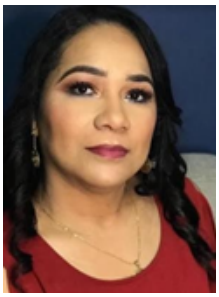
CONTRIBUTION OF THE VARIOUS DISCIPLINES OF GEOMATICS TO THE FORENSIC AREA



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ABSTRACT

Geomatics being a term that first appeared in 1969, by the Frenchman Dubuisson, the definitions given today maintain that initial essence, one of these being according to the Royal Academy of Sciences: *"science and technology of the capture, analysis, interpretation, distribution and use of geospatial data". "Field of activities that, using a systemic approach, integrates all the means to acquire and process spatial data required as part of scientific, administrative, legal and technical activities concerned with the production and management of spatial information".* This discipline in recent years has been developed to a large extent in various areas, the incorporation of the use of GPS (global positioning system), belonging to the United States and that after emerging for exclusive use in the military and security, opened its doors to public use, bringing with it a range of multiple utilities. Similarly, the other branches of geomatics such as topography, cartography, remote sensing and photogrammetry, are equally interesting for the development of multiple activities in the forensic area. Hence, in various countries and in attention to the scientific nature that the different areas used in criminalistics and forensic sciences should have, the various branches of geomatics such as topography have been incorporated to obtain field data for different crimes and proceedings, from the initial ocular inspection at the site where an event occurs, verification of data in cases related to land litigation issues or fixing by methods such as the use of polygons to establish affected areas in a case against the environment. Likewise, photogrammetry, which understood *"In a more formal way we can consider it as the discipline that carries out indirect measurements of objects using photographic perspectives. In other words, the objective of photogrammetry is to obtain three-dimensional information of objects from measurements made on photographs"*[1], has also been incorporated to that range of interesting tools used to generate data that are

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1 Rodríguez, Joan, et al. Fotogrametría arquitectónica, Universitat Politècnica de Catalunya, 2007. ProQuest Ebook Central, http://ebookcentral.proquest.com/lib/biblioumecitsp/detail.action?docID=3229703.
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then presented to support and serve as illustrative demonstrative evidence, since the advent of Digital Photogrammetry in the 90's, one of the most notable features of this line is its growing popularization and socialization; that is, the possibility of developing low-cost lines within the reach of any type of user. Currently, one of these possibilities is the use of Unmanned Aerial Vehicles (UAVs), popularly known as *"drones"*, with which to obtain aerial images that allow the derivation of cartographic products whose applications extend to different fields of work. The incorporation of all these existing forms within the ranges offered by geomatics have not escaped our country, where in recent years tools related to this discipline have been used in the field of topography and illustration through the use of georeferenced data, as well as the incursion into the use of unmanned aerial platforms more recently.

Keywords: geomatics, topography, georeferencing, photogrammetry, forensics.

INTRODUCTION

Initially, concepts related to geomatics, branches and disciplines that compose it, fields of application in which it has been used since its beginnings and the results obtained in some of these will be presented. In addition to the above and based on articles and works developed by experts, mainly in the engineering field, mention will be made of some studies carried out by them, presented through works of great interest, as well as the way in which some countries currently use them and also the use of some elements derived from this discipline, which have been discussed and presented through research and concrete cases and even observations and contributions of a legal nature have been made with reference to them.

It is important to point out that geomatics is the science in charge of integrating the means of capture, processing and analysis of georeferenced data and as such can be used in different applications, all of them useful for the development of countries, it has not been left out of the forensic reality and investigations of various crimes, so we will present aspects in which in different ways it has been incorporated as evidence of great value, Some of the branches of this science, such is the case of the use of GPS in the location of people, the use of photogrammetry for illustration and animation in forensic cases, topography in cases related to litigation and legal disputes of land, which are presented to the competent authority, as well as the application of methods and instruments as popular today as the well-known *"drones"*.

DEVELOPMENT

During the last few years and more acutely as a result of the pandemic, which emerged in the Asian continent at the end of 2019, technological means have become a necessity in all areas of

our lives, going from being a novelty, a luxury or an object of exclusive use for the new generation to being an everyday aspect in the life of everyone regardless of gender, age or social background. Consequently, it has also become an instrument of interest in the development of multiple forensic disciplines.

In this sense, the aspects to be addressed within the problem to be presented are, within this wide range of technological issues, those related to geomatics, which is the science, engineering and art used in the collection and management of geographically referenced information. Geomatics in turn includes a series of disciplines such as geodesy, cartography, photogrammetry and topography, which can be used by criminalistics to support the presentation of certain elements of illustrative demonstrative character specifically in the case at hand through the use of some disciplines in court cases such as the location of people through geolocation, 3D animation in cases against life mainly, among other applications.

When we referred in previous lines to the concept of *"illustrative demonstrative"*, we referred to the visual presentation of some elements that can contribute to better understand information that in written or narrated form, in the judicial and investigative field may not be clearly understood. Thus, the great increase in the use of cell phones, which provide permanent information of our location, as well as other types of activities we perform, has become for many years a great tool that contributes to justice.

Since some decades ago the location of people through instruments that have information of their location have been used as a fundamental piece in the development of criminal investigations, being announced by Jose Antonio Gonzalez, in his article called *"The Real Motives of Crime"*, some interesting aspects within an investigation conducted in Spain in which the information obtained from a cell phone, played an important role, as noted in the following lines:
"Geolocation is key to locate a suspect at the crime scene or reconstruct his steps with the GPS signal. This was also the case with the Breton case. In 2012 he murdered his two children, Ruth and José, his alibi being that they were abducted in the Cruz Conde de Cordoba park.
However, Jose Breton forgot the location of his mobile device. Despite turning it off so that the police could not trace him, from the terminal several calls were made that allowed to discover all the steps that October 8, 2012."

On the other hand, another of the disciplines that encompasses geomatics is photogrammetry, which becomes very innovative and efficient in many aspects of research, since we can obtain visual information aerially through various forms, but in this specific case we will refer to the *"drone"*,

as well as photographic views or terrestrial records that can also occur through more modern and expensive instruments such as laser scanners. One of the great challenges to develop in this sense is to expand the knowledge and create mechanisms that, based initially on basic and intermediate knowledge of geomatics, in some of its branches, can serve as an effective tool and provide relevant information in the investigations of cases to investigate that merit it.

The problem to be solved is to know in a broader way what geomatics consists of and how it can be used in the forensic area in our country, without losing its essence and adapted to the particular need in the field of criminalistics that collaborates as an auxiliary arm of justice in the clarification of criminal cases of various kinds. It is important to take into account that there are professionals dedicated to the study of geomatics and geodesy, whose field of study has ventured in recent years in our country and that covers a wide and detailed range of these, but that knowledge and aspects are also required. of the criminal expert, who will have another approach and nuances in the use of this knowledge, for which a more technical preparation, applied to the desired and useful results, to provide data of interest in various judicial investigations, for which I will develop in a simple way basic information about geomatics and the ways in which it can be applied to criminalistics according to experiences in other countries and the first steps of incursion into this discipline within our Panamanian isthmus.

In search of references to the exposed subject matter and taking as reference, that nowadays there have been more and more frequent cases in which by means of geolocation in its various forms have been achieved great contributions presented in court, both to corroborate information of the location of a person or object at a certain date, time and place, as well as to disprove it. The above, due to the way in which the use of various methods of obtaining data has been increasing, especially through information generated by coordinates from satellites, as well as other types of information that can be obtained from them, mainly through the use of GPS, which despite being known by the vast majority in a generic way, is not known in a more detailed way what it is, how it arises, how it works and even the proper way of handling this type of information. In the same way and through the experience of other countries, as well as the initial training that criminal experts have received in our country and the exchange of experiences, new ideas and ways have emerged in which the essence of this interesting discipline can become in the short or medium term an efficient tool within the forensic sciences at a national level.

SCIENCES AND DISCIPLINES INCLUDED IN GEOMATICS

Geomatics includes several sciences, disciplines or techniques such as remote sensing, photogrammetry, geodesy, cartography, etc. The following is a brief explanation of the main

branches or disciplines of geomatics.

► **Remote sensing**

Remote sensing is a way of obtaining information about objects by taking and analyzing data without the instruments used to acquire the data being in direct contact with the object (MIRELES 2017). This aspect is very interesting and according to literature consulted has been of great help in the study of environmental crimes, since these data are saved and remain or maintain the real information of a given area being able to serve as a reference for the study of this type of cases in which, in the particular case of our country, due to multiple situations in the minority of cases can attend to perform the inspection of the place, sampling and observation of any other element of interest to establish causes in a scientific way, the above affects greatly as they can go losing data of great value with the passing of the days.

► **Geodesy**

It is the mathematical science that studies the shape and size of the Earth and the positions on it. Therefore, geodesy is about knowing the exact shape of the Earth and modeling it so that we can position ourselves on it.

This science has been used for thousands of years and in a rudimentary way we were taught from our first years of school, without knowing at that time the relevance that this could have in an investigation, the relevant aspect of this science within the investigation is to be able to position on earth people or objects, which is the basis of the data obtained from the global positioning system referred to in previous lines.

► **Cartography**

Cartography basically consists of map making. In addition to the execution of maps, cartography tries to solve aspects such as the most appropriate way to represent the Earth on a flat surface. It is the rudimentary and classic way of locating us within a place, in Panama this type of maps are made mainly by the Tommy Guardia Geographic Institute and also by one of the departments of the National Comptroller of the Nation which must keep constantly updated the data of each district, township, neighborhood, etc., so that it can be available to those who require it.

► **Photogrammetry**

Photogrammetry according to definition obtained from Wikipedia the free encyclopedia: is the technique whose purpose is to study and accurately define the shape, dimensions and position

in space of any object, essentially using measurements made on one or more photographs of that object.

A more updated definition, from the American Society for Photogrammetry and Remote Sensing (ASPRS): *"is the art, science, and technology of obtaining reliable measurements of physical objects and their environment by recording, measuring, and interpreting images and patterns of radiant electromagnetic energy and other phenomena".*

The word photogrammetry derives from the word *"fotogram" (from "phos", "photós", light, and "gramma", tracing, drawing),* as something ready, available (a photo), and *"metrón",* to measure.

► **Topografía**

Topography is the science that studies the set of principles and procedures that aim at the graphic representation of the earth's surface, with its forms and details; both natural and artificial; (see planimetry and altimetry). This representation takes place on flat surfaces, limiting itself to small extensions of land, using the denomination of *«geodesy»* for larger areas. In a very simple way, it can be said that for a topographer the Earth is flat (geometrically), while for geodesy it is not (Wikipedia.org, Accessed August 2, 2021).

From the latter derives the planimetry and altimetry, both currently used in criminalistics in Panama, both in cases addressed by planimetry itself, as well as in those related to traffic accidents, which are attended by forensic accidentology, who present the representation, in this case, of the surface of interest in which a criminal event occurs.

In the line of the applicability of some of the modalities that geomatics comprises, we observe in the Degree project developed by Fabio Nelson Rodriguez, which is called *"Manual Of Topography Applied To The Investigation And Reconstruction Of Traffic Accidents"*, that different technical areas and necessary foundations are exposed, for the understanding of the current topographic technical procedures, photographic and scene management or processing of the scene of the facts, applied to the reconstruction of traffic accidents, ballistic deaths and other violent deaths. The tools, techniques and equipment used in the investigation and reconstruction of traffic accidents are also mentioned, being this the main intention of the research document. This will allow us to know what procedures and results are achieved with the different manual-electronic measuring equipment and digital reconstruction platforms focused on the forensic field; allowing us to know the evolution of topography in this field of action, which considers a faster, more accurate, efficient, dynamic and

illustrative handling of the topographic work applied to the forensic reconstructive area and the management of criminalistic information.

FIXATION OF THE PLACE OF THE FACTS

The original conditions of the place of investigation are unique and unrepeatable, so we must document them through various procedures (Rodriguez, 2013). The fixation of the place of the facts, its evidences and other material manifestations is carried out by applying the following techniques:

- Written description (written report of procedure, calculations and location of EF).
- Forensic photography (support for the spatial location of the FE and its characteristics).
- Forensic videography (support for spatial localization of FE and its characteristics)
- Forensic topography (spatial localization of FE and crime scene)
- 3D modeling (spatial representation of FE and crime scene).

On the other hand, SANDRA ZANCAJO BLÁZQUEZ in her doctoral thesis *"Geo laser and photogrammetric technologies applied to 3D modeling of complex scenarios in forensic computer graphics"*, presents interesting elements related to the study of three-dimensional reconstruction of scenes and objects for subsequent analysis is a subject of research by different disciplines. One of the disciplines in which it is necessary to obtain 3D models is in forensic engineering, and more specifically in the field of computer graphics.

Forensic computer graphics is a technique that allows the virtual reconstruction of different events through the use of computers and digital images. The great advantage offered by laser and photogrammetric geotechnologies for the modeling of complex scenarios in forensic computer graphics is that they are non-invasive and non-destructive techniques. That is, through them there will be documentary evidence of the evidence present in the scene, without altering at any time their spatial positions or their physical properties, in addition to providing rigor, completeness and realism to the reconstruction of the event.

In this Doctoral Thesis it has been demonstrated that the application of various geotechnologies such as conventional digital cameras (including *"Smartphones"*), *"Gaming Sensors"* scanners and mobile indoor mapping systems *("Indoor Mapping")*, are suitable for the ocular inspection of the crime for its subsequent three-dimensional graphic representation.

The applied method and the conclusions reached by Zancajo Blanques in his doctoral

thesis can be taken into account to carry out similar studies in our country, at a more basic level, with the measurement instruments currently available, or by introducing professionals trained in engineering, geomatics, geodesy or similar professions in our universities to this research, in order to verify more effectively the effectiveness and real scope of these technologies applied to the forensic area. Among the conclusions of Zancajo Blanques, it is highlighted that through the acquisition of data with the proposed passive sensors and the application of a methodology and proprietary software (PWF), three-dimensional reconstruction has been achieved automatically and dimensional analysis of forensic scenes using only images. A great advantage of this tool is that the images for processing can be taken with any type of camera, even with uncalibrated and low-cost cameras (*"Smartphones" and "Tablets"*), which allows great flexibility for non-experts.

GPS (GLOBAL POSITIONING SYSTEM) TECHNOLOGY

The commonly known GPS by its acronym Global Positioning System, has become part of our daily life, nowadays they are mainly immersed in our smart phones. On the other hand, and for some years now, the issue of obtaining information on individuals through devices and vehicle control has been the subject of debate in other countries, such as the United States, a country that provides this service, which initially was exclusively for military use.

The use of this information for tracking or location of a given object was presented in an article by ALLISON SMITH, United States Legislative Attorney, entitled *"Law Enforcement Use of Global Positioning (GPS) Devices to Monitor Motor Vehicles: Fourth Amendment Considerations"*, in which she refers to Law Enforcement Use of Global Positioning Systems (GPS) Devices for location and control mainly of vehicles.

In this interesting article he makes reference to what has been repeatedly mentioned in this paper that *"technology continues to advance, what was once novel thinking, even a luxury, quickly becomes banal, even a necessity"*. GPS (Global Positioning System) technology is an example. Generally, GPS is a satellite-based technology that reveals the location of a given object. This technology is used in automobiles and cell phones to provide drivers with directional assistance. Just as individuals are finding more and more applications for GPS technology, so are state and federal governments.

Another aspect to consider is the increased reliance on GPS technology, which has occurred in the last five years, which should raise legal and social considerations. Some argue that law enforcement's use of such technology to track the movements of motor vehicles provides for a safer society. Conversely, others have expressed concern that GPS technology could be used to

reveal inherently private information. In this regard the SMITH article notes that defendants at the state and federal levels are raising Fourth Amendment constitutional challenges, asking courts to require compliance with the law to first obtain a warrant before using GPS technology and likewise discusses in its content the basic concepts of GPS technology, society's reliance on it, and some of the related privacy and legal implications.

In this sense, in our country the Public Prosecutor's Office is the institution that has the power to prosecute crimes and violations of constitutional or legal provisions, as established in paragraph 4 of Article 220 of the Constitution, so within the framework of the law may request this type of data for an investigation, this is also established by Executive Decree 285 of May 28, 2021, was regulated by Law 81 of Protection of Personal Data, in its article in its Article 17:

> *"Conditions of lawfulness for processing: processing may proceed when at least one of the following conditions is met:*
> *...6. When required by a public entity in the exercise of its lawful functions, for the safeguarding of a public interest or by court order."*

Therefore, in many countries today, GPS technology has been put to new uses to assist in tracking and evidence gathering, here are some examples cited in the article published by SMITH:

- Wisconsin police, acting on a tip about a former methamphetamine manufacturer, attached a GPS device to the suspect's car, this yes, without first obtaining a warrant. The information recorded on the device led them to a large tract of land visited by the suspect. With the consent of the landowner, they searched and found paraphernalia used for the manufacture of methamphetamines. The suspect was subsequently arrested.
- The NYPD used evidence acquired from a GPS device (without first obtaining a warrant) that had been attached to a carjacking suspect the previous year. The device, which monitors the suspect's movement without interruption for more than two months, showed that the suspect had driven into a shoplifting robbery. This evidence was used to corroborate a witness's testimony that the suspect had been watching the store to determine its vulnerabilities.

These examples and other multiple cases reported, in which GPS technology has been used, including in our country, where among others it has been used in the investigation of Crimes Against Life, one of them in which through the verification of the data provided by the telephone of the investigated citizen, it was found that he had moved through a series of places that were clearly related both to the discovery of the body of the victim, as the place where he was seen alive for the last time, contrary to what he indicated in his statement. This demonstrates its usefulness, not only

in data as such, but also in the way it can be presented through a cartographic map or satellite image in an oral trial, showing in an understandable way to those who are part of the process, the exact sites referred to by means of the information provided by this instrument, which in our country uses the model of the WORLD GEODESIC SYSTEM-84 (WGS-84), which is based on satellite and terrestrial technology within a global scheme that unifies and processes all the information with these modern scientific techniques and which are detailed in the EXECUTIVE DECREE N°139 - 30-06-2006 - *"BY WHICH A NEW NATIONAL GEODESIC FRAMEWORK OF THE REPUBLIC OF PANAMA IS ESTABLISHED"*.

In addition to geodesy, other disciplines or branches of geomatics have also been incorporated in our country, such as the use of topography for the collection of data and presentation of information in cases mainly related to land litigation, in which it could be said that the result of these topographic data captured through a report, in which through the collection of field data can be issued a useful conclusion to answer the questioning of the authority. This same branch is used in the development or presentation of information to the competent authority in other crimes.

So that the expert can use these tools, as an auxiliary arm of those who carry out the investigation, there is also a legal framework, in our country, that shelters some of the components of the forensic profession, such as:

> *"**Article 28.** Article 2 of Law 50 of 2006 shall read as follows:*
> ***Article 2.** The Institute of Legal Medicine and Forensic Sciences shall have, among others, the following functions:*
> *3. To identify persons, things and places by means of examinations, inspections, plans, photographs and other technical, scientific and/or medico-legal expertise.*
> *10. Serve as a scientific center of national reference in all matters related to Forensic Medicine and Forensic Sciences."*

The Code of Criminal Procedure, Law 63 of August 2008, also includes the aspect of expertise and participation in proceedings, including those currently practiced mainly by staff of the Forensic Planimetry Section:

> *"Article 406. An expert evidence may be practiced when it is necessary to have special knowledge in any science, art or technique to discover or value an element of evidence. The expert evidence must be practiced by impartial, objective and independent experts. Only a natural person may act as an expert witness who proves by means of the respective certificate or diploma his suitability for the subject matter submitted to his*

expertise or opinion. An exception is made for practical cases for which a diploma or certificate of suitability is not required, in which case experience must be accredited. Article 407. Participation in proceedings. If the nature of any proceedings to be carried out during the investigation stage requires the assistance of experts, the Public Prosecutor's Office shall bring the corresponding experts. The intervening parties may also attend with their experts if they consider it pertinent, as long as they have been announced before the Prosecutor. At any other time, they shall be appointed by the Judge or Court, at the proposal of the party. The expert shall keep confidential all that he/she learns on the occasion of his/her performance."

MATERIALS AND METHODS

The present research is of a descriptive qualitative nature, within which the reader has been presented with valuable information related to the subject and which will also present data of interest related to the subject, through a documentary and bibliographic study of contents related to the sciences that Geomatics encompasses and the application and usefulness they have had in various fields of research in American and European countries, as well as the experience of our country.

The analysis based on qualitative data can be classified into two categories: descriptive studies, which focus on the description of the data, without conceptualization or interpretation, aiming to faithfully describe life, what happens, what people say, how they say it and how they act. On the other hand, interpretative studies seek to transcend the social subject in order to explain and understand more complex social facts or phenomena. All of them are based on a deep theoretical background of the social fact or cultural phenomenon under study. Grounded theory discovers theories, concepts and hypotheses from the data. It is a non-experimental research design, which according to Sampieri is defined as research that is carried out without deliberately manipulating variables and in which only phenomena are observed in their natural environment and then analyzed.

The population used as a sample was 68 individuals, related to the area of criminalistics, in different areas, as well as the data and information obtained from the documentary analysis of the aspects related to the subject, to collect valuable information with which we can know important aspects of the subject, through interviews and documents, that due to the nature, complexity and novelty of the problem investigated, there was no intentional manipulation of the variables of study, that is, the problem to investigate was studied as it was given in its context and evaluated at a certain time.

Data Collection Instruments and Results

In this research the structured interview was used, which is carried out following a guide of specific questions and is subject exclusively to it. In this case, the interview was conducted verbally, keeping a written record of the questions and answers to a group of people in order to obtain the information required for this research. The interview guide consisted of nine (9) questions.

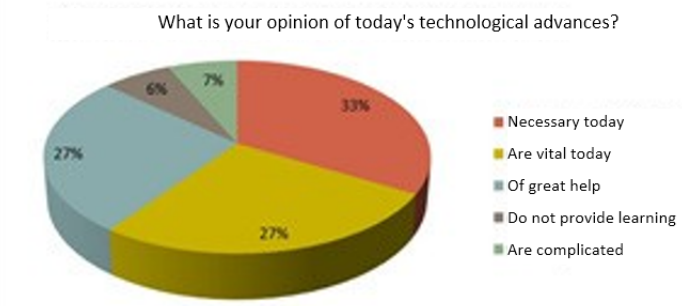
The typology of questions used was developed based on Grinnell, Williams and Unrau, which includes general questions (grand tour), questions to exemplify, structure questions and contrast questions. The results of the interviews were captured using the "grouping" technique, in which first, we noted down themes linked to the approach mentioned in the interviews or groups, or detected in the observations and documents. Then, we noted which ones are common (repeated over and over again), which ones are the most distinctive (closely related to the approach) and which ones are only mentioned once or a few times. The latter are discarded.

These data were processed qualitatively, based on the results of the interview detailed below, these items provided us with the necessary information for the creation of the grouping table, taking a sample of twenty (20) of the total interviewed.

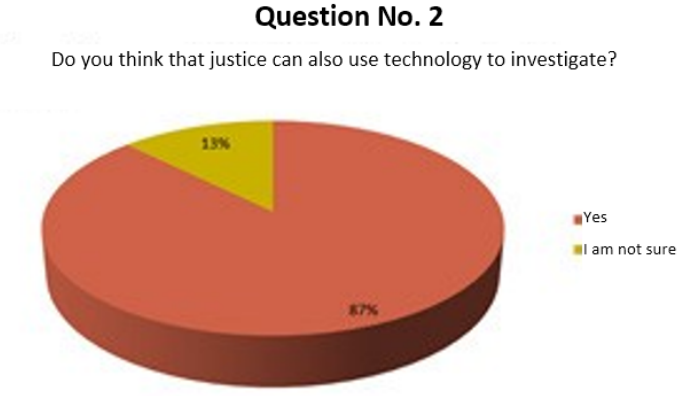
List of Topics	Which are common	Which are different	Grouping
1	Of great help (4), currently necessary (5), vital (5), are currently vital (4)	Do not contribute to learning (1), are complicated (1)	currently required (5)
2	Yes (14)	Not sure (2)	Yes (14)
3	GPS (6), location of cars (6), location on cell phones (5)	I do not know (1)	GPS (6), location of cars (6),
4	computer information (4), has to do with the earth (5)	Must be related to robotic issues (2)	has to do with the earth (5)

5	Yes (11)	They are expensive (1), no opinion (1)	Yes (11)
6	For GPS (3), to locate (3), for location (5)	It would be difficult (1)	for location (5)
7	Informing more (7), creating trainings (5)	I do not know (2)	Reporting more (7)
8	Of course (9), I would love to (7)	No (1)	Of course (9)
9	It is novel (7), sounds interesting (8)	To test (1), do not know (1)	

Question No. 1

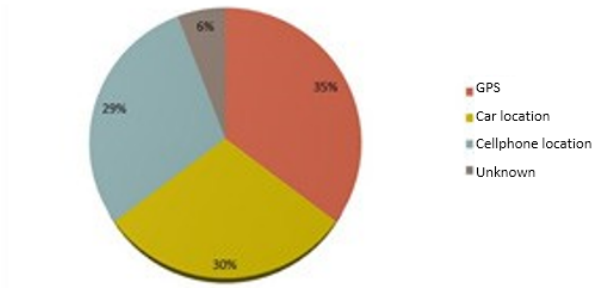


Question No. 2



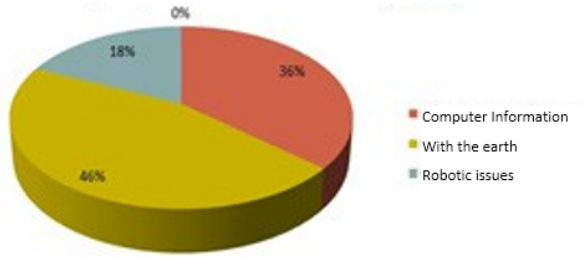
Question No. 3

What do you think is the technology related to geolocation data?



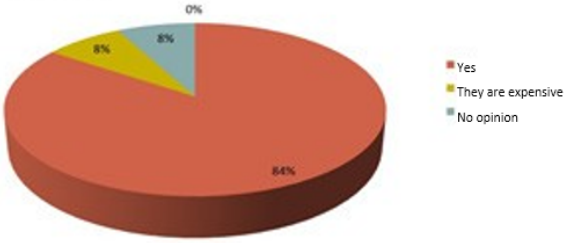
Question No. 4

What is your opinion of geomatics in this case?



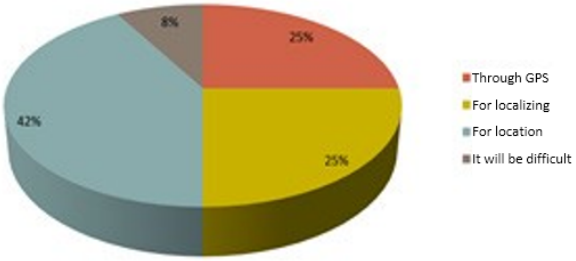
Question No. 5

Within the forestry sciences, do you think that techniques related to this one could be effective?



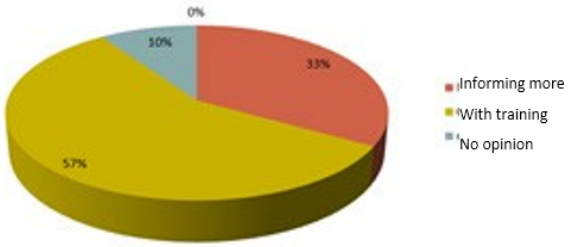
Question No. 6

In which cases do you think it can be used?



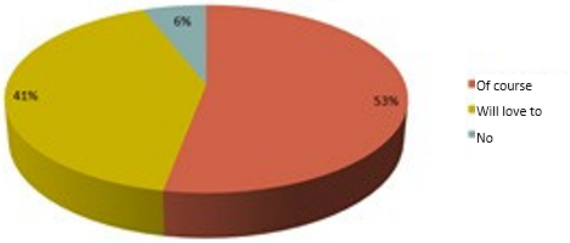
Question No. 7

What would you recommend to obtain better results in the use of geomatics in Panama?



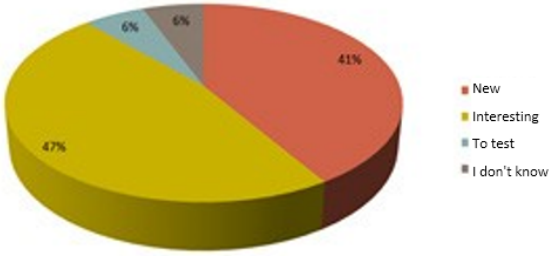
Question No. 8

¿Estaría dispuesto a formarse como experto en esta área dentro de la Ciminalística?



Question No. 9

Why?



Discussion of Results

Through the development of this questionnaire we can see according to the different answers of the participants, that in a higher percentage they are willing to believe that technological changes are beneficial and necessary, as well as the willingness of these to enter and experiment new ways, methods and techniques that can be applied to the field of forensic sciences to investigate various crimes in our country, Likewise, they consider that the best way to carry out, increase and make known the use of geomatics among experts related to forensic sciences, as well as to those involved in the investigations and even in those who practice or dominate areas related to geomatics, is the promulgation, make known and implement training programs focused on the application of geomatics to the forensic area.

It is important to note that during the development of the field research, other concerns arose during the interview from the participants, most of whom were a representative sample of people under 30 years old, such as the way in which, in addition to those already mentioned in the previous chapters, aspects related to geomatics could be used in our country.

The above leads us to emphasize that in a higher percentage and within the young population, the incorporation in a more active way and with new techniques of aspects related to geomatics, would be of great success in our country and even more, using these elements we can even awaken in the students methods of analysis in which they can summarize information from various aspects as mentioned by the respondent, not only from the crime scene or what was done during the ocular inspection, but also aspects of the investigation. This last aspect has been a “plus” in my research, since as a teacher it is extremely interesting that students generate their own opinions and develop skills, so that they are not limited to the material provided or the indications given to them and this would result in better professional results in any area of Criminalistics.

CONCLUSIONS

- It was presented in a simple way what geomatics consists of, being the science, engineering and art that are used in the collection and management of geographically referenced information, it is of great value to provide data of interest and serve as evidence in various types of research.
- Similarly, the disciplines that comprise it such as photogrammetry, topography, cartography, geodesy and remote sensing were observed and what each of these can contribute to the forensic field, providing in addition to the scientific data obtained, a substantiation and presentation to the courts that supports the results and report presented and can provide additional and valuable information within the investigated case.
- It is important that the objective of presenting, through the experience of other countries, the way in which geomatics through its different disciplines has already had a positive impact within the judicial field as an important part in the contribution of resources, such as geolocation through which the location of people or things can be verified, topography through the use of its main components to define cases related to land litigation in its various forms, as well as the interesting way in which photogrammetry has been used as a visual demonstrative form, through the use of 3D animations or more realistic presentations with mathematical data or distances of a place.
- In the same way, it is of great importance that in our country new trends are developed in the same way, which support and can be integrated within the existing ones within criminalistics, taking into account that the changes and advances in the technological, scientific, cultural and even within the criminal development, has not stagnated and every day innovations emerge, new mechanisms, cutting-edge technology, so we must also be constantly evolving within our area of responsibility and even innovate, implement and try to validate and implement tools and methods that can contribute to a result equal to or better than the previous ones.
- Equally presented in the present research work was the need to include new disciplines, experts, as well as to create new study alternatives that can contribute to the growth and constant improvement of services within criminalistics and forensic sciences, as well as to make a call to professionals in the area of engineering to make contributions that can benefit investigations and above all contribute in many cases, so that justice can effectively reach our citizens, incorporating means of proof with greater validity and scientific support.

- This work also shows the current weaknesses and strengths existing in our country, as well as in other countries of the region and Europe in relation to geomatics in the field of judicial investigation.

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