

# Technical Competency of Engineer Expert in Brazil and the USA approach

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**Abstract**—This article discusses the system of choice of experts, especially engineers experts in Brazil and the United States. Despite being different legal systems, there are common issues that have different solutions in both countries. First will be exposed as is the Brazilian legal system, and will be described how is the choose of experts in the judiciary. Next will be described the American legal system and how is the choice of the experts in this system. Possible solutions to the problems of the Brazilian system based on the American system will be pointed out.

**Keywords**—engineer expert; technical competency; forensic; Brazilian judiciary; legal system; forensic science;

## 1. INTRODUCTION

The purpose of this paper is to compare the system adopted by Brazilian courts with the system adopted by the United States for the use of legal experts.

Before discuss reforms based on American common law procedures, this article will examine the role of the expert in Brazilian civil law system, in special case of the engineering.

Americans procedures are different in many aspects of the Brazilian system to choose the expert and the expert acting in court proceedings. These differences become very important at the time that judges, in Brazil, has to make the choice of an expert that will do his job using scientific methods.

Despite the legal systems differ, the issues related to the "quality" of the applied science as well as the professional qualification are common concerns in both countries.

In this regard, the United States in recent pioneer report by the National Academy of Sciences (NAS), acknowledged that part of forensic science is not based on an established science. The report notes that many disciplines such as hair microscopy, bite mark comparisons, fingerprint analysis, testing firearm and tool mark analysis, were developed just to solve criminal cases, being used in the context of individual cases which have significant variations in research and expertise. These have not gone through a rigorous experimental scrutiny, as there are no standards in the United States or anywhere else that can validate these methods consistently, with the exception only of DNA testing.[1]

## 2. BRAZIL'S LEGAL SYSTEM

The forensic engineer is a professional engineer who deals with the engineering aspects of legal problems. Activities associated with forensic engineering include determination of the physical or technical causes of accidents or failures, preparation of reports, and presentation of testimony or advisory opinions that assist in resolution of related disputes. The forensic engineer may also be asked to render an opinion regarding responsibility for the accident or failure.[2]

It is also the application of the art and science of engineering in the judiciary, including the investigation of the physical causes of accidents and other types of claims and litigation, preparation of engineering reports, testimony at hearings and trials in administrative or judicial proceedings, and interpretation of advisory opinions to assist the resolution of disputes affecting life or property.

The first skill that expert must have is competency in his specialized engineering discipline. This competency must be acquired by education and experience, so a professional who has a large professional experience will be better than an engineer that does not have much experience, even with the same education.

Another skill that is very important is the knowledge of legal procedures and the vocabulary used in Courts not to cause trouble or misunderstanding during the process.

Brazil is a federal republic formed by the indissoluble union of the states, municipalities and the Federal District.

The government is composed of the legislative, executive and judiciary. The country adopts the system of Civil Law, which has its origin in Roman law and was introduced by the Portuguese colonizers. The system is based on codes and laws enacted by the federal legislature, as well as by state and local legislatures.[3] [4]

The federal legislature is practiced by Congress, which is composed of the Chamber of Deputies and the Federal Senate, through the legislative process. The President and the Ministers of State make up the Executive Branch, and the Supreme Court, the National Council of Justice, the Superior Court of Justice, the Federal Court, the Labour Court, the Electoral Court, the Military Court, and state courts make up the Judiciary.

The Federal Supreme Court is the highest court and is entrusted with the responsibility of safeguarding the Constitution, as well as functioning as a court of review. The Federal Supreme Court also has original jurisdiction to try and decide direct actions of unconstitutionality of a federal or state law or normative act, or declaratory actions of constitutionality of a federal law or normative act, which somewhat resemble the issuance of advisory opinions. This situation not allowed in the Supreme Court of the United States, for example.

Brazil does not follow the doctrine of stare decisions and only after the amendment of the Federal Constitution in 2004 that the Supreme Court started to adopt, in special situations, binding decisions.

The Common Law admitted its origins in the precedents from previous cases as sources of law. The principle is known as stare decisis and recommends that once a court has answered a question, the same question in other cases must elicit the same response from the same court or lower courts in that jurisdiction. In turn, the system of Civil Law, attaches great importance to the codes, laws and opinions of jurists.

The principle of free conviction of the judge's what guides all Brazilian judicial decisions, and this should be beaconed by the law.

In Brazil there are two types of forensic experts: the criminal and non-criminal. The first ones are public employees, in almost cases, and the others are hired for all other types of judicial cases, by the parts involved. Obviously exists exceptions in this two cases, but they aren't relevant for these observations.

There are criminal forensics experts only in two spheres of government, namely in the federal scope and in state government, with no performance in the district, or county, for such experts. In Brazil there is no specific jurisdiction in the city and district. Municipal issues are resolved in state courts.

These forensic experts to be hired by the government go through a public examination to evaluate their knowledge. On the other hand, not forensic experts are hired for their expertise, but there is no effective way of measuring the level of such knowledge. The judges pick their experts in non-criminal cases, among professionals inscribed on a prior list in state and federal courts.

Likewise there is no specific government agency that regulates the forensic science to bring regulations to both categories of experts, nor the "quality of the science" applied in the cases by the experts.

The criminal expertise is regulated by the Code of Criminal Procedure [5] and the non-criminal skills are covered by the Code of Civil Procedure. [6]

The Code of Criminal Procedure provides in Article 158 that when the violation leaving any trace will be indispensable examination of *corpus delicti*, direct or indirect, cannot supply him the confession of the accused. The examination of *corpus delicti* and other skills will be conducted by official expert, holder of college degree.

In civil investigations, the judge chooses the expert from among those previously enrolled in that jurisdiction. The parties have five days to submit their questions for the expert. Article 436 of the Code of Civil Procedure provides that a judicature is not attached to the expert report, his conviction may form with other elements or facts proven in the case.

Specifically for the engineering, professional regulation in Brazil is a responsibility of the professional supervisory board of Engineering (CONFEA), which was created by federal law and has to care for and regulate the engineering profession.

Considered a landmark in the history of professional and technical regulation in Brazil, the Brazilian Confederation of Engineering and Agronomy came up with that name on December 11, 1933, by Federal Decree No. 23,569. In its current design, the Federal Council of Engineering and Agronomy (CONFEA) is governed by Law 5,194 of 1966 and also represents geographers, geologists, meteorologists, technologists such arrangements, industrial and agricultural technicians and their specializations, totaling hundreds of professional titles.

The CONFEA system has in their records about one million of professionals who account for about 70% of Brazil's GDP. It is a demanding job in the expertise and knowledge of technology, fueled by intensely technical and scientific findings of man. Takes charge of social and human interests of the whole society and, on that basis, regulates and supervises the professional practice in the areas. The Federal Council is the highest level at which a professional can use with regard to the regulation of professional practice [7]. The Council also gives permission for expert activity of the engineering professional, but this is just an administrative issue.

The principles adopted for expert opinions, is the state of art and also good practices in each specialty, as well as, eventually, which is regulated by the Brazilian Association of Technical Standards (ABNT), private institution that aims to promote the development of technical standards and promote their use in scientific, technical, industrial, commercial, agricultural, among others, keeping them updated, counting both the best technical expertise and lab work, as well as encourage and promote the

participation of communities in the technical research, development and dissemination of technical standardization in the country.

ABNT is also collaborating with the state in the study and solution of problems that relate to technical standardization in general and also with the public authorities mediates the interests of civil society with regard to matters of technical standardization. [8]

A recurring drawback for the lack of a mechanism or official body control expert activity is that regular professionals sometimes do not have adequate technical knowledge to perform certain work or not using methodology consistent with the need of expertise.

In cases where the expert has no scientific or technical knowledge and without reasonable cause, fails to comply with the charge given to him he may be replaced in accordance with Article 424 of the Code of Civil Procedure. Normative Decision 69 CONFEA also predicts this hypothesis and treats this as an ethical infraction.

Also the Code of Criminal Procedure provides in Articles 343 and 344 punishments ranging from two to four years and a fine for "perjury or false expertise", but these crimes must be intentional. [9]

When talking about professional assignment, it is necessary to make the distinction between academic ability, legal requirements and professional qualification, since there is a relationship of dependency between them, while distinct, each being arising from other.

Gotten the graduation course, acquires academic ability, but it is not possible yet practice the profession, which happens only with enrollment in respective professional Council, that is the legal authorization, and the professional qualification is acquired only through constant training and experience.

Professional Assignments and technical knowledge are not necessarily associated in the field of engineering. Professional assignments are conferred by CONFEA resolutions, being differentiated by each type of professional.

It is not necessary and sufficient for the exercise charge of the expert's mere record of the professional class organ as the expert charge depends on its technical and scientific knowledge condition.

This knowledge will be built with the knowledge acquired during graduation and specific courses. The classic example is the case of the newly formed engineer that receives his properly registered title in the class organ that enables expert activity, but there is lack of expertise and knowledge of legal aspects inherent to it, because technical knowledge of application in judicial skills are not included in undergraduate courses, and needed further depth of knowledge, which is a distortion of the Code of Civil Procedure, as to the operationalization of expertise activity.

The major problem is that rarely unqualified practitioners are punished for their actions, as it rarely the parties perform accusations in the Council, as well as the judges, which only fail to request the services of experts who do not meet the expectations.

Another issue is that the judge is a layman, he has no knowledge to evaluate the use of the scientific quality of expertise, which also hampers the punishment of the wicked experts, and there is no legal instrument or procedure that it can be used to make this review.

### **3. THE LEGAL SYSTEM IN U.S.**

In United States, the U.S. Constitution establishes a federal system of government and gives specific powers to the federal government, and all powers not delegated to the federal government are left to the states. The fifty states of the country have their own constitution, government structure, legal codes and own judicial system.

The legal system adopted has Anglo-Saxon origin and is based on the study of judicial precedents (Common Law). Also the Judicial Branch of the federal government is established by the Constitution specifying its authority. Federal courts have exclusive jurisdiction only in certain types of cases, such as in cases involving federal laws, disputes between states and cases involving foreign governments. There are cases in which federal courts share jurisdiction with the state, such as a federal and a state court can make a decision together about two parts that reside in different states. The state courts have exclusive jurisdiction over the vast majority of cases.

The parties have the right to trial by jury in all criminal cases and in most civil cases. The jury usually consists of twelve citizens who hear the evidence and based on the evidence presented during the trial, apply the law determined by the judge to reach a decision based on the facts that the jury determines itself as true, based on the evidence presented during the trial. [10]

As measures to ensure the reliability of the expert's opinion, before the presentation of expert evidence at trial in a U.S. federal court, the expert goes through some essential preliminary steps. The expert is selected and maintained by the party; evaluates the starting materials; emits a report; giving his testimony. The admissibility may have been evaluated under standards by the trial judge. [11]

Initially to present an expert opinion, the proposed expert must be qualified and able to meet the admissibility requirements as established by the Supreme Court in the 1990s in cases Daubert, Joiner, and Kumho. A more recent decision of the Court of Justice, the Kumho case, again confirmed and clarified that judges should act as "gatekeepers" in determining the admissibility of expert evidence, and must be sure that the witness is relevant and reliable. [12]

The FRYE test of "general acceptance" is given on behalf of the admissibility of lie detector test with over 80 years in the case *Frye v. United States*, which generated controversy over what standard a court should apply in evaluating the expert evidence.

In *Frye*, the defendant was subjected to a scientific test designed to determine the innocence or guilt based on the variation of blood pressure when questioned about facts related to the crime for which he was accused. The defendant objected to the methodology and results based on the novelty of the technique. In stating the rule, the Court argued that is difficult to know when a scientific principle or discovery crosses the line between the experimental and final stages. The probative force of the principle must be recognized at some point but until this occurs, the deduction must be sufficiently established to have general acceptance in the particular field to which it belongs.

In light of the new rule, the *Frye* Court held that the blood pressure test at issue had not yet gained such standing and scientific recognition to justify admitting the expert testimony at hand. The *Frye* "general acceptance" test was applied by federal courts for more than 50 years, and was applied exclusively to expert testimony based on new scientific techniques. The *Frye* test was also adopted and applied by many state courts, some of which still apply the *Frye* test today.

By applying the new rule, the Court held that the blood pressure test in question had not gained acceptance and recognition for justifying the admission of expert evidence. The *Frye* test of "general acceptance" was applied by federal courts for over 50 years, exclusively to expert testimony based on new scientific techniques. Some state courts still use the *Frye* test today.

The *Frye* test was the rule until 1975, when Congress passed the Federal Rules of Evidence (FRE), which seemed to create a new standard for the courts to assess the admissibility of expert evidence. FRE 104 went to the district court the power to determine the qualifications of a witness. Preliminary questions concerning the qualification of a person to be a witness, the existence of a privilege, or the admissibility of evidence shall be determined by the court, subject to the provision of subdivision pertaining to conditional admissions.

The FRE 702 seemed to bring new parameters for the courts to assess the admissibility of expert testimony. The rule provides that the specialized scientific, technical, or other will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert, knowledge, skill, experience, training, or education may testify thereto in the form of an opinion or otherwise. The coexistence of the two rules created great confusion and different strands of the courts in applying the rules.

The uncertainty was then clarified by the Supreme Court in *Daubert v. Merrell Dow Pharmaceuticals*. The authors were trying to introduce expert testimony that supported the birth defects occurred due to ingestion of the drug Bendectin by mothers. The Court held that FRE 702 superseded *Frye* and the general acceptance test was not a pre-condition for the admissibility of scientific evidence under the Federal Rules of Evidence, considering the court of first instance as a "guardian" to determine the admissibility of expert evidence ensuring that this is on a reliable foundation and is relevant to the issue under examination.

In *Daubert*, the trial judge must consider two issues: the relevance and scientific basis. To determine the relevance, the trial judge must ensure that the expert will help the judge to understand or determine a fact in issue. As the trust in the scientific basis, the Court found different factors to consider, among them, the methodology can be and has been tested, the methodology has been subject to peer review or publication and if error rates are known, observe if there is existence of patterns of control and operation, and if the theory obtained general acceptance in the relevant scientific community.

The Court found that this list is not definitive. Acknowledged that peer review or publication is not always a determinative consideration because not always correlate with reliability, with some propositions, very particular, very recent or very limited interest to be published.

The facts of each case must be considered to achieve the determination of admissibility. Even if weak evidence is found admissible by the trial court, the court and the parties still have other means yet to reach the truth.

In *General Electric Company v. Joiner* the Supreme Court clarified some issues, where the plaintiff alleged that exposure in the workplace to polychlorinated biphenyls (PCB) and their derivatives have generated small cell lung cancer. The author admitted to being a smoker. The author was assumed smoker.

The district court granted summary judgment for the defendant, relying on the fact that there was no causal link between exposure to PCBs and the author's illness. The district court also found that the testimony of prosecution expert was used subjective arguments or unsupported speculation.

On appeal, the Eleventh Circuit Court of Appeals reversed the decision, stating that the Federal Rules of Proof related to experts, assist the admissibility, and therefore, the reviewing courts should adopt a strict standard of review for exclusion of expert testimony by the trial's judge.

The Supreme Court reversed the decision of the Eleventh Circuit Court, contending that the appellate courts should be more judicious to admit or exclude expert testimony. Analyzing the admissibility of expert evidence in question was realized that the studies presented were different from the case presented by the author and thus did not provide adequate basis for the allegations. The *Joiner* Court held that, although in *Daubert* require courts to focus only on principles and methodology, not on the conclusions generated, they are not required to admit evidence where there is a major omission in the data presented and the opinion offered.

There was still the problem of non-scientific expert evidence, which was not resolved by *Daubert*, since only treated the expert scientific evidence. Then the question remained whether the trial courts should also work with gatekeepers in these cases.



In *Kumho Tire Company v. Carmichael*, the Court held that *Daubert* was applied to all types of evidence.

The case was about a motor vehicle accident caused by a tire blowout that killed one person and caused injury to others. The claim was that the tire had a manufacturing fault, based on studies done by failure engineers.

It was confirmed that the engineering evaluation of the evidence, the trial judge may consider the *Daubert* factors to the extent of its relevance, and that the application of these factors should depend on the nature of the issue, the expert's area of specialization, and the subject under discussion. The *Daubert* factors should be utilized to be useful and not immutable and responsibility of gatekeeping is to evaluate each individual case, except that the trial judge go beyond the *Daubert* factors to assess the relevance and reliability, ensuring that techniques were used stringently.

In a national survey of judges in USA on judging expert evidence in a post-*Daubert* era is explicit the belief that the guard against "junk science" is the intent of decision. [13]

It was also found that judges have difficulty in operationalizing the *Daubert* criteria and apply them, especially in regards to falsifiability and error rate. Judges also have some difficulty to understand the scientific meaning of these criteria.

Another point is that the validity and reliability of approaches and procedures for forensic analysis should be tested. In this sense, there is an effort of the acting community to achieve this goal. [14]

Certification programs for individuals and accreditation of educational programs and crime labs are voluntary and are not supervised by the American Academy of Forensic Sciences (AAFS), which has a council to examine existing certification bodies. [15]

Randall K. Noon sets forensic engineering as "the application of engineering principles and methodologies to answer questions of fact. These questions of fact are usually associated with accidents, crimes, catastrophic events, degradation of property, and various types of failure". [16]

As in Brazil, in U.S. forensic engineers are experts that use engineering disciplines to assist in legal matters. They work in all areas of engineering. It's necessary at least a bachelor's degree in engineering, and most professionals are licensed as professional engineers and this license may be required for some practical. Some forensic engineers have masters or doctorate degree too. Most experts full time are in private practice or small private companies. There are also academics who do eventually consultancy. There are many Forensic engineers engaged in the reconstruction of traffic accidents (car, train, airplane, etc..) and may be involved in some cases failures materials, construction or other structural and collapses and other failures. [17]

The duty of the engineer appears in the following instruments: a contract for engineering services; laws governing the licensing engineer; recommendations for good practice and codes of ethics promulgated by professional societies; and case law, which is the law based on judicial decisions and precedents.

The case law established that engineers have a duty to provide its services in a manner consistent with the standard of care of their professions. The standard jury dealing with the duty of a professional instruction provides that when performing professional services for a client, a professional has a duty to have that degree of learning and skill ordinarily possessed by reputable professionals practiced in the same location and under similar circumstances.

When performing professional services for a client must have the degree of learning and skill ordinarily possessed by reputable professionals. It is his duty use skill and care ordinarily used in similar cases by other reputable professionals in the same locality and under similar circumstances. Should also use reasonable diligence and his best judgment in the exercise of his professional skill and applying his knowledge, struggling to fulfill the purpose for which it was employed. Failure to comply with any duty is negligence.

In this way, there are four main obligations presented by the jury instruction: have knowledge and skill; use care and skill; make use of reasonable diligence and his best judgment; and strive to achieve the purpose for which it was hired.

The level of learning, skill and care that professional engineering must own and use are those owned and used by respected engineers in similar situations and locations. The requirement of "reasonable diligence" means that the engineer must apply a balanced level of effort to complete their tasks. Efforts must involve or result in a serious, careful examination, but without exceeding the bounds of reason. [18]

#### 4. CONCLUSION

In the legal system of the United States, can be said that the quality of engineering professionals are determined by the "gatekeepers" at the time of the admissibility of evidence, unlike the Brazilian system expert is chosen by the judge.

Despite the failures that the system can provide, there are standards that, although not decisive, serve to guide the court as to the admissibility of a particular evidence, getting the system always subject to improvement by a new decision because the American system is based on the history of judicial decisions.

The focus on Brazil is the expert and their technical expertise, in other words the person's professional, while in the U.S. the focus is on the result of the work of the expert: if this is usable, if the work has credibility, or whether it was used "junk science," which therefore demonstrates that the professional is not a good expert.

The biggest problem of the Brazilian system of choice of experts is that the choice of the expert stay only at the discretion of the judge. The judge does not have the standards as adopted in the United States for the admissibility of expert evidence, and technical assistants who could act as "supervisors" have little or no influence on the final results of forensic analysis.

It turns out that experts with little technical knowledge, or that use "junk science", influences the court decision because the judge believes in his assistant since it has no effective parameters to assess the quality of work of the professional.

A list of experts available to judges does not exist, as well as the quality of professionals is not evaluated objectively. Also the scientific method is not evaluated which often exposes the judge take decisions based on unreliable information.

The work of technical assistants could be valued, contributing to these act as beacons of expert performance , functioning as critical expertise held, almost like in America when using the cross-examination.

Despite being different judicial systems, the idea of control of the professionals who act as experts and a review of the results of their investigations, in other words, if the expert reports are scientifically sound and not based on junk science, one can have a benefit of expert activity much better and more useful results for society.

Due to the Brazilian legal system, to achieve this goal, it is necessary to make changes in the existing legislation, which will only happen with a mobilization of experts and judges.

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