POSSIBILITIES OF IMPROVING THE QUALITY OF THE REGISTER OF EXPERT WITNESSES IN THE REPUBLIC OF SERBIA IN THE AREA OF BALLISTICS, COLD WEAPONS, AND FIREARMS

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Introduction

Science development and developments in engineering are unfortunately used in criminal activities (Bjelovuk, Jaramaz & Micković, 2012). Firearms can be used as both a tool and an object of perpetration of a variety of crimes. It is most frequently used to commit violent crimes. "According to statistical data, (hand) firearms are the most common weapon used to perpetrate the crime of murder. They may be military (gun, revolver, rifle, machine gun), hunting and sporting, or hand-made, with short or long barrels." (Lajić & Marinković, 2016:31).

For the purpose of solving and proving the commission of these crimes, as well as identifying their perpetrators, expert witnesses who appear in criminal proceedings as persons with specialized knowledge in a particular area play a crucial role (Criminal Procedure Code, Article 113). Expert witnesses are individuals who possess specialized training, education, or experience (Gardner & Anderson, 2004) and who, in accordance with the established principles of their respective scientific field, technical knowledge, skills, or artistic orientation, examine objects of expertise and subsequently provide their expert findings and opinions (Bošković & Kesić, 2020). The Law on Expert Witnesses of Serbia (LEW/S) defines expert work as professional activities that involve the application of scientific, technical, and other advancements to provide the court or any other relevant authority conducting the proceeding with necessary professional knowledge utilized in the process of establishing, evaluating, or clarifying legally relevant facts (Article 2). The Law on Expert Witnesses of Serbia states that expert opinions can be conducted by natural and legal persons who meet the requirements outlined in this law, state bodies authorized to perform expertise, as well as scientific and professional institutions. In addition, it is permissible for expert witnesses (natural and legal persons) from foreign countries to perform expert work, so long as there are no expert witnesses of appropriate profession in Serbia or if there are other legal or practical justifications for expert witnesses from Serbia being unable to perform expert work in a particular case, and if they meet the requirements for performing expert work as set forth in the law of the country they come from (Article 3). In Serbia, a natural person may be appointed as an expert witness provided that, apart from the statutory general requirements for employment in state bodies, they satisfy the following special conditions: possess appropriate Master's or Bachelor's degree for a relevant area of expertise; possess a minimum of five years of professional experience; possess professional knowledge and practical experience in a specific area of expertise; and that they are deserving of performing expert work. In exceptional cases, a person possessing a minimum of a high school diploma may be appointed as an expert witness in a particular area of expertise

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where there is insufficient number of expert witnesses holding higher education degrees (Article 6 of the LEW/S). It is important to underscore that a natural person can perform expertise only if they are registered in the Register of Expert Witnesses (Article 8 of the LEW/S) and if no criminal proceedings have been initiated against them for a criminal offense that makes them unfit to perform expertise during the course of the said proceedings (Article 20, paragraph 1 of the LWE/S). To provide additional clarity regarding the requirements pertaining to professional knowledge and practical experience, the law mandates that these facts be substantiated through published professional or scientific papers, a certificate of attendance at consultations organized by professional associations, or the opinions or recommendations of courts, other governmental bodies, scientific or other institutions, or legal entities in which the individual was employed or provided professional services (Article 7 of the LEW/S). Many studies have been conducted on the criteria for selecting expert witnesses and the legal basis for registration in the register, and they exhibit notable similarities with the countries surrounding the Republic of Serbia (Žarković, Bjelovuk & Borović, 2014; Bjelovuk, Kesić, & Žarković, 2021).

An expert witness engaged in the analysis of the submitted material from the crime scene, where there are traces and objects related to the criminal offense in which a firearm was used, should be entered in the Ministry of Justice of the Republic of Serbia's Register of Expert Witnesses. The Register of Expert Witnesses is organized by areas, and an expert witness who deals with the analysis of traces connected to the use of firearms is listed in the area termed ballistics, cold weapons, and firearms. In this paper, the Register of Expert Witnesses of the Republic of Serbia in this area is analyzed to determine the possibility of its improvement. The analysis of the data from the Register of Expert Witnesses is necessitated by the fact that the public availability of the data on expert witnesses is crucial for all parties to the proceeding in order to make a well-informed decision regarding which expert witness to hire. In addition, the data on expert witnesses are directly related to the assurance of the quality of the paid service, i.e., the expertise. A poorly performed expertise would necessitate the hiring of another expert witness to provide findings and opinions, which would impact the course and costs of the procedure and could jeopardize the right to a fair and timely trial.

The analysis was conducted based on a variety of criteria, including gender, age, vocation, and specific area of expertise.

Previous research has revealed that similar analyses dealing with expert witnesses and their competencies for performing expert work were conducted in the area of fires and explosions (Bjelovuk, et al., 2021). In one of the papers that analyzed the jurisdiction and competence of expert witnesses and the manner in which the register was maintained, an overview of the educational profiles of expert witnesses in the Republic of Serbia was provided without a detailed analysis (Žarković, et al., 2014). In these papers, the authors also addressed the legal basis for engaging in expert work in certain countries, i.e. they performed a comparative-legal analysis of legal solutions and made recommendations for the optimal solution with regard to expert work. A 2016 study that examined jurors' perceptions of expert witnesses revealed that it was crucial for jurors to be informed about the qualifications of expert witnesses and that they accorded greater respect to those with better qualifications (Freckelton, Goodman-Delahunty & McKimmie, 2016). In addition, an analysis of the role of expert witnesses in the judicial systems of the Western Balkan countries revealed that the number of expert witnesses was insufficient and that they were not equally burdened. Furthermore, it was established that court decisions relied heavily on the findings and opinions of expert witnesses. This study did not analyze the competencies of specific expert witnesses (Senderayi, Runyararo, Sipka, & Sofijanic, 2019).

The European Network of Forensic Science Institutes (ENFSI) defines recommendations for dealing with certain traces at the level of the European Union and beyond. There are 17 Expert Working

Groups within the ENFSI framework, including the Firearms/GSR group. (https://enfsi.eu/about-enfsi/structure/working-groups/). In addition, the accreditation procedure for forensic laboratories significantly increased the guarantee of the quality of expertise conducted in forensic laboratories (Bjelovuk, Kesić, & Radosavljević-Stevanović, 2013). Accreditation improves the quality and reliability of physical evidence, as well as the implementation of quality systems both at crime scenes and in forensic laboratories (Bjelovuk, Kesić, & Žarković, 2012). The English courts developed the rule about the acceptability of evidence, according to which expert evidence must have a sufficiently reliable scientific basis to be admitted (Ward, 2020).

Material and Methods

The research conducted utilized statistical and content analysis methods.

For the purpose of research justification, a diagram depicting the number of crimes committed in the Republic of Serbia between 2013 and 2022 in which firearms were used is presented. According to the types of firearms used, criminal offenses are classified as follows: hunting rifle carbine, automatic gun, hunting rifle shotgun, short-barreled shotgun, gun, revolver, gas gun, rifle, air rifle, and automatic rifle. It is evident from the diagram that the number of crimes committed with firearms is not negligible; therefore, any research that can contribute to an increase in the number of firearm-related crimes solved and proven is significant. The type and method of use of firearms represent relevant facts for drawing conclusions about the motive and profile of the perpetrator of the crime (Đurđević, 2014). The profile of the perpetrator, that is, the most likely characteristics of the perpetrator based on the method of execution, the place, and the profile of the victim, serves as the foundation for selecting a strategy to prove the criminal offense and the perpetrator's guilt (Đurđević, et al., 2019). The exchange of information regarding firearms, both as a means and object of execution, is defined as one of the priorities in the cooperation between the Republic of Serbia and the EU in combating organized crime (Radović, & Đurđević, 2016).

Figure 1 is a diagram depicting the number of firearm-related crimes committed in the Republic of Serbia between 2013 and 2022.[2]

The largest number of crimes involving the use of firearms were recorded in 2013, with a total of 926 cases. Among these, 833 (89.95%) involved the use of a gun. The data reveals a gradual decline in the number of crimes involving firearms over the years. Specifically, in 2014, 712 crimes were committed, with 628 (88.20%) of them involving the use of a gun, in 2015 – 644, with 578 (89.75%) involving a gun, in 2016, 454 with 395 (87.00%) involving a gun, in 2017, 358, with 295 (83.57%) involving the use of a gun, in 2018, 313 with 261 (83.38%) involving a gun, in 2019, the number of crimes further decreased to 277, with 202 (72.92%) involving a gun. In 2020, there were 249 crimes, with 191 (76.70%) involving a gun. In 2021, 223 crimes involving firearms were committed, of which 163 (73.09%) involved gun. In 2022, 203 crimes were committed, of which 131 (62.98%) involved a gun. Over the observed period, a hunting rifle carbine was most used in 2013 – 13 times, and the least in 2020 – three times. A rifle was most used in 2013 – 32 times, and the least in 2016 – 10 times. An automatic gun was most used in 2013, 2015, and 2016 – three times, but not in 2022. A revolver was most used in 2013 – 18 times, and the least in 2019 – once. An air rifle was most used most in 2021 and 2022 – 7 times, and the least in 2018 – once. A rifle hunting shotgun was most used in 2013 and 2014 – 25 times, and the least in 2021 – 10 times. A gas gun was most used in 2022 – 19 times, and the least in 2013 and 2014 – 8 times. An automatic rifle was most used in 2016 and 2018 – 6 times. During the observed

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period, a short-barreled rifle was least used firearm – twice in 2019 and twice in 2020, while it was not used in any other year.

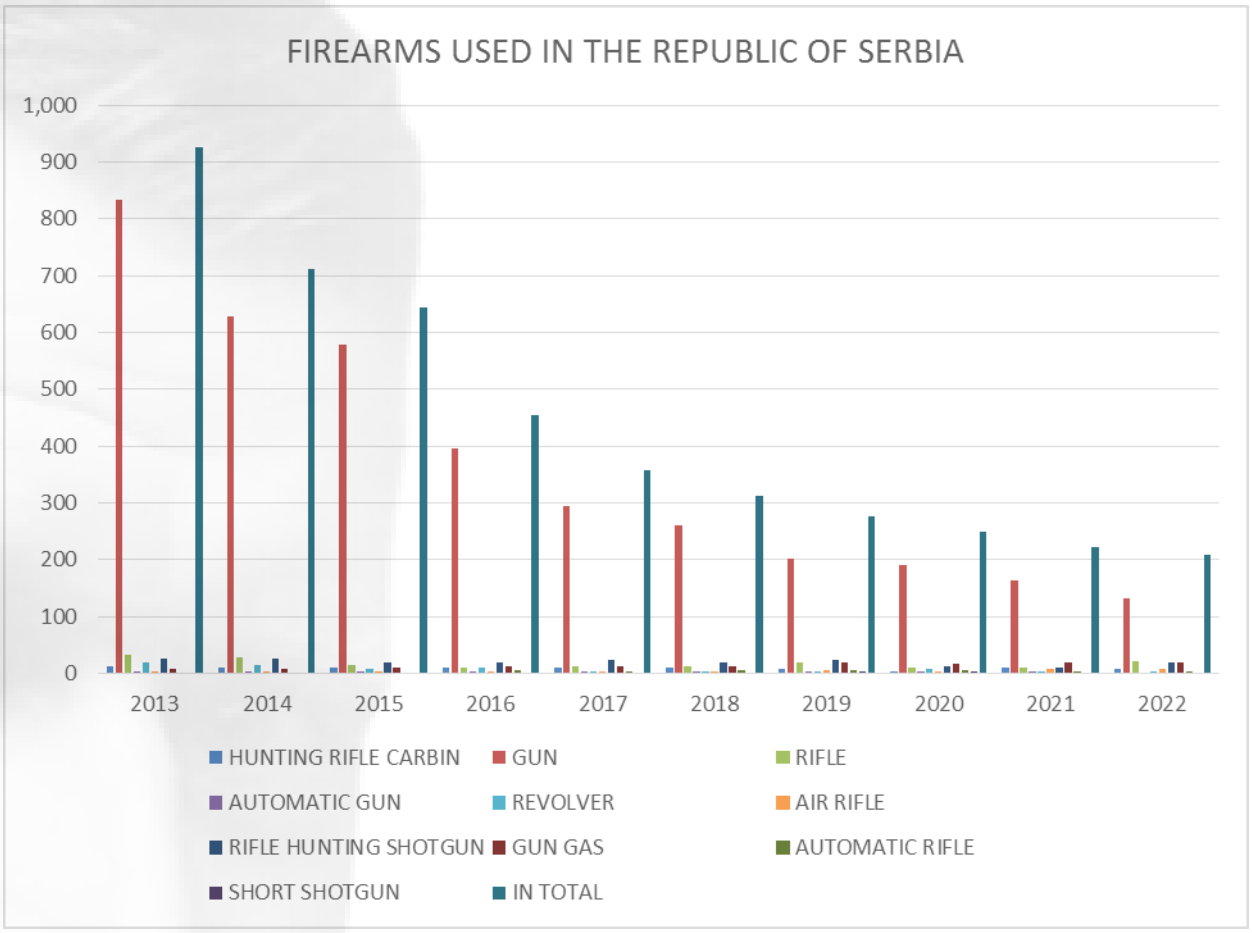

Figure 1 *The number of criminal offenses committed by different firearms (hunting rifle carbine, automatic gun, rifle hunting shotgun, short-barreled shotgun, gun, revolver, gas gun, rifle, air rifle, automatic rifle) in the period 2013–2022*

The perpetrator leaves traces following the use of a firearm, either in the form of powder particles or mechanical traces on the cartridge case, projectile, at the crime scene along the path of the projectile, or on the victim. At the crime scene, traces are processed, packaged, and transported to a certified ballistics laboratory, where expert witnesses conduct their analysis. The laboratory should be licensed and accredited in accordance with ISO 17025. The ballistics laboratory should be equipped with a comparative microscope or automatic ballistic identification system IBIS, which compares disputed and non-disputed projectiles and cartridge cases, as well as devices for measuring speed, 3D scanners for projectile path reconstruction, microscopes for observing gunshot residues (GSR), ultra-fast cameras, and trigger force measurement devices, among others. Expert witnesses should be entered in the Register. The Ministry of Justice's Register of Expert Witnesses in the Republic of Serbia has 32 registered expert witnesses for the area "ballistics, cold weapons, and firearms", including their following data: name and surname, year of birth, vocation, area of expertise, specific area of expertise, number and date of the decision, and contact details (https://www.mpravde.gov.rs/court-experts.php). By examining the Register of Expert Witnesses in the area of ballistics, cold weapons, and firearms, it was determined that each expert witness possesses a valid license to perform expert work. In 2010, 31

of them were entered in the Register, whereas in 2006, only one expert witness was entered. 30 expert witnesses renewed their licenses in 2011, one in 2006, and one in 2013.

Regarding the area of expertise, as reported by the expert witnesses upon registration, all of them specified expertise in the area of ballistics, firearms, and cold weapons. Additionally, the Register contains contact information for all expert witnesses.

The age of each expert witness was established based on their year of birth, and this information is depicted in Figure 2. The age of all expert witnesses who are registered is above 50 years. The diagram clearly indicates that there are the most expert witnesses aged 71 (4). There are 9 expert witnesses in their sixth decade of life, 12 in their seventh decade, and 11 in their eighth decade.

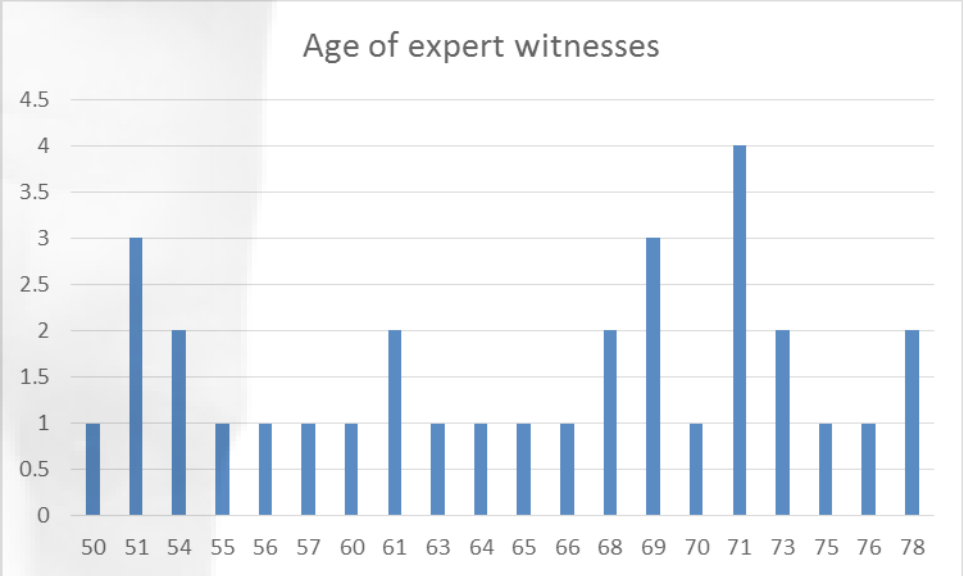

Figure 2 *Age of expert witnesses in the Republic of Serbia*

On the basis of the names of expert witnesses, conclusions about their genders were drawn, and among the 32 expert witnesses in this area, 30 men and two women were registered, as depicted in the diagram in Figure 3.

Figure 3 *Gender of expert witnesses in the area of ballistics, firearms and cold weapons in the Republic of Serbia*

The analysis of the data on expert witnesses for the observed area was also conducted according to the *specific area of expertise* criterion that the expert witnesses specified when they entered the register. 28 out of 32 expert witnesses, or 87.5%, specified an identical phrase for the area name, namely ballistics, cold weapons, and firearms, as their specific area of expertise. One expert witness identified their specific area of expertise as the identification of traces of tools (3.125%), one as the technical functionality of personal weapons, one as firearms, and one as weapons, ammunition, and explosive devices (3.125%).

Regarding the criteria of vocation specified by the expert witnesses, the majority of the expert witnesses in the Register for this area are graduated mechanical engineers – 9 (28.125%), MSc – master of technical sciences – 3 (9.375%), PhD – doctor of technical sciences – 2 (6.25%), graduate in physics and chemistry – 2 (6.25%), gunsmith – 2 (6.25%), and major – 2 (6.25%), graduated engineering officer – 1 (3.125%), graduated engineer in chemical technology – 1 (3.125%), officer – 1 (3.125%), graduated engineer – 1 (3.125%), fire protection engineer – 1 (3.125%), security management specialist – 1 (3.125%), bachelor of law of internal affairs – 1 (3.125%), bachelor of laws – 1 (3.125%), mediation specialist – 1 (3.125%), professor of sociology – 1 (3.125%), graduated marketing manager – 1 (3.125%), and not specified – 1 (3.125%). Vocations of expert witnesses for the area of ballistics, cold weapons, and firearms are shown in Figure 4. From the aforementioned data on the vocation of expert witnesses, it can be concluded that the vocations are quite diverse, some of which are extremely loosely defined.

Figure 4 *Vocation of expert witnesses in the area of ballistics, firearms and cold weapons in the Republic of Serbia*

Discussion

Ballistics experts examine cartridge cases, bullets, and gunshot residue (Rolins & Dahl, 2004). Every expert witness registered in the Register for the area of ballistics, firearms, and cold weapons possesses a valid license. It is evident that all of the expert witnesses' licenses have not been renewed in over a decade, which is a considerable amount of time. Consequently, there is no information regarding the potential update of the Register data. In some registers of expert witnesses, such as the one in the Republic of North Macedonia, there is information about whether an expert witness has lost their work license (Bjelovuk, et al., 2021) or maybe is no longer able to conduct expert work.

The majority of expert witnesses are older than 65 (17 expert witnesses, or 53.12% of the total number of expert witnesses in this area of expertise). As the right to an old-age pension in the Republic of Serbia is acquired upon reaching the age of 65, the question of access to accredited laboratories for those types of expertise that require modern devices arises (e.g. access to a comparative microscope or an automatic system for ballistic identification – IBIS, access to a ballistics laboratory to determine the trigger force, the velocity of the projectile, etc.). The access of expert witnesses to accredited laboratories has a significant impact on the quality of their expertise; therefore, it is crucial that each expert witness has access to an accredited laboratory with a valid work permit. The observed data provided by the Register of Expert Witnesses does not indicate whether or not the expert witness has access to an accredited forensic laboratory or to which particular one. This information should also be included in the Register of Expert Witnesses.

In comparison to the total number of expert witnesses, the number of female expert witnesses is negligible, accounting for only 6.25%.

The vocations of expert witnesses are not specified precisely (one expert witness did not even specify their vocation), such as: doctor of technical sciences, master in technical sciences, officer, or major. Certain occupations seem inadequate at first glance, such as graduated marketing manager, professor of sociology, mediation specialist, bachelor of law of internal affairs, bachelor of laws, security management specialist. Even upon further reflection, most faculties have modules, that is, majors, and consequently there is also a difference in education and courses that expert witnesses took as students. At the Faculty of Mechanical Engineering, for instance, an expert witness who graduated in the field of weapon systems did not receive the same education as a graduate in another field. (https://www.en.mas.bg.ac.rs/faculty/). Modules at the University of Defense and other universities in the Republic of Serbia follow the same pattern. The competencies of an expert witness are not solely determined by their vocation and level of education but also by other variables. In contrast to the UK Register of Expert Witnesses, the Register of Expert Witnesses in Serbia contains no information about the work experience of expert witnesses. An expert witness could be trained through various forms of training, seminars, workshops, and other professional development opportunities. This information about expert witnesses in this area of expertise is also not evident in the Register.

The ratio of the number of crimes committed with firearms to the number of expert witnesses is inadequate. The average number of crimes committed with firearms over the course of the observed ten-year period is 436, and there are 32 registered expert witnesses. Within a ballistics examination, an expert witness may be asked several questions for which they are expected to conduct a ballistics analysis and provide a response, including: Is the item submitted for expert examination indeed a firearm, and if so, does it function properly? Is the firearm factory-made, or has it been modified? Is this an illegal weapon? What is the trigger force value? Was a firearm discharged? When was the firearm discharged? What distance was the firearm discharged from? What was the projectile velocity? Is it

possible to reconstruct the projectile? Whose hand discharged the firearm? Multiple bullets can be discharged from a single firearm during the commission of a crime, so the number of expert reports per firearm exceeds one. An expert witness who examines traces of the use of firearms can examine traces on ammunition and its components (cartridge cases, projectiles), traces on the firearm and its components, traces at the crime scene, i.e. on the trajectory of the projectile (parabolic ballistic curve), and traces of particles and other combustion products left after a discharge. It is implied that, when examining the traces on the projectile and cartridge case, the expert witness checks whether the weapon from which the bullet was discharged, from which the cartridge case or projectile originated, was used in a previously committed crime. The number of working hours per an expertise varies from case to case based on the number of traces being examined and the number of questions. An expert opinion can be rendered by either an individual expert witness or a team of expert witnesses.

The UK Register of Expert Witnesses was used for comparison (https://www.jspubs.com/expert-witness/index.htm?l=b). A comparative review of the UK Register of Expert Witnesses revealed differences in the structural organization and content of the Register. This Register is organized completely differently compared to the Register of Expert Witnesses in the Republic of Serbia. The UK Register of Expert Witnesses is unique (https://www.jspubs.com/experts/register.htm). A list of expert witnesses is provided, with the areas of expertise arranged alphabetically by the areas names. It contains a list of areas of expertise that are much more narrowly defined than the areas in the Republic of Serbia. One of the areas is ballistics (https://www.jspubs.com/expert-witness/si/b/ballistics/). Five expert witnesses are registered within this area, of which three are gentlemen, and two are ladies (one identifying as Ms., and the other as Mrs.). On the basis of this criterion, the gender and marital status of the expert witnesses can be determined. There are different areas of expertise in which the expert witnesses are registered, as stated by the expert witnesses themselves. Furthermore, the specific areas of expertise in which the expert witnesses are registered are listed along with the name and surname of each expert witness. Some expert witnesses have many years of experience, as well as a variety of expertise they perform. Many of them have different areas of expertise listed. The Register can be searched, and when the word ballistics is entered, 19 ballistic expert witnesses are displayed (ballistics – 4 expert witnesses, ballistics external – 2, ballistics forensic – 3, ballistics internal – 1 expert, ballistics terminal – 2, ballistics wound – 2, forensic ballistics – 3, wound ballistics – 2 expert witnesses).

Conclusions

The prevalence of firearm-related crimes is evident in the Republic of Serbia. A range of ballistic tests can be conducted for each firearm used, depending on the questions posed by the procedural authorities to the expert witness. Given the number of firearms-related crimes committed, as well as the fact that after each use of a firearm, many different traces are left behind that can be used to identify the firearm based on the markings on the projectile and cartridge case and a person who used firearms based on gunpowder particle traces, to reconstruct projectile trajectory, firing distance, firing time, etc., as well as considering the fact that a large number of questions can be posed to a ballistics expert witness, it can be concluded that there is a large number of ballistic tests and expert reports. Due to the fact that only 32 expert witnesses are registered in the Republic of Serbia, one gets the impression that the number of expert witnesses is small compared to the number of examinations and expertise they should perform and that they are consequently overburdened. There is a need to recruit a substantial number of expert witnesses due to the perception that the number of expert witnesses in the Register is inadequate given that there is a significant number of crimes involving the use of firearms. So, there is a need for a greater number of expert witnesses in the area of ballistics, cold weapons, and

firearms because of the high number of crimes committed with the use of firearms. Further research that exceeds the boundaries of this scope is required in order to ascertain the exact number of working hours and expert witnesses.

The Ministry of Justice is responsible for the maintenance of the Register of Expert Witnesses in the Republic of Serbia. Name and surname, year of birth, vocation, area of expertise, specific area of expertise, date of license issuance, license number, and contact information are all available information pertaining to expert witnesses. It would be useful if the Registry of Expert Witnesses included details regarding the date of update, specifically the renewal of each expert witness's license, in addition to whether and which accredited forensic laboratory the expert witness utilizes. The data contained in this list should be regularly updated to reflect any developments that may occur that would render certain expert witnesses incapable of providing their expert opinions (e.g. death, illness) or whose contact information may have been changed, rendering them unreachable.

It is evident from the Register that males comprise the majority of expert witnesses for this type of expertise (93.75%). Efforts should be directed towards promoting the profession so that expert witnesses of both genders are more evenly represented. An intriguing observation when comparing the UK Register of Court Witnesses to this list is the prefixing of each expert witness's name with the titles Mr., Mrs., and Ms., so that the expert witness's gender and marital status are evident. Furthermore, according to the research findings, individuals aged 65 and above comprise the majority (53.12%) conducting this type of expertise. Notably, the Register does not contain any individuals under the age of 50. In this context, younger individuals should get involved in expert work.

When it comes to the specific areas of expertise of expert witnesses for ballistics, cold weapons, and firearms in the Republic of Serbia, they are not standardized and appear to be specified arbitrarily. The situation is identical with the UK Register of Court Witnesses.

Certain expert witnesses' vocations are not sufficiently precisely defined in the Register, and therefore it is advisable to supplement it with relevant data. Although there may be vocations that appear unsuitable, this does not inherently indicate that the expert witness lacks sufficient competence. On the other hand, the expert witness might possess competencies obtained via some other type of education, including specialized courses, seminars, workshops, military service training, and so forth. Furthermore, an expert witness may have acquired knowledge in the area of ballistics, cold weapons, and firearms through their work experience, experimental research, and professional and scientific papers. Given the aforementioned, it is advisable to supplement the Register of Expert Witnesses with more comprehensive data pertaining to the expert witness's acquired knowledge from diverse professional development and education programs, published papers, work experience, etc., which would provide the one who hires the expert witness with a more comprehensive understanding of the expert witness's capabilities.

The analysis of the Register of Expert Witnesses in accordance with predetermined criteria revealed that its quality could be improved. The comparative analysis of the UK Register of Expert Witnesses and the Register of Expert Witnesses in the Republic of Serbia unveiled differences in both the structure and content of the registers. This Register exhibits a completely different organizational structure, wherein the areas of expertise are significantly more numerous and arranged alphabetically. The areas of expertise are defined differently and are considerably more specialized (for instance, ballistic interior, ballistic external, ballistic terminal, ballistic wound, etc.). Navigating through the UK Register of Court Witnesses is much easier.

The analysis of the Register of Expert Witnesses is very significant from the aspect of the availability of visible data on expert witnesses in the Register for the participants of the proceedings. The quality and content of the Register of Expert Witnesses in the field ballistics, cold weapons, and firearms in the Republic of Serbia are directly related to the outcome of criminal proceedings because they affect the length of court proceedings, and therefore should be improved.

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