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## QUALITY MANAGEMENT SYSTEM IN FORENSIC LABORATORIES

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**Abstract:** Quality management system is important element of every working organization whether it deals with manufacturing material goods or giving services. Applying of quality system in forensic laboratory implies qualifying of the lab, commonality of the procedures in lab, defining of required working instruments, its calibration and verification, defining of qualified working profile for using those instruments, defining of the obligatory working procedures, etc. Application of quality system in processing of real evidence is one of the fundamental postulates for the validity of material evidence in court. This paper gives model of quality management system in forensic laboratories due to standard ISO/IEC 17025 as recognizing the competence of laboratories and accepting of testing and calibration results in all countries using this International Standard.

**Key words:** quality, quality management system, sample, forensic laboratory, validity of real evidence

### 1. Introduction

Quality management system is a sign post for all working procedures of one organization. The meaning of word “quality” is not just “good” or “the best”. It denotes the operative ability of organization for satisfying users requests of the services. It is evident that all of us are daily in contact with quality either as manufacturers (donors of services) or consumer (users of services). If we want a competitive organization at the market, there are the three most important business aspects which have to be compatible:

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1. the price of a product (service),
2. the quality of a product (service) and
3. the delivery terms of a product (service).

In the last decade, the theory and practice of quality management system have achieved tremendous changes in the world. These changes are in transition of relation with the demands of customers for quality. Nowadays, quality is the most important market factor and the basic element of being competitive. Perfection and excellence are standards of quality now. Satisfaction of consumers and other interested parties is ordinary and the accomplishment of new promises is aim which has to be realized. So, users of laboratory services require sharp and reliable laboratory results, the security of effective environmental management protection, health protection and the safety of employees, ergonomic, information and social systems in organization.

JUS ISO 9000 Standard gives the following definitions referring to quality system:

- Quality – the level which has to be achieved (demand or promise which are outspoken, implied and responsible);
- Quality management system – the management system which is used for leading of organization (from the quality aspect);
- Quality management – a part of quality management which is focused on satisfaction of quality demands;
- Quality assurance - a part of quality management which is focused on assurance of confidence that quality demands are achieved;
- Organization – an organized body; group of people, objects and equipment with retrieved responsibilities, authorization and relations;
- User – an organization or a person who gets a product;
- Deliverer – and organization or a person who delivers a product (goods);
- Process – a complex of activities which are in relevance and which simulate import elements in export elements;
- Product/service – the result of process.

## **2. Development of Quality Management System**

The need for quality and measuring of quality changes over time are present in all phases of integral management of quality. High specialization in science field intrudes integration of science knowledge in the development of product (service), with the goal to obtain the level of recent demands. The development of quality management system (QMS) cannot be achieved only by

using sophisticated machines, modern technology, automation, etc. Experience, knowledge and qualification of employees are also needed. The development of quality management system is in relation with the development of its segments which are involved in the control, measurements, standardization, defining of technology in quality management system.

Scientific research in natural and other sciences cannot be imagined without measurements. The abilities of scientists for research, analyzing and applying nature phenomena depends on the available measuring instruments and measuring techniques.

### **3. Quality Systems and Validity of Real Evidence in Criminal Proceedings**

The question of proving in criminal procedure is one of the most important and complex ones, but necessary for the correct and complete establishing of all legally relevant facts in order to attain truth. Proving is a set of activities directed towards correct and complete explanation of all legally relevant facts to reach the truth. This is the way how court reaches the decision in a concrete criminal matter. Actions which court undertakes in order to create belief about existence or nonexistence of facts that can have influence on its decision are called proving action or definition of the evidence in formal sense (Grubač, 2006). Definition of the evidence in material sense includes every proving foundation or reason that is contained in certain proving means which speak about the authenticity of some important facts for the proceeding (Grubač, 2006).

Nowadays evidence can be classified differently and this depends on the acceptance of the division criterion. For example, in foreign literature evidence is categorized into the two groups: the ways in which evidence can be proved and the main evidential rules. Evidence can be proved in the following ways: original (primary) evidence, real evidence, secondary and documentary evidence. For the purpose of this paper we will consider real evidence. Real evidence usually takes the form of a material object for inspection by the court. This evidence is to prove, either that the material object in question exists, or to enable the court to draw an inference from its own observation as to the object's value and physical condition (Johnston & Hutton, 2005).

Real evidence is known as scientific or forensic evidence which is accompanied by expert testimony, or expert witnesses (Brandl, 2004).

No matter what kind of evidence, each piece of evidence must fulfill certain standards in order to be admissible in court. This is particularly important for real evidence. There is clear and precise procedure that regulates how to handle real evidence, from the identification of clues at the crime scene to their pres-

entation in the criminal proceedings. To use physical evidence in a criminal or civil trial, the party offering the evidence has the burden of proving that the evidence is genuine and authentic. This requires testimony establishing an adequate foundation about where and how the object was obtained and that the object offered in evidence is the object that it is claimed to be. If the evidence could be subject to alteration by tampering, substitution, or contamination, a chain of custody must be shown (Zarkovic, Bjelovuk, & Kesic, 2008). This requires that all persons who had possession of the evidence must appear as witnesses to testify that the evidence had not been tampered with, substituted, or contaminated while the witness had custody and control of the evidence (Gardner&Anderson, 2004).

One way in which the law tries to ensure the integrity of evidence is by requiring proof of the chain of custody by the party who is seeking to introduce a particular piece of evidence. A proper chain of custody requires three types of testimony:

1. Testimony that a piece of evidence is what it purports to be;
2. Testimony of continuous possession by each individual who has had possession of the evidence from the time it is seized until the time it is presented in court, and
3. Testimony by each person who has had possession that the particular piece of evidence remained in substantially the same condition from the moment one person took possession until the moment that person released the evidence into the custody of another.

Proving chain of custody is necessary to “lay a foundation” for the evidence in question, by showing the absence of alteration, substitution, or change of condition. Whether the requisite foundation has been laid to establish chain of custody for an exhibit is a matter of discretion on the part of the trial judge. Possibilities of misidentification and adulteration must be eliminated, not absolutely, but as a matter of reasonable probability.

Besides that, handling forensic evidence is very important issue for the forensic laboratory accreditation process. Forensic laboratory must have accurate records of chain of custody. In order to meet the standard of quality control required for accreditation, the forensic laboratory immediately needs to document how evidence will be controlled in and out of the evidence/property room and to appoint Property Officer. Create and implement a policy to question, document and resolve where possible, any gaps in location of evidence before signing the next chain of custody entry. Duplicate logs should not be permitted.

The forensic laboratory should write procedures that require all evidence be locked in an examiner’s locked bench storage cabinet while not being handled

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during the testing process, or returned to the Property Room. All the examiners must sign the chain of custody record before further identifying the quality and quantity of drugs and controlled substances. It must be determined what type of evidence the laboratory will store temporarily and what it will store permanently. Clients must be informed about this policy and about special storage arrangements when evidence is returned to their jurisdiction. Generally, every laboratory must have a chain of custody record, with clear procedures and control to ensure the records are accurate. Everything we mentioned above is important to apply in practice to increase the reliability of real evidence in criminal courts.

#### **4. Quality System Applications in Forensic Laboratories**

*The European Network of Forensic Science (ENFSI)* was established in 1992. The main aim of the ENFSI is quality assurance of forensic labs, exchange of experiences and information in forensic field at science meetings, working group activities, special workshops, etc. The ENFSI has developed successfully from its beginning. The 56 laboratories come from 32 countries, geographically spread across Europe, including countries of the European Union as well as nearly all the EU candidates: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, the Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovenia, Slovakia, Spain, Sweden, Switzerland, Turkey, Ukraine and the United Kingdom. The importance of quality assurance is recognized in specialized forensic laboratories. So, the ENFSI has certain demands towards its members. Credibility and reliability of lab results are key items in trajectory of real evidence from crime scene to the court. Forensic laboratories, as the other laboratories who are dealing with similar examinations have to be accredited according to ISO/IEC 17025 standard.

*The Quality and Competence Committee* of the ENFSI is the one which is responsible for defining and application of quality management system. The Committee gives references for making the field handouts for forensic practitioner proceedings at the crime scene and in the lab, validity of applying laboratory methods, development of conscience that there is a need of the international quality system and the existence of international standards which have to be achieved and that the forensic labs have to be accredited. The Committee is also responsible for: the control of using the most sophisticated equipment and computer technology; use of the best sampling techniques at the scene; doing the field manuals related to the reliability of used measuring system; the

development of the strategy of communication and exchanging of experiences between the labs in Europe and in the world. The aim is to assure consequent and reliable real evidence at the court. The real evidence has to be based on science principles from the beginning: from the scene to the courtroom. That is why it is important to apply standards according to the lab working and accreditation of those labs. Nowadays, there is no reliable information how far the ENFSI members achieved control of lab personnel competence and accreditation of the labs. Some members of the ENFSI have already accredited their labs and some others have not done it yet, but they are on a good way to do so. The situation is different from one country to another. Each country has specific instruments. Some of them have sophisticated instruments, some of them not. For instance, some of them have SEM/EDX, some of them not. Some of them have sophisticated instruments for projectile speed measurement, some of them not. Each country has its own level of calibration of instruments. Each country has specific problems with spending recourses, references, etc. The accreditation of a forensic lab implies the presence of common instruments for specific researches and tests such as special microscopes, scales, equipment for chromatography, DNA and other analysis, competence of personnel (the appropriate value of a university degree, the attendance of special trainings and seminars, the presence of standard operating procedures and test methods, calibration and verification of methods, etc.). Calibration certificates for measuring instruments give the measurement deviation, or correction, and the uncertainty of measurement. Equipment has to be serviced from time to time. Quality can only be achieved by competent forensic practitioners that work under the guidance of a quality system and with the right philosophy of approach.

The key factor for a laboratory to be accredited is laboratory personnel. Accreditation of forensic labs requires not only competence of the personnel. Professional competence of each employee in a forensic lab and the concept of common standards for forensic practitioners should be defined also. The quality of modern apparatuses and the quality of personnel are not the only condition that should be provided. It is important that personnel should move its capacities and use its potentials to fulfill the established tasks. It is possible to be efficient in forensic practice if the employees are motivated for optimal use of their individual characteristics within a team. This accents the meaning of motivation and stimulation of personnel in quality management system development. The forensic laboratories have become production units rather than research units - with the performance of the organization becoming more important than individual efforts. This development has meant that the director's job has become a managerial job rather than a first scientist's job.

As the users of forensics there are judges, prosecutors and other subjects introduced in chain of forensics. They have the right to demand competence, specialty and responsibility from forensic experts. We now want to look at how we can define competence and how we can assess whether competence has been achieved. How do we recognize competence? Is it about how a person dresses or looks? Is it about adequate wearing of a working uniform? Is it about if a person is a member of an organization? Is it about qualifications or working experience? How do we recognize a competent person for special forensic field? We believe that it is almost impossible to define and recognize the competence in any objective manner in the absence of standards. That is why there is a need for defining standards for the forensic experts. Those standards are about proving the competence and professionalism of the forensic experts. It is about demonstrating competence in the workplace and not in the classroom during the education or special training, that is to say about actually doing the job. It is certainly not enough for an individual with a university degree today to be considered an expert in special forensic field.

Competence is a mixture of knowledge, skills and their application, attitudes and models of behaviors in special fields. It is important to know how to apply scientific knowledge for solving practical problems in forensics. Also, it is important to be good in representing the results and the form of written report, too. If one of the mentioned characteristics is missing we cannot consider forensic expert as competent.

Forensic expert must be cogent when presenting the results of expertise in the courtroom. Also, forensic expert must be good in answering the questions in the courtroom. It does not matter whether some mistake has been made at the crime scene during the sampling or during the transport to the forensic lab, or during the bad handling with sample in the lab, unless it is valid the real evidence would not be delivered to the court. That is why we have to define competence of forensic experts in crime scene investigation; the required field equipment with appropriate documentation about accuracy and validation; the standard operating procedures of handling evidence at the crime scene; the procedure of writing report from the scene (sampling, packing, transport and storage of collected evidences) to the lab; the required lab equipment with appropriate documentation about accuracy and validation; the required qualification and certification of the personnel; the procedures of handling lab equipment; the traceability of measuring and test equipment to the realization of CSI units; valid methods and appropriate form of results presentation.

#### 4.1. *The Model of Quality Management System Appliance in Forensic Laboratories*

The National Criminalist Technical Center (hereinafter referred to as forensic laboratories) is in the process of introduction of quality management system (QMS). The development of the model of the QMS appliance in forensic laboratories is important for every laboratory which deals with similar tests. The aim of the QMS model is systematic approach in determination of the QMS situation and its design in forensic labs. The whole approach is based on: the insight of the present state, the analysis of the present state, the insight and analysis of standard demands and the defining of the present state improvement regarding to the standard demands. The basic approach of the QMS modeling is contemplated to:

1. Improve the present quality management system by modeling;
2. Design the model of the QMS and to introduce and certify it, and
3. The overall conditions of the QMS by model, to improve existent and accept new standards.

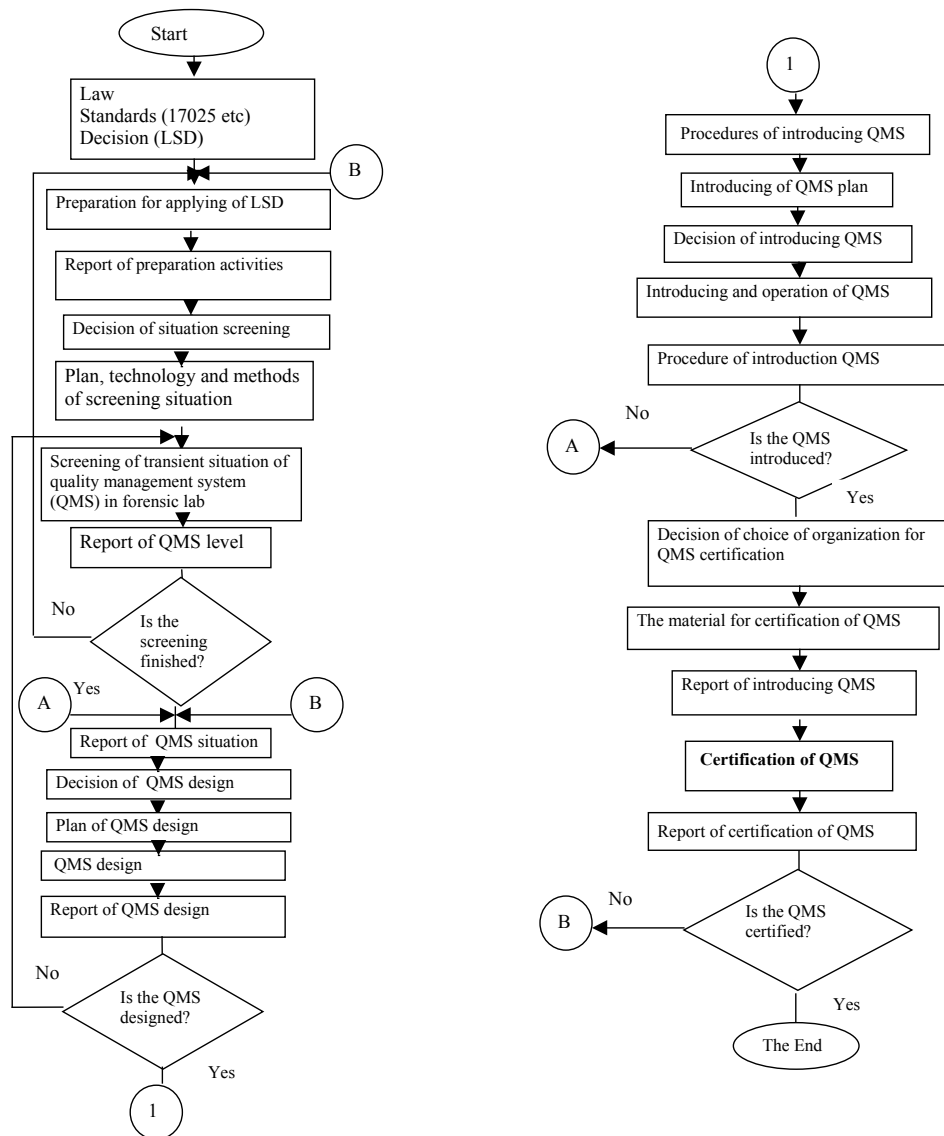
The technology of introducing and working of the QMS in forensic labs implies:

- The preparation for applying of laws and standards;
- The screening of transient situation of quality in management system;
- The design of the QMS;
- The introduction and certification of the QMS, and
- Checking if the QMS is certified.

For continuous and systematic management of quality in forensic labs as business systems, there is a need for defining of the QMS as the specialized subsystem of business system and for qualifying the other subsystems within a working net for the promotion of quality system. The algorithm at *Figure 1* shows design, introducing and certification of the QMS.

*Preparation for applying of laws and standards* means the decision about introducing the QMS; use of standards and laws to get information about the QMS; forming the working group (from their own experts or special consultants) and defining the working strategy – defining aims, terms and ways of implementation); the decision of nomination of chief assistant for quality; choosing of software backup for screening, design and introducing of the QMS; defining of the attitude that quality is important task for a lab as working organization which should be achieved through education and training; the qualification of management structure.





**Figure 1. – Design procedure, introduction and certification of the QMS in forensic laboratories**

*Screening of transient situation of the quality management system (QMS) in forensic lab should diagnose the situation of the present QMS and its relation with standard demands.*

*Design of the QMS in forensic lab requires: planning of the QMS design and its subsystems, design and control of the QMS design, defining the aims*

and policy of quality defining the QMS organization, making the global network procedure of high and low levels of hierarchy and making and control procedures of the QMS.

*Introducing and operation of the QMS* in forensic labs is the hardest part of the job and it is carried out through: considering, realization of planning and introducing of the QMS, observing complete technology of introducing the QMS, making decisions about solving problems in process of introducing and operating of the QMS, realization of quality politics, the QMS organization functioning and respect of global procedures in networking high and low levels of hierarchy, observing and analysis of introducing effects of the QMS and doing reports and observe terms of implementation tasks.

*Certification of the QMS* is verification of the achievement of compatibility between the introduced QMS and the standard. It implies: the choice of adequate institution which would certify the QMS; preparing the documentation for the certifying organization; introducing complete certification of the QMS; reading and analysis of report of certification results of the QMS and the assumption of correction if it is necessary; the meeting of promotion should be organized after getting certificate to inform business partners and doing interior and exterior certification of the QMS after a specified time. Each model of the QMS is adapted to new organization towards policy of introducing the QMS in lab, reports of transient situation, adequate standards and laws. The model of the QMS of forensic laboratory as a business system implies: the model to manage measurement, control and test equipment, the model for laboratory working and the model for data base. Document projects of the QMS are being accepted after probation. There is a need for the appropriate training of employees as we want to introduce the QMS after the creation of mentioned documents.

## 5. Conclusion

As the forensic crime scene practitioners look for “mistakes” of the delinquents in the form of real evidence so defense of the offender looks for “mistakes” of forensic experts and other subjects in the chain of custody at the court. The defense of the offender tries to arraign real evidence in court. The aim of introducing of quality management system in forensic labs implies minimization of risk of delusion in which forensics could bring with presentation lab results in court. That is why quality is the most important aspect of the forensics. Quality is achieved by the existence of qualitative forensic experts – practitioners who are doing their job with guidance of quality management system and accreditation of the labs also.

## 6. References

1. Brandl, G.S. (2004). *Criminal Investigation, An Analytical Perspective*, Pearson Education, Boston, p.101.
2. Gardner, J.T., Anderson M.T. (2004). *Criminal Evidence, Principles and Cases*, 5<sup>th</sup> edition, Thomson/Wadsworth, Wadsworth, p. 309-310.
3. Grubač, M. (2006). *Krivično procesno pravo, četvrto izmenjeno i dopunjeno izdanje*, Pravni fakultet Univerziteta Union i JP Službeni glasnik, Beograd, str. 235. (in Serbian)
4. Johnston D. and Hutton G. (2005). *Blackstone's Police Manual*, volume 2, Evidence and Procedure, Oxford University Press, p. 142-144.
5. Sippola E. (2002). *Accreditation examples of some laboratories*, Zagadnien Nauk Sadowych, p. 195-198.
6. Petrović, T. (2004). Razvoj modela metrološkog sistema u elektroprivredi prema zahtevima standarda JUS ISO 9000:2001, magistarska teza odbranjena 01.03.2004. na Mašinskom fakultetu univerziteta u Beogradu, (in Serbian).
7. Zarkovic, M., Bjelovuk, I., Kesic. T. (2008). Multimedijaska uvidjajna dokumentacija i njezin dokazni znacaj, *Vjestak, Zagreb*, p.307-322 (in Croatian).
8. ISO/IEC 17025, Opšti zahtevi za osposobljenost laboratorija za testiranje i kalibraciju.
9. ISO 9000, Sistemi upravljanja kvalitetom – osnove i rečnik. (in Serbian).
10. Internet stranice: [www.european-accreditation.org](http://www.european-accreditation.org), <http://forensic-evidence.com>, [www.eu.org/2008.fr](http://www.eu.org/2008.fr), <http://legal-dictionary.thefreedictionary.com> available 2009 Jun 1,

## SISTEM KVALITETA U FORENZIČKIM LABORATORIJAMA

### Rezime

Sistem kvaliteta je veoma bitan segment u poslovanju svake radne organizacije bez obzira na vrstu delatnosti kojom se ona bavi (proizvodnja materijalnih dobara ili uslužna delatnost). Kada je reč o laboratoriji kao radnoj organizaciji, sistem kvaliteta podrazumeva njenu osposobljenost, unificiranje radnih postupaka počev od definisanja potrebne aparature za neki laboratorijski postupak, kalibracije instrumenata, definisanja sertifikovanog radnog profila, propisanih obaveznih radnih procedura isl. Sistem kvaliteta u obradi materijalnog dokaza (počev od samog mesta događaja do analize u forenzičkoj laboratoriji) je jedan od osnovnih preduslova za validnost materijalnog dokaza na sudu. Standard ISO/IEC 17025 se primenjuje pri akreditaciji svih laboratorija, pa i onih koje rade za potrebe pravosuđa – forenzičke laboratorije. U ovom radu predložen je univerzalni model primene sistema kvaliteta u forenzičkim laboratorijama sa pozitivnim efektima akreditacije laboratorija prema pomenutom standardu u smislu kompetentnosti i priznavanja rezultata rada laboratorije u svim zemljama sveta. Primenom ovog modela bio bi olakšan svaki naredni ciklus akredita-

cije forenzičke laboratorije, ali i znatno smanjen broj nepriznatih materijalnih dokaza od strane suda u postupku.

### **Summary**

Quality management system is important element of every working organization whether it deals with manufacturing material goods or giving services. Applying of quality system in forensic laboratory implies qualifying of the lab, commonality of the procedures in lab, defining of required working instruments, its calibration and verification, defining of qualified working profile for using those instruments, defining of the obligatory working procedures, etc. Application of quality system in processing of real evidence is one of the fundamental postulates for the validity of material evidence in court. This paper gives model of quality management system in forensic laboratories due to standard ISO/IEC 17025 as recognizing the competence of laboratories and accepting of testing and calibration results in all countries using this International Standard.