is undertaken to confirm that a method, process or device is fit (or remains fit) for the specific purpose intended [29,45]. Military organisations have a process of testing and evaluation of capabilities before they are introduced into service. In the forensic context, the military testing and evaluation process needs to be documented, limitations of tests reported, and processes for managing cognitive bias for subjective tests developed. Through forensic verification and validation programs, military concepts will become standard doctrine.

### 3.5. Implementation challenges for military forensic quality management system

In a previous publication we argued that the military forensic exploitation operating environment has inherent complexity but that this should not prevent the military forensic exploitation system working within a forensic quality management environment [1]. ISO 17025 and AS 5388 parts 1–4 do not take into consideration the military operational environment, which adds complexity to implementing a fit for purpose forensic quality management system in the military domain. The challenge for Defence will be to develop doctrine that is principle based and not overly proscriptive with respect to processes, but recognise accepted practices. A mechanism for Defence to achieve quality management is through considering a whole-of-government framework. Defence needs to consider the broader forensic system and could partner with law enforcement agencies through a memorandum of understanding (MOU) to consider the already established law enforcement quality protocols. This would enable Defence to implement a quality management system without the need to “reinvent the wheel”. The Australian law enforcement quality management system has matured over the last three decades and Defence can benefit from the forensic industry's experience with implementation of forensic quality management systems in the whole-of-government framework.

## 4. Conclusion

A fit for purpose quality management system should be balanced to allow organisations to meet objectives, provide continuous improvement, mitigate risk, and impart a positive quality culture. An Defence quality management system needs to consider policy that enables quality management principles, appropriate standards to form the bases of military forensic doctrine, and testing and evaluation programmes that meet the forensic verification and validation requirements. One of the mechanisms required to implement a military forensic quality

**Table 2**

Cost/benefit analysis of implementation of a third-party forensic accreditation program in the military domain.

Benefit	Cost/disadvantage
Professionalisation of the facility.	Cost of implementation and maintaining accreditation for each facility under the organisation's quality management system.
Assists organisation meeting objectives.	If the primary objective of the facility is intelligence, third-party accreditation may not be required to meet operational objectives.
Promotion of laboratory or field capability as an accredited facility.	National Association of Testing Authorities requires facilities to be accredited for all tests that they perform and reserve the right to inspect all facilities under the organisational quality management system. There is added complexity of accrediting expeditionary deployed forensic facilities that are established to meet operational imperatives.
Reporting under the accreditation body logo.	If the primary objective of the facility is intelligence, reporting under the accreditation body logo does not add value. In Australia, organisations can provide briefs of evidence from non-accredited facilities. Reports from non-accredited organisations require a demonstration that they are operating under a quality management system and thus the results can be relied upon.
Provides the criminal justice system with confidence in the forensic results.	Australian Standards and International Standards do not take into account military forensic operations and a third-party accreditation body may have difficulty accrediting military forensic facilities.

management system is the development of a quality manual, which can be facilitated through collaboration with law enforcement partners. In the military domain, a fit for purpose forensic science quality management system will meet intelligence and potential prosecution objectives without compromising timeliness of reporting or stifling innovation. In future papers, we will address the development of a forensic intelligence model, risk management, and biometrics system that, along with a quality management system, will support the forensic science system of systems.

### Funding

This work was supported by a Secretary of Defence Fellowship, Australian Government Department of Defence.

### Note

All views expressed are those of the authors and not necessarily of the Australian Government Department of Defence.

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