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ORIGINAL

Environmental impact of waste management in car repair shops in 2023

Impacto ambiental de la gestión de residuos en talleres mecánicos en 2023

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ABSTRACT

The objective of this research was to determine the environmental impact generated by waste management in mechanical workshops in the district of Comas during 2023. A qualitative approach with an action research design was used, applying semi-structured interviews to citizens living near these workshops. The study revealed poor management of hazardous waste such as used oil, batteries and automotive fluids, which caused significant damage to natural elements such as soil, air and possibly water. Most mechanical workshops did not properly classify or isolate waste, which contributed to environmental degradation and posed a threat to human health. Although some citizens expressed an intention to act sustainably, they felt limited by the lack of government support and their lack of knowledge of environmental laws. The interviews revealed a negative perception of waste management and a collective concern about the long-term effects. It was concluded that there is an urgent need to implement action plans in conjunction with the local government, as well as to raise awareness among both operators and the community about the effects of poor management. It was also suggested that innovation should be encouraged through the use of eco-friendly materials and methods such as the 5S technique to improve order and cleanliness in workshops. Finally, greater municipal oversight and environmental education from an early age were recommended.

Keywords: Environmental Impact; Auto Repair Shops; Waste Management; Comas; Sustainability.

RESUMEN

La presente investigación tuvo como objetivo determinar el impacto ambiental generado por la gestión de residuos de los talleres mecánicos en el distrito de Comas durante el año 2023. Se abordó desde un enfoque cualitativo con diseño investigación-acción, aplicando entrevistas semiestructuradas a ciudadanos que habitaron cerca de estos talleres. El estudio reveló una deficiente gestión de residuos peligrosos como aceites usados, baterías y líquidos automotrices, lo cual generó un daño significativo en los elementos naturales como el suelo, el aire y posiblemente el agua. La mayoría de los talleres mecánicos no clasificaron ni aislaron adecuadamente los residuos, lo que contribuyó al deterioro ambiental y generó una amenaza para la salud humana. A pesar de que algunos ciudadanos mostraron intención de actuar de manera sostenible, se sintieron limitados por el escaso apoyo del Estado y la falta de conocimiento de leyes medioambientales. Las entrevistas evidenciaron una percepción negativa respecto al manejo de desechos y una preocupación colectiva por los efectos a largo plazo. Se concluyó que existe una urgente necesidad de implementar planes de acción en conjunto con el gobierno local, además de concientizar tanto a operarios como a la comunidad sobre los efectos de una mala gestión. Asimismo, se sugirió fomentar la innovación con el uso de materiales ecoamigables y aplicar métodos como la técnica 5S para mejorar el orden y limpieza de los talleres. Finalmente, se recomendó una mayor fiscalización municipal y educación ambiental desde edades tempranas.

Palabras clave: Impacto Ambiental; Talleres Mecánicos; Gestión De Residuos; Comas; Sostenibilidad.

INTRODUCTION

Maintenance and repair are essential activities; their beginnings date back to the 19th century in Europe because, along with the invention of the automobile, there were also problems of which the owners, commonly upper class, were unaware; then, their employees appeared, drivers with more experience in handling the vehicle, which benefited both parties, since they developed a path between the lower and upper classes with vehicle maintenance and later the appearance of the mechanical workshop.[1] However, the waste generated by this activity is highly harmful to the ecosystem. For 1 liter of used oil, the contamination covers 1'000,000 liters of water.[2] Likewise, Arciniega et al.[3] indicate that most workshops (86 %) have ever discarded batteries. Gómez et al., in Ramírez and Antero[4] state that there is an uncontrolled system of production, consumption, and waste. These wastes take a long time to decompose; paradoxically, they abound in the soils of these businesses. All this contributes to the wear and tear on the environment, as well as the well-being of society. Therefore, the following sections will present the problematic reality, justification, and research questions; then, the theoretical bases, including the national and international background and relevant theories or events that support the research. Subsequently, the methodology and design will guide this dissertation in achieving the objectives previously proposed. In addition to the above, the results, discussions, and conclusions will be presented. Finally, all the annexes referring to evidence and structures that support this research will be presented.

Over the last few years, various initiatives have been introduced to promote environmental care. However, the highest representatives have not adequately implemented ecological plans. In the United States, for 2019, the company Verisk Maplecroft determined that 2,100 million tons of garbage were generated, of which only 16 % was recycled (323 million tons). The majority being plastic waste.[5] Additionally, according to Hoornweg and Bhada in Segura et al.[6] global waste amounts to 1,3 billion tons per year and is expected to reach 2,2 billion by 2025. In our country during 2020, of the total number of municipalities, "84 % deposit it in a landfill, 31,2 % dispose of it for recycling, 18,3 % destines it to a sanitary landfill, 10,1 % burns or incinerates it and the remaining 5,9 % goes for composting".[7] This shows a reduced percentage of waste reuse. It also raises concern to see that our country lacks efficient waste management. Similarly, that same year, waste totaled 7,9 million tons, of which 76,4 % could be reused, and only 0,98 % was reused.[7] In Spain, mechanical workshops manage waste each year of "270 342 tons of tires, 121 004 tons of used oil, and 239,5 tons of batteries".[8] A large amount of waste is produced by mechanic workshops, both formal and informal, as they generate elements that contribute to a sustainable economy. In Lima, according to the Peruvian Automotive Association[9] there are approximately 38 000 garages where only one or two professional mechanics are employed. According to Arciniega et al.[3] "a garage receives 15 cars a day, each one is equivalent to 4 liters of used oil (...) 1 liter of that contaminates 1 million liters of water and on the ground forms a 4-meter film," which causes irreparable damage in our society. Fundamentally, waste management is a significant contributor to this problem. According to Loctite Tersone[10] various chemical materials are used in machine shops. "These are divided into nine classes "(pressurized gas, explosive, corrosive, oxidizing, irritant, flammable, carcinogenic, toxic, and dangerous for the environment)," and their correct disposal and isolation is of great importance to avoid major problems, especially for the environment. Finally, used oils that are negligently disposed of, due to their low biodegradability, can penetrate the different layers of the soil, generating a risk of ending up in water wells that are later used for treatment and human consumption, which represents a great danger, since it can "cause from rashes to gastrointestinal problems, anemia and some other symptoms".[11] Therefore, it is necessary to determine what is the environmental impact of mechanical workshop waste management in the district of Comas during 2023? Conducting a thorough and rigorous investigation will enable us to gather relevant data that will contribute to the solution of this problem.

Research Question

General Question

What is the environmental impact of the management of mechanical workshop waste in the district of Comas during 2023?

General Objective

To determine the environmental impact of the waste management of mechanical workshops in the district of Comas during 2023.

METHOD

Type and design of research

Qualitative Approach

A qualitative approach is understood as a "methodological procedure that uses words, texts, speeches, drawings, graphs, and images (...) to understand the social life of the subject through the meanings developed by the subject," showing a more complex side of the being found by his behavior and unfolding in his society.

This approach is framed within the naturalistic scientific paradigm; according to Barrantes, it is referred to as naturalistic-humanistic or interpretative because it "focuses on the study of the meanings of human actions and social life". It is an intrapersonal analysis of the individual. This type of research is essential because it helps to understand aspects of a person that are not easily perceived.

Action Research Design

It aims to "understand and solve specific problems of a community linked to an environment (group, program, organization or community)".[12] It seeks to include the citizen who, without being aware of it, is part of the problem. It aims to improve the situation by changing the way people think in society. Colmenares and Piñero[13] suggest that the researcher acts as an agent of change through action research, as it demonstrates the existence of a phenomenon to the public, making the magnitude of this phenomenon noticeable and thereby facilitating societal change.

Explanatory Scope

According to Hernández et al.[14] its objective is to present the causes, relationships, and effects of the phenomena being studied. Still, it does not intend to describe and ponder the situations but rather to understand the contexts in greater depth. According to Ramos[15] the explanatory scope in qualitative approaches aims to build an idea through the participation of the subject. It seeks to understand the phenomenon better, as it makes a significant contribution to the field of ethnographic research.

Categories, subcategories, and categorization matrix

In the present work, the main variable taken as the primary variable is environmental impact, from which four categories, such as the environment, natural elements, waste, and sustainable behavior, are derived since, due to the qualitative approach, it was possible to build a theory with the criteria that are thought to be relevant.

Study Scenario

Taking the basic time, space, and thematic compounds, it is intended to conduct the research only in the present year, "2023". Additionally, I conducted interviews with residents of the Comas district in Lima, Peru. Finally, they are citizens who live near areas exposed to mechanic workshops with deficient waste management.

Participants

Sample

A non-probabilistic sampling was used "because with this the choice of the elements does not depend on probability, but on causes related to the characteristics of the research or the researcher's purposes",[12] which left it to the researcher's discretion to choose the interviewees for this dissertation.

Data Collection Techniques and Instruments

The qualitative interview was used as a technique that "is defined as a meeting to talk and exchange information between one person (the interviewer) and another (the interviewee)".[14] It generates greater intimacy in data collection and provides the opportunity to discover essential aspects that are not immediately apparent.

The semi-structured interview guide was used as an instrument; according to Hernández et al.[12] "they are based on a guide of issues or questions and the interviewer is free to introduce additional questions to specify concepts or obtain more information". It aims to establish a fixed meaning for both pure and topic-specific data collection. Likewise, it allows for the modification and addition of questions during the interview.

Procedures

The interview guide tool was selected to achieve the research objectives. A presentation and brief introduction of the analyzed topic was made to the participants. Likewise, we addressed the inhabitants of Comas who have experienced the development of activities carried out by the mechanical workshop or live near areas where this business is conducted.

Scientific rigor

We used only reliable academic sources obtained from databases specific to the field of study, as well as institutional repositories of the most prestigious universities in the country, excluding books by authors recognized for their outstanding work.

Credibility Criteria

The credibility of the study will be accepted as long as it presents a complete and clear image of the

investigated problem. It also states that the hermeneutic sciences conform to the part inside the person and community.[16,22,23,24,25,26,27]

RESULTS

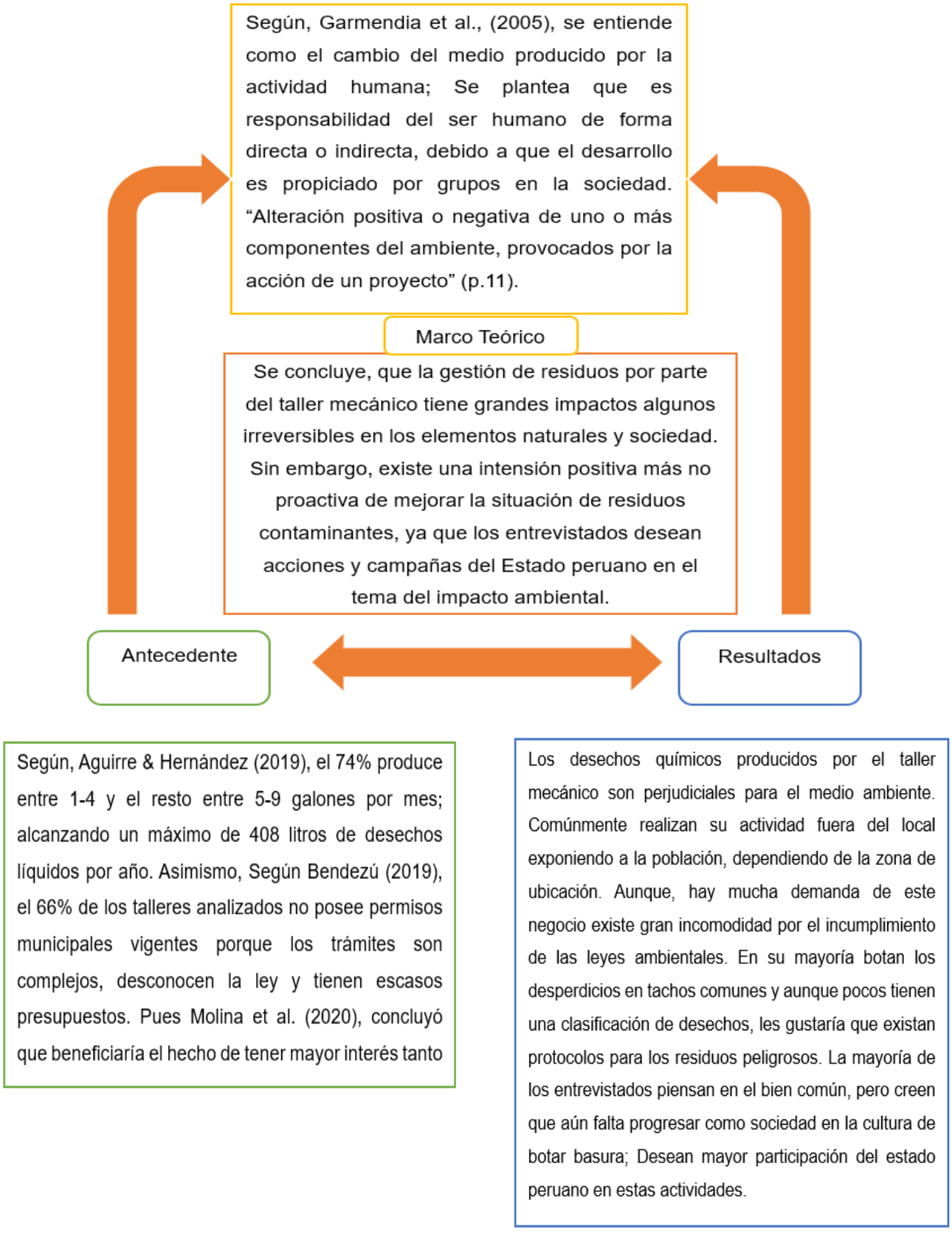

Figure 1. Background, Theoretical Framework and Results

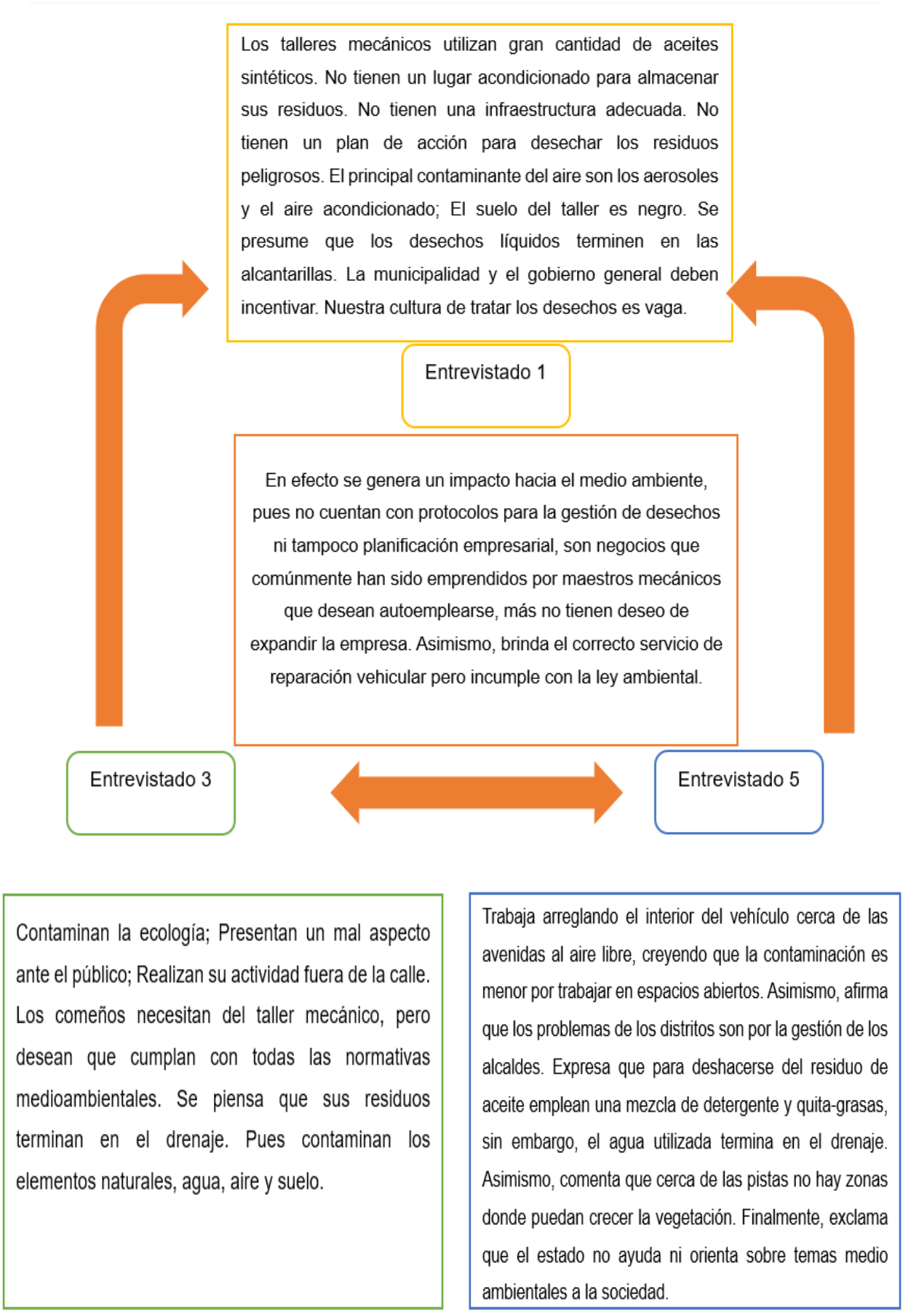

Figure 2. Semi-structured interviews

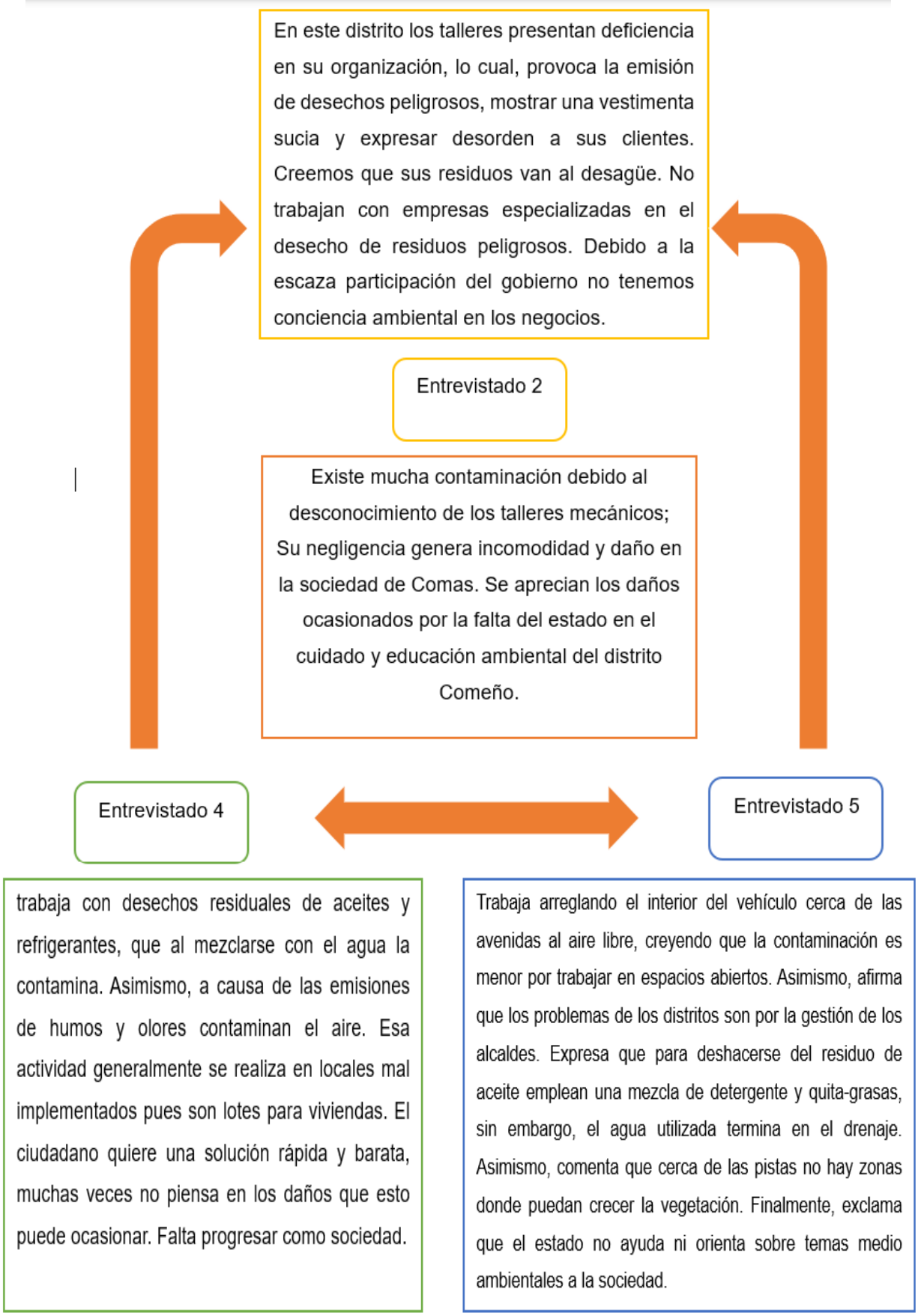

Figure 3. Semi-structured interviews

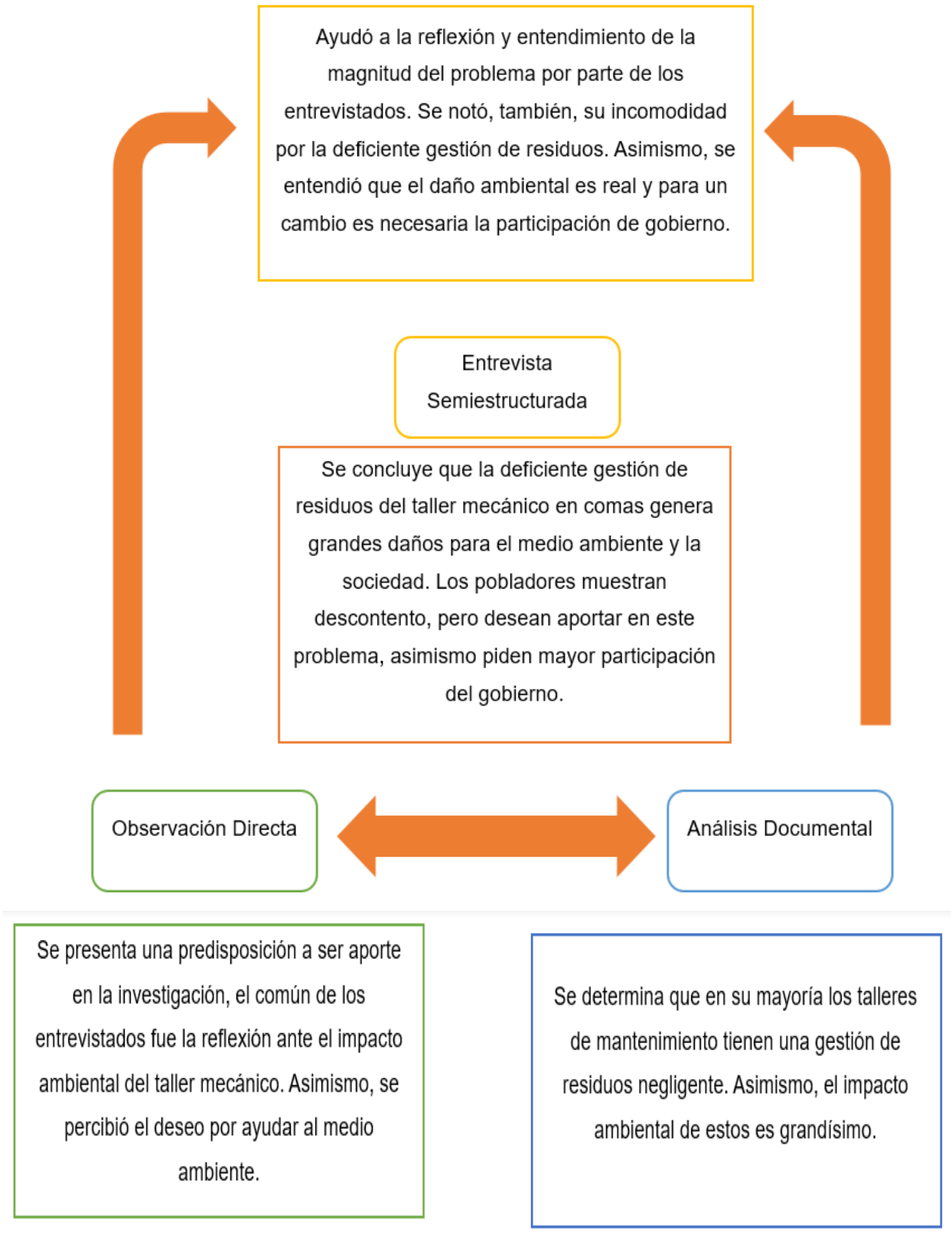

Figure 4. Techniques used for the research

Confirmability Criterion

Guba and Lincoln, in Castillo and Vásquez[17] explain that it is the path left by the original researchers of the subject for future scholars who will follow in their footsteps. Therefore, it is essential to document everything that has occurred. In the same way, Marshall, in Cornejo & Salas[18] emphasizes that each event must be thoroughly documented, including both the methods used to collect the data and the obstacles encountered, as well as presenting substantial evidence, thereby generating a truly valuable report for future researchers.[28,29,30,31,32]

Transferability Criterion

Guba and Lincoln, in Castillo and Vásquez[17] refer to the adaptability of the study to a similar problem in another context. It seeks to transfer knowledge, so it is necessary to be very specific in the characteristics of the problem, the place, and the units of analysis.[33,34,35,36,37]

Data analysis method

The data analysis was based on the recordings made during the interviews with the participants, as they served as evidence and a storage of information. These recordings were analyzed with great care and caution. Matrices were used to decode the data, and later, a triangulation was employed to facilitate discussion between the theoretical bases and the answers obtained, as well as to conclude the research question.[38,39,40,41]

Ethical aspects

The information was collected in an integrated and scientific manner, meeting the expected requirements, including location, time, and problems, among others. Likewise, the guidelines proposed by the university and teachers were respected. The proposed structure was employed, along with inquiry into reliable sources, referencing the cited author, and additional information.[42,43,44,45,46]

DISCUSSION

Due to the set of techniques used in this research, it was determined that the environmental impact of the mechanical workshops in Comas during 2023 was several and harmful to both nature and human beings. Because business owners are unaware of and ignore the magnitude of the damage, they take refuge in the idea of having an honest job that brings value to society. However, this business also has a negative side that must be addressed urgently.[47,48,49,50]

In the environment, it was found to have a dramatic impact on the ecology, aesthetics, and interests of citizens. As in the work of Perez[19] who obtained results of 59 %, 93 %, and 93 % indicating that respondents believe the workshop where they work generates waste in the form of lubricating oil, brake fluid, and coolant, respectively. Respondents expressed discomfort regarding the environmental damage.[51,52,53,54]

Similarly, in the natural elements, the sample presented their dissatisfaction because they stated that they perceive damage to the soil and air; they also speculate that the water is affected by the waste disposed of in the sewage system. In the soil, they claim to have seen an unnatural, black, and shiny color from the used oil and other liquids inside the car. In addition to the above, Aguirre & Hernandez[20] showed a result that 74 % produce between 1 and 4 gallons of used oil per month, and the rest between 5 and 9 gallons per month, reaching a maximum of 408 liters of liquid waste per year. This coincides with the problematic reality of the northern Lima district.

Likewise, most of the waste is dumped in the typical garbage dump, which is then transported by a garbage truck. Two out of three participants, or 40 %, commented that they separate recyclable waste, while the rest commented that the waste generated should be treated differently. Still, they do not carry out this practice.[55,56,57,58]

Sustainable behavior, it was determined that all respondents think about the common good and want to contribute to society through responsible waste management, among which recycling stands out, as they mentioned the separation of plastics for later reuse, also transforming garments into other products in a handmade way, also helps to conserve the planet. As a final observation, there is a responsible and ethical desire to help the earth and its environment; however, in the pursuit of this objective, they feel isolated because they believe that the Peruvian government needs to participate to provide a real solution. Similarly, Molina et al.[21] concluded that it would be beneficial to have greater interest among both university and municipal leaders in conducting research related to the environmental impact of businesses.[59,60,61,62] Also, the development of new ordinances and laws that encourage and control the management of hazardous waste. It is necessary to work together with true unity and selflessness to do the right thing without expecting anything in return.[63,64,65,66,67,68,70,71]

CONCLUSIONS

As a general conclusion, it is determined that the waste management of garages is negligent and has a significant impact on both environmental and social aspects, as the failure to classify, isolate, and supervise hazardous waste has had adverse effects. And, as if that were not enough, their waste will not only damage the current state of the natural elements but also the future of the ecology. It is necessary to act to rectify this mistake in mechanical workshops.

First, it is concluded that the management of waste in garages is deficient and harmful to the environment and the community of the Comas district. Although it is a business with high demand, it harms specific sectors of the ecosystem, especially the natural part. It is necessary to take action and inform citizens that this is a latent problem while also exploring more environmentally friendly options, such as vegetable-based lubricants,

electric cars, and information campaigns, among others.

Second: It is concluded that people want to contribute to the environment and solve these problems, but they do not have enough tools, due to the lack of knowledge of environmental laws and the scarce participation of the state in eco-friendly campaigns, the citizens cannot feel useful at the time of giving their opinion on the environmental issue.

Third: It is concluded that it is necessary to venture into new and innovative options in line with the technological vanguard, seeking to repair the damage and change the products used for car maintenance, such as soil or water care. Achieving eco-friendly materials will significantly benefit the future of our planet.

Fourth: In this problem, everyone plays a part. Both the government, with its lack of incentives, and the citizens resigned to the development of negligent activities, as well as the same owners and operators of the garage, ignored the issue and continued with their activities. The responsibility for this damage lies with the culture itself, one that took several years to build and is deeply rooted in the Peruvian people. It is necessary to investigate further, explore the unknown, and have greater ambition to bring about positive change for the benefit of our planet, ourselves, and future generations.

RECOMMENDATIONS

As a general recommendation, it is necessary to work with events and activities that involve citizens in environmental issues and encourage them to participate in the conservation of our planet. Additionally, the influence of childhood on the public generates a fundamental shift in ecological culture, as the cause of this problem is the lack of awareness of existing damage, as well as the rights that everyone has to live in a better environment.

Implement the 5S technique for continuous improvement. To mitigate the ecological damage caused by the repair and maintenance area, which presents a dirty and disorderly appearance and exposes the public to poor waste management. The values of seiri (sort), seiton (organize), seiso (clean), seiketsu (standardize), shitsuke (persevere) are provided. It states that its first goal is to “improve the work environment by eliminating clutter. This can be accurate for the improvement of a mechanical workshop and its problem of disorder and pollution it generates for society.

Greater control by the municipality of Comas on environmental issues. Due to the contamination caused by the natural elements, the corresponding managers of each district must implement incentives and sanctions. The aim is to ensure the correct development of business activities, especially those with hazardous waste. Additionally, it is essential to develop movements that raise awareness among the local population; often, those who live near this activity do not complain about the problem because they are unaware that it is being committed. Additionally, it is advisable to act proactively and initiate the change by taking responsibility for waste classification in our own homes.

Also, in the control of waste from poor waste management by the garage, it would be essential to implement a medium-term plan with the participation of the garage owners and the municipality of Comas to provide deposits for the garage waste and identify with a color for each particular waste, to have greater control and provide some benefit in taxes to the garages that contribute to the care of the district and the environment.

Finally, in search of a solution to the lack of sustainable conduct of the leaders of the mechanical workshop, it is essential to mention the existing laws: General Environmental Law No. 2861, National System for the Evaluation of Environmental Impact Law No. 27446, and Law No. 25238 of the Commission for the Review of the Draft Code of the Environment and Natural Resources. It is essential to understand the regulations to comply with them. All citizens have the right to live in a healthy and prosperous environment.

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