

# ANALYSIS OF CONSUMERS' WILLINGNESS TO ADOPT SUSTAINABLE PRACTICES WHEN CHANGING AUTOMOTIVE LUBRICATING OILS

*ANÁLISE DA DISPOSIÇÃO DOS CONSUMIDORES SOBRE PRÁTICAS SUSTENTÁVEIS NA TROCA DE ÓLEOS LUBRIFICANTES AUTOMOTIVOS*

*ANÁLISIS DE LA DISPONIBILIDAD DEL CONSUMIDOR SOBRE PRÁCTICAS SOSTENIBLES EN EL INTERCAMBIO DE ACEITES LUBRIFICANTES AUTOMOTRICES*

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## ABSTRACT

This research aimed to verify consumers' willingness to pay more for a sustainable lube oil change service and the practical considerations involved in choosing the place to carry out the change. The methodology used was descriptive research with a quantitative approach and the data was collected using questionnaires applied to 162 participants in Catanduvas/PR which contained questions about motivation, consumption habits, evaluation of competition and acceptance of sustainable practices. The data was analyzed using statistical tests to validate the hypotheses formulated. The results presented an analysis of the factors influencing the adoption of a sustainable oil change service, using data from four blocks to understand consumer attitudes and preferences. The results highlighted awareness of the need for regular oil changes and the complexity involved in consumer choice. Competitor analysis highlighted the influence of reliability, service and recommendations. The concept test confirmed consumers' willingness to pay more for a sustainable service, highlighting their reluctance to change oil in inappropriate places. The confirmed hypotheses have crucial implications for strategies, emphasizing awareness, education and supply in line with expectations. The findings demonstrate the feasibility of implementing sustainable actions, positively impacting the economy, technology, safety and the environment, in line with awareness and sustainability trends. It can be inferred that entrepreneurs can adapt their establishments to offer ecologically correct services and invest in advertising. Just as commercial associations can create programs to promote sustainable companies and publicize them to the population, public authorities can create subsidies and programs for companies in the sector that adopt sustainable practices and adhere to environmental programs. Through a comprehensive analysis of sustainable oil change services, this research contributes to confirming the willingness to pay extra for ecological practices and highlights the importance of environmental awareness in decision-making.

## KEYWORDS

Sustainability; Oil change; Consumer behavior; Automotive services; Environmental awareness.



## **RESUMO**

*O objetivo dessa pesquisa foi verificar a disposição dos consumidores em pagar mais por um serviço sustentável de troca de óleo lubrificante e as considerações práticas envolvidas na escolha do local para realização desta troca. A metodologia utilizada foi uma pesquisa descritiva com abordagem quantitativa e os dados foram coletados por meio de questionários aplicados a 162 participantes em Catanduvas/PR que continham perguntas sobre motivação, hábitos de consumo, avaliação da concorrência e aceitação de práticas sustentáveis. Os dados foram analisados usando testes estatísticos para validar as hipóteses formuladas. Os resultados apresentaram a análise dos fatores influenciadores da adoção de um serviço sustentável de troca de óleo, utilizando dados de quatro blocos para entender atitudes e preferências dos consumidores. Os resultados realçaram a consciência da necessidade da troca regular de óleo e complexidade envolvendo a escolha dos consumidores. A análise da concorrência destacou a influência da confiabilidade, atendimento e recomendações. O teste do conceito confirmou a disposição do consumidor em pagar mais por um serviço sustentável, destacando a relutância em trocar óleo em locais inadequados. As hipóteses confirmadas têm implicações cruciais para estratégias, enfatizando conscientização, educação e oferta alinhada às expectativas. Os achados demonstram a viabilidade para implementar ações sustentáveis, impactando positivamente na economia, tecnologia, segurança e meio ambiente, em consonância com as tendências de conscientização e sustentabilidade. Pode-se inferir que os empresários podem adequar seus estabelecimentos na oferta de serviços ecologicamente corretos e investir em publicidade. Assim como as associações comerciais podem criar programas para promoção das empresas sustentáveis e divulgação das mesmas para a população, bem como os poderes públicos podem criar subsídios e programas para as empresas do setor que adotem práticas sustentáveis e aderem a programas ambientais. Através de uma análise abrangente em relação serviços com práticas sustentáveis de troca de óleo, essa pesquisa traz como contribuição a confirmação da disposição para pagamento adicional por práticas ecológicas e destacou a importância da conscientização ambiental na tomada de decisões.*

## **PALAVRAS-CHAVE**

*Sustentabilidade; Troca de óleo; Comportamento do consumidor; Serviços automotivos; Consciência ambiental.*

## RESUMEN

El objetivo de esta investigación fue verificar la disposición de los consumidores a pagar más por un servicio de cambio de aceite lubricante sustentable y las consideraciones prácticas involucradas en la elección del lugar para realizar este cambio. La metodología utilizada fue una investigación descriptiva con enfoque cuantitativo y los datos fueron recolectados a través de cuestionarios aplicados a 162 participantes en Catanduvas/PR que contenían preguntas sobre motivación, hábitos de consumo, evaluación de la competencia y aceptación de prácticas sustentables. Los datos fueron analizados mediante pruebas estadísticas para validar las hipótesis formuladas. Los resultados presentaron un análisis de los factores que influyen en la adopción de un servicio de cambio de aceite sostenible, utilizando datos de cuatro bloques para comprender las actitudes y preferencias de los consumidores. Los resultados resaltaron la conciencia de la necesidad de cambios regulares de aceite y la complejidad que implica la elección del consumidor. El análisis de la competencia destacó la influencia de la confiabilidad, el servicio y las recomendaciones. La prueba de concepto confirmó la voluntad del consumidor de pagar más por un servicio sostenible, destacando la reticencia a cambiar el aceite en lugares inadecuados. Las hipótesis confirmadas tienen implicaciones cruciales para las estrategias, enfatizando la concientización, la educación y la provisión en línea con las expectativas. Los hallazgos demuestran la viabilidad de implementar acciones sustentables, impactando positivamente la economía, la tecnología, la seguridad y el medio ambiente, en línea con las tendencias de concientización y sustentabilidad. Se puede inferir que los empresarios pueden adaptar sus establecimientos para ofrecer servicios ecológicamente correctos e invertir en publicidad. Así como las asociaciones comerciales pueden crear programas para promover empresas sustentables y darlas a conocer a la población, las autoridades públicas pueden crear subsidios y programas para empresas del sector que adopten prácticas sustentables y se adhieran a programas ambientales. A través de un análisis integral de los servicios relacionados con prácticas sustentables de cambio de aceite, esta investigación contribuye a confirmar la disposición a pagar adicionalmente por prácticas ecológicas y destacó la importancia de la conciencia ambiental en la toma de decisiones.

## PALABRAS CLAVE

Sostenibilidad; Cambio de aceite; Comportamiento del consumidor; Servicios automotrices; Conciencia ambiental.

## 1. INTRODUCTION

The National Solid Waste Policy (PNRS) defines reverse logistics as an economic and social development instrument characterized by a set of actions involving processes such as collection, inspection, repair, disassembly, disposal, recycling and remanufacturing of collected products (Paredes-Rodríguez et al., 2022). The PNRS made it compulsory to properly manage lubricating oils and the waste resulting from their exchange and the shared responsibility between all the links involved in the logistics chain for this product, while Resolution 362/2005 of the National Environment Council (CONAMA) requires oils to be recycled through the re-refining process (Batista et al., 2019).

Automotive lubricating oil is a non-biodegradable chemical compound that poses risks of environmental contamination, according to the Brazilian standard NBR 10.004/2004 (Nascimento et al., 2016). CONAMA Resolution 9/1993 classifies lubricating oil as derived from petroleum or chemical synthesis and contaminated lubricating oil, known as OLUC, as that which is unsuitable for its original purpose, contaminated as a result of use or contamination (Nascimento et al., 2016). OLUC contains dust, fuel, water and heavy metals that have a high potential environmental impact if not managed properly (Sencovici & Demajorovic, 2015).

Due to the difficulty in supervising the disposal of used lubricating oil, the waste is used in numerous illegal and unsustainable applications (Shuelter, Fernandes & Tagliialenha, 2016). In order to win the trust of customers, companies are obliged to demonstrate an environmentally friendly stance by repositioning their products after sales and by using an image of preserving the environment in which they operate (Pires, 2015).

It can be seen that studies involving the topics of sustainability and lubricating oils have a variety of focuses, from government barriers (Gardas, Raut & Narkhede 2018; Gupta, 2022) to legislation (Schuelter, Fernandes & Tagliialenha, 2016; Rebelatto, et al., 2016). In addition, several studies focus on reverse logistics on reverse logistics (Paredes-Rodríguez, Grisales-Aguirre & Sánchez-Zambrano, 2022; Batista, Oliveira, Oliveira, Moura & Santos, 2020; Nascimento, Teixeira, Menezes & Alves, 2016; Sencovici & Demajorovic, 2015); and waste disposal and collection (Ribeiro, Chaves & Muniz, 2018; Oliveira & Magrini, 2017; Gonçalves, 2013); as well as research assessing the costs involved in the reverse logistics process (Paydar, Babaveisi & Safaei, 2017; Seramim, Zanella, Araujo & Bertolini, 2016; Dacroce, Fujihara & Bertolini, 2016) and

waste management (Marques, Marques & Silva, 2015; Santos & Conceição, 2017; Müller, Presrlak & Bertolini, 2016). There are also studies discussing the recycling of used lubricating oil (Martins, 2005; Gonzaga, Silva & Andrade, 2021; Tristão, Tristão & Frederico, 2017).

It can be seen that although the studies by Dacroce, Fujihara and Bertolini (2016) and Seramim, Zanella, Araújo and Bertolini (2016) address the issue of costs involved in the reverse logistics process, there are still research gaps to be filled regarding the economic viability of implementing sustainable practices in the process of changing automotive lubricant oils by establishments providing this service, especially regarding the importance that consumers attach to this type of sustainable practice. Thus, improving the organizational image to differentiate itself from competitors, as well as the intense change in consumer purchasing attitudes, are some of the reasons that lead the market to adopt measures and actions aimed at the environment (Bertolini et al., 2012), which leads to the following research question: considering consumers' willingness to pay more for a service, is it feasible to implement sustainable actions in the process of changing automotive lubricating oil? Given this context, the aim of the study is to verify consumers' willingness to pay more for a sustainable lube oil change service and the practical considerations involved in choosing the place to carry out this change.

This research is justified because, according to Tan, Johnstone and Yang (2016), exploring consumer perceptions of ecologically sustainable products, practices and consumption enables a new perception of the barriers and profile of this public, which has contributed to improving the positioning of the business in this market context, which is increasingly competitive and technological, resulting in environmental, social and, consequently, economic gains for the company.

## 2. LITERATURE REVIEW

Brazilian environmental legislation is made up of a set of legal norms that establish rules related to the environment in order to defend it, promote sustainability and preserve natural resources. Used or contaminated lubricating oil is classified, according to the Brazilian Association of Technical Standards NBR 10004, as hazardous waste, so its management is challenging and it must be recycled through re-refining so that so that there is no contamination of water, soil and air (Gonzaga, Silva & Andrade, 2021).

The main Brazilian laws relating to the recycling of lubricating oils are Law No. 12.305/2010, known as the National Solid Waste Policy, and CONAMA resolutions. Article 33, item IV of the National Solid Waste Policy establishes the obligation to manage solid waste, including OLUC and its packaging, indicating that after consumption it must be returned, via the consumer, to manufacturers, importers, distributors and traders (Rebelatto, et al., 2016).

It also establishes guidelines for structuring and implementing reverse logistics, independent of the public urban cleaning and solid waste management service. The PNRS aims to reduce the extraction of virgin raw materials from the environment and reduce costs in the manufacture of new products, using reverse logistics as a means of reinserting materials into new production processes (Rebelatto, et al., 2016).

Conama is a body that aims to advise, study and propose guidelines and government policies for the environment to other environmental bodies and to decide, within the scope of its powers, on norms and standards for the environment (Conama, 2023). Resolutions 362/2005 and 450/2012 stipulate that OLUC must be collected and re-refined in a way that causes less damage to the environment and prohibits the use of landfills to dispose of the oils; if the oils are contaminated, they must be incinerated with authorization from the environmental agency. CONAMA also determines the minimum percentage that must be collected of used or contaminated lubricating oil in Brazil and in each of the regions, this percentage was 45.5% in 2022, while IBAMA evaluates the results of implementing the resolution (Schuelter, Fernandes & Tagliapietra, 2016; Conama, 2023).

There are many governmental barriers which are inadequate government policies or strict and ineffective regulations and this can influence all the other barriers. Understanding this type of barrier and its intensity is very important for making decisions about its elimination and is the first step towards the effective implementation of reverse logistics for lubricating oils (Gardas, Raut & Narkhede, 2018).

Brazil, despite having extensive environmental legislation, faces obstacles arising from the legislation itself. The following are examples of Brazilian governmental barriers to recycling automotive lubricating oils: the useful life of the product ends only after disposal, the manufacturer has responsibility for disposal, but coordinating the entire production chain is challenging (Sencovici & Demajorovic, 2015); recycling cooperatives can act as suppliers in some links of the recycling chain, but the turnover of waste pickers,

lack of equipment and safety, precarious infrastructure and lack of legislation hinder the relationship between cooperatives and companies (Sencovici & Demajorovic, 2015); the implementation of reverse logistics must take place through a sectoral agreement, but conflicts between participants mean that agreements are slow in coming (Sencovici & Demajorovic, 2015).

Reverse logistics is an area of logistics that integrates the logistical aspects of returning goods that have reached the end of their useful life to the production cycle, involving processes such as collection, inspection, repair, disposal, disassembly, recycling and remanufacturing of the products collected, adding economic and environmental value to them, reducing damage to ecosystems and preventing waste from being disposed of in the environment (Paredes-Rodríguez, Grisales-Aguirre and Sánchez-Zambrano, 2022). This process becomes important in the sustainability scenario as it reflects the population's awareness, drives sustainable development and considers the end of the product only after it has been correctly disposed of after use (Gupta, 2022; Sencovici & Demajorovic, 2015).

The reverse logistics process for OLUC takes into account adequate infrastructure specifications for its management, both in mechanical workshops and in storage packaging and transportation, to ensure that all links in the chain fulfill their role and that OLUC has its final destination in accordance with the legislation (Batista, Oliveira, Oliveira, Moura and Santos 2020). OLUC is a non-biodegradable petroleum derivative that decomposes in approximately 300 years and whose incorrect disposal of 1 liter is equivalent to the domestic sewage of 40,000 inhabitants (Gonzaga, Silva & Andrade, 2021). The cycle that automotive lubricating oil goes through in order to be recycled includes the production and sale of the oil, its use in cars, collection and finally re-refining, which is the industrial process that makes used or contaminated oil have the basic characteristics of lubricating oils, by removing contaminants (Nascimento, Teixeira, Menezes and Alves (2016).

Companies must adapt to the demands and requirements of consumers if they want to remain competitive and gain a foothold in the market. This is no different for mechanical workshops, which face one of the major global challenges: reducing the amount of chemicals that are hazardous to the environment. This waste requires special attention because it affects people's quality of life and the environment, and this situation is exacerbated when it is discovered that most

workshops do not have a Solid Waste Management Plan (PGRS) due to a lack of resources or knowledge.

Most companies do not invest in environmental issues and, as improper disposal of waste is prohibited, different types of waste end up being mixed, turning non-hazardous waste into hazardous waste, which makes it difficult to collect these materials properly and they end up being disposed of in landfills in an inappropriate manner (Gonçalves, 2013). As seen in many emerging countries, Brazil has experienced exponential growth in the number of cars and with it an increase in the amount of hazardous waste generated, especially lubricating oils, the incorrect disposal of which causes extremely serious damage to the environment (Oliveira & Magrini, 2017). With this progress, the need to strengthen public policies to manage the waste generated has grown. Re-refining, a legal recycling activity for Contaminated and Used Lubricating Oil - OLUC, supported by National Environmental Council - CONAMA resolution no. 362/2005, was the alternative created to add value to this waste (Brasil, 2005).

The problems with refining are that there is little inspection by the responsible bodies and a great deal of prejudice among manufacturers towards the refined product. Another challenge is Brazil's vast territory, which makes it difficult to collect this material, especially in the North and Northeast. The population's lack of awareness about the proper disposal of this contaminated waste is another barrier, which makes it less efficient to send the material for recycling. According to recent studies, only 53% of the lubricating oil generated is sent for recycling (Ribeiro, Chaves & Muniz, 2018).

Companies that provide services and have an impact on the environment tend to allocate a greater proportion of their revenue to preserving, improving and repairing the environment, since they are under greater pressure from the environment in which they operate, and consequently invest more to compensate for damage, guaranteeing social legitimacy. And, depending on the industry, investing in sustainability is a strategic environmental positioning. If we consider that the car fleet in Brazil is growing at an average rate of 5% a year and that this increases the generation of solid waste, the investments needed to adapt the company go far beyond the legal requirements and the prospect of a return, and include the importance of sustainable actions focused on the environmental dimension that guarantees in the market. However, investing in environmental actions is often not a problem for managers, but a challenge that

requires time, dedication and professional development (Seramim, Zanella, Araujo & Bertolini, 2016).

With regard to the challenges, the biggest ones are the high costs involved in reverse waste logistics. As these are highly polluting products, the more difficult it is to collect, recycle, reuse or dispose of them correctly, the higher the cost of the entire logistics process. This often ends up encouraging irregular disposal of the product (Paydar, Babaveisi & Safaei, 2017). An alternative to this is for companies to implement an RMSP, since when it is carried out properly, it enables economic, technological, occupational safety and environmental improvements, based on simple, low-cost actions that combine sustainable development and environmental preservation. For this, not only the company's turnover should be evaluated, but also the costs of all the adjustments needed to provide environmentally friendly services (Dacroce, Fujihara & Bertolini, 2016).

The waste generated in mechanical workshops has become a cause for concern and its improper disposal and storage results in environmental and public health problems. For this reason, machine shops must be concerned about all the waste generated in the process: packaging, flannels, towels and even liquid effluents such as oils, greases and fuels used to clean the surfaces to be worked on or to clean parts. Plastic packaging is a major concern not only because of its disposal, but also because of the oil residue. That's why, after use, they need to be completely emptied, draining the product contained in the walls and bottom of the packaging, in order to reduce the remaining amount inside as much as possible (Santos & Conceição, 2017).

All this waste is classified according to the potential risks to the environment and public health. In order for them to be handled and disposed of properly, companies need to comply with NBR 10004, which deals with this subject, based on a sustainable policy. NBR 10004 divides this waste into 2 categories: class I: hazardous waste is waste whose physical, chemical or infectious properties pose a risk to public health and the environment if it is improperly managed; class II: non-hazardous waste, but which may have properties such as biodegradability, combustibility or solubility in water. As for storage, the standard emphasizes that the company must have a plan for "temporary containment, in an area authorized by the environmental control body, awaiting recycling, recovery or adequate final disposal, provided that it meets basic safety conditions". This demonstrates the importance of efficient workshop waste management and how this

contributes to preserving the environment (Marques, Marques & Silva, 2015).

One of the main contaminants of the soil is lubricating oils and petroleum products, when handled or disposed of improperly. Improving the quality of life mistakenly thought to be linked only to consumption, when it is important to note that the natural resources that are essential for the production of consumer goods are finite. This requires companies to adopt a sustainable stance, not just to reduce waste emissions, but by incorporating sustainable practices into their activities, saving direct and indirect costs, having a low negative impact on the environment and being socially responsible (Müller, Preslák & Bertolini, 2016).

After the sale of automotive lubricants, the - successful - production chain ends and the environmental problem begins. When discarded, lubricant bottles still retain a significant amount of oil. Because of this, considering the characterization of the waste generated, the Plastic Bottle + Oily Waste combination can be considered "Hazardous" waste - Class I. The processes used to recycle it start with separation, grinding, washing, drying and agglutination, and finally extrusion and granulation (Martins, 2005).

Used oil, on the other hand, is a resource that, if properly recycled, can return to the production chain unlimited times, suffering only the losses of each process. Re-refining technology has come a long way since the days when oil was regenerated simply by removing water, dust, sludge and some volatile compounds. Today, re-refined oil goes through a process very similar to that which crude oil goes through in a refinery, with stages including vacuum distillation and hydrotreatment (Tristão, Tristão & Frederico, 2017).

The physical-chemical process of re-refining aims to recover the characteristics that are lost with the use of the oil, transforming it into a new raw material for the production of new lubricating oil. In addition to the environmental aspect, it is also economically viable, since producing base oil from used oil in a re-refinery consumes only 33% of the energy it would take to produce the same amount of base oil from crude oil in a refinery (Gonzaga, Silva and Andrade, 2021).

Based on the literature review carried out, several relevant variables were identified and analyzed in the context of the study on the reverse logistics of automotive lubricating oil. The following table summarizes these variables, together with the respective authors and the main findings of each article. This table seeks to provide a panoramic view of each author's contributions to the

topic in question, highlighting the different perspectives and insights offered. By analyzing and comparing these variables and findings, we seek a more comprehensive and grounded understanding of the relationships investigated, providing a solid starting point for choosing the variables that will be used in the data collection:

Variables	Authors	Main results found
Legislation	Schuelter, Fernandes e Tagliarenha (2016)	The effective establishment of reverse logistics depends on two factors: an increase in research and technological innovation activities and the creation of a market for recycled products.
	Rebelatto, et al.(2016)	Presentation of more robust critical considerations of the Agreements, seeking to broaden the understanding of the variables involved in the problem of Reverse Logistics, and to provide subsidies for the improvement of these Systems.
Reverse Logistics	Paredes-Rodríguez, Grisales-Aguirre e Sánchez-Zambrano (2022)	The most significant risks in the reverse logistics of used vehicle oil are inadequate storage, the lack of a suitable vehicle for transportation and the low quality of the waste.
	Batista, Oliveira, Oliveira, Moura e Santos (2020)	Reverse logistics of OLUC is not effective, and greater supervision of oil change establishments and environmental education are needed.
	Nascimento, Teixeira, Menezes e Alves (2016)	More than half of the respondents are aware of the important role of the controller's office, but the majority do not have sufficient knowledge, although they do take actions that are appropriate for the correct disposal of waste.
	Sencovici e Demajorovic (2015)	Technological advances now make it possible to generate re-refined oil with superior properties to virgin oil (economic and socio-environmental gains), but there are several difficulties in doing so.

Variables	Authors	Main results found
Disposal and collection	Ribeiro, Chaves e Muniz (2018)	Some companies still dispose of OLUC improperly. The main causes are: lack of supervision, complex taxation and the lack of credibility of the reused oil.
	Oliveira e Magrini (2017)	Reducing the proportion of LOPCs going to landfill has a positive impact on reducing the burdens caused by the life cycle of LOPCs. Incineration has proved to be a promising option, but it is not used in Brazil.
	Gonçalves (2013)	The results obtained led to the conclusion that not only is it technically feasible, but also environmentally and economically it has very favorable results.
Costs	Paydar, Babaveisi e Safaei (2017)	Two objective functions are considered: profit maximization and revenue risk minimization. The augmented $\epsilon$ constraint approach is used to solve the bi-objective model.
	Seramim, Zanella, Araujo e Bertolini (2016)	It was possible to conclude on the viability, based on consumers' willingness to pay more for services in a mechanic's shop that adds value to the service by using environmentally sustainable practices.
	Dacroce, Fujihara e Bertolini (2016)	Procedures were proposed that were easy to implement and affordable, but effective in reducing environmental impacts. The investment analysis of the ecological services project proved to be viable, generating a profit for the company.
Waste management	Marques, Marques e Silva (2015)	Waste management in the workshop, as in other companies in different segments, needs to be environmentally conscious and seek to promote environmental conservation, starting with the activity itself.
	Santos e Conceição (2017)	The results of the analysis of the effluent from the oil and water separator and the organization of the workshop showed the importance of the management system, which proved to be viable and necessary, especially given that the workshop under study is located near a body of water.

Variables	Authors	Main results found
Waste management	Müller, Preslák e Bertolini (2016)	With the data collected, suggestions for improvement were made based on current legislation, such as adapting the waste storage barrels and building a containment barrier for the used lubricant oil barrel.
	Martins (2005)	Discusses the problem of used commercial lubricant bottles (considering the disposal methods usually used and the technical and marketing aspects of the waste)
Recycling	Gonzaga, Silva e Andrade (2021)	The proper management of used lubricating oils is in line with ideas discussed worldwide. It is necessary to restructure waste management practices and actions to increase the performance of reverse logistics.
	Tristão, Tristão e Frederico (2017)	There are systemic deficiencies and a need to improve the LR system in the lubricant oil recycling process. Benefits: streamlining the process, adding value and minimizing environmental impacts.

**Table 1:** Variables and main findings of each author

**Source:** authors of the survey (2023)

Taking Table 1 into account, these variables make it possible to construct four distinct blocks. In the first block, information on the participants' socio-economic profile was collected. In the following blocks, the questions were organized and tabulated based on the variables listed in Table 1. The second block, related to consumption habits, used variables such as costs, waste disposal and collection. In the third block, which dealt with knowledge and evaluation of the competition, the variables used were costs and reverse logistics. Finally, in the fourth block, referring to testing the business concept, the analysis used variables such as waste management, legislation, destination and collection, as well as the cost variable.

Assessing the feasibility of implementing the service at the garage is supported by analyzing consumers' willingness to make additional payments and what percentage they would be willing to pay. This approach is based on specific investments, as identified by researchers such as Seramim, Zanella, Araujo & Bertolini (2016), which include restructuring the infrastructure and effectively managing the solid waste generated by the garage. Among the necessary measures are waterproofing the



floor, installing containment channels, refurbishing the water and oil separator box, purchasing suitable containers for segregating waste and training employees, all of which require resources and commitment. In the business context, investments are directly linked to the prospect of a return, whether in terms of savings or the projection of the entity as an agent committed to environmental values. Although environmental actions should not depend exclusively on consumers' willingness to pay more, this variable needs to be considered and analyzed in greater depth. Therefore, in order to make the environmental project viable, it is essential to consider the following hypothesis:

Hypothesis 1: Price is the main factor in consumers' choice of where to get their vehicle's oil changed.

Hypothesis 2: There is a significant difference between consumers willing to pay more for an ecologically sustainable oil change service, with correct waste disposal and less environmental impact.

This hypothesis is broken down by the following sub-hypothesis:

Hypothesis 2.1: There is a significant willingness among consumers to accept an increase of up to 10% in the cost of ecologically sustainable oil change services.

These hypotheses are fundamental to directing the research and providing insights into consumer acceptance of sustainable services, as well as their financial expectations associated with such practices.

### 3. METHODOLOGICAL PROCEDURES

This study is characterized as exploratory research of a quantitative nature. This research requires a wide range of interconnected information, as highlighted by Triviños (1987), seeking to describe the characteristics of a given population and investigating the relationship between the variables found in the literature review. The final objective is to verify consumers' willingness to pay more for a sustainable lube oil change service and the practical considerations involved in choosing the place to carry out this change.

In order to establish the objective of this work, the initial procedure consisted of conducting a systematic literature review, with the aim of deepening the concepts related to the subject. To do this, the Web of Science, Scopus, Capes and Google Scholar databases were used, using the keywords "revert" + oil. As exclusion criteria, only articles whose titles and abstracts were aligned with the scope of the research were considered, resulting in a

final database made up of 4 articles from Web of Science, 4 articles from Scopus, 7 articles from Capes and 7 articles from Google Scholar.

The next step was to determine the size of the population needed for data collection. As the research is aimed at mechanics in the city of Catanduvas, the target audience was determined to be all residents of the city of Catanduvas who owned a car, and for this, the fleet of vehicles registered in the municipality, Detran in the year 2022, was considered. The total fleet was 5,571 vehicles, but of this number, only the types of vehicles that have their lubricating oil changed in mechanics' workshops were taken into account, i.e. cars, vans, pickup trucks and utility vehicles. All other vehicles were discarded, such as trucks, truck-tractors, mopeds, minibuses, motorcycles, scooters, motor homes, buses, quadricycles, trailers, semi-trailers, sidecars, crawler tractors, wheeled tractors, mixed tractors and tricycles. For the population, the sum of 3,114 cars, 730 pickup trucks, 182 vans and 38 utility vehicles was considered, for a total of 4,064 vehicles (DETRAN, 2022).

Thus, considering a population of 4064 vehicle users and a sampling error of 8%, the minimum sample size to be collected is 150 respondents. The sample was defined based on the following equations:

$$n_0 = \left( \frac{1}{\epsilon_0} \right)^2 \quad e \quad n = \frac{(N * n_0)}{(N + n_0)}$$

Where  $n_0$  = first approximation of the sample size,  $\epsilon_0$  = sampling error,  $n$  = sample size and  $N$  = population size (Pinheiro, da Cunha and Carvajal, 2009).

Sample error	n0	Sample size (n)
1%	10000	2890
2,5%	1600	1148
5%	400	364
6%	277,77	260
7%	204,081	194
8%	156,25	150
10%	100	98
15%	44	44
20%	25	25

**Table 1:** Sample Error Table

**Source:** authors of the survey (2023)

For data collection, a questionnaire was drawn up via Google Forms containing 15 (fifteen) questions sent to residents of the city of Catanduvas/PR via messaging apps, emails and social networks, between July 14 and 28, 2023. The structure of the questionnaire included obtaining information on the socio-economic profile, consumption habits, knowledge and evaluation of the competition, as well as testing the business concept.

The four blocks of questions created from Table I were treated individually, allowing for a detailed exploration of the relationships within each domain. Subsequently, the information collected was cross-referenced in order to identify broader patterns and reveal interconnections between different aspects of consumer behavior, so as to enable companies to analyze the consumer's willingness to make an additional payment due to the company's adoption of a sustainable stance, incorporating environmentally conscious practices and having a positive impact on the environment and society (Müller, Presrlak & Bertolini, 2016). In this context, the comprehensive and systematic analysis of this data will provide valuable insights that will guide the implementation and development strategies of the service provided, based on the preferences and trends identified in the sample of the population surveyed and based on the data related to the socioeconomic profile of the 162 respondents, the diverse representativeness of the sample becomes evident.

After collecting the data, a total of 162 responses were added to the database, providing a solid basis for the subsequent analysis of the results. Data analysis was conducted using Action Stat software version 3.6. After the individual analysis of each block of questions, we

proceeded to test the hypotheses that had previously been tabulated. This approach allowed for a thorough evaluation of the results and a well-founded conclusion on the issues raised in each block of the questionnaire about consumer willingness to implement sustainable actions in the process of changing automotive lubricant oil.

## 4. RESULTS AND ANALYSIS

Data analysis represents a crucial step in understanding the factors that influence the acceptance of an ecologically sustainable oil change service. The questionnaire that was applied covered a variety of areas, including socio-economic profile, consumer habits, knowledge of regulations and assessment of competition, as well as testing the concept behind the proposed business.

The first block to be analyzed is the socio-economic profile of the respondents (Table 2). There is a balanced distribution of age groups, with the highest proportion of respondents aged between 29 and 38 (37.65%), followed by 39 to 50 (29.63%) and 18 to 28 (16.67%). This distribution reflects a sample that covers a wide range of ages, which allows us to explore how different age groups can influence acceptance of the proposed service.

What's your gender?	Female	Male	
	48,77%	51,23%	
What is your marital status?	Married	Divorced	Living with partner
	52,47%	6,17%	17,28%
	Single	Widowed	
	23,46%	0,62%	
What is your age?	18 to 28 years	29 to 38 years	39 to 50 years
	16,67%	37,65%	29,63%
	51 to 60 years	Over 61 years	
	11,11%	4,94%	
What is your salary range?	R\$ 1.320,00 to R\$ 2.640,00	R\$ 2.641,00 to R\$ 5.280,00	R\$ 5.281,00 to R\$ 7.920,00
	15,43%	25,31%	15,43%
	R\$ 7.921,00 to R\$ 10.560,00	R\$ 10.561,00 or R\$ 13.200,00	R\$ 13.201,00 or more
	13,58%	8,64%	21,60%
What is your level of education?	Incomplete primary education	Incomplete primary education	High school incomplete
	3,09%	1,23%	1,23%
	Completed high school	Complete university degree	Postgraduate studies
	12,35%	25,31%	56,79%

**Table 2:** Socio-economic profile of questionnaire respondents

Source: authors of the survey (2023)

As for education, the results indicate a significant presence of respondents with completed higher education (25.31%), followed by those with postgraduate degrees (25.31%) and completed high school (12.35%). This educational panorama reinforces the importance of understanding how the level of education can influence attitudes towards sustainability and the adoption of ecologically responsible services. When analyzing the salary distribution, we noticed that the majority of respondents

fall into the intermediate income brackets, especially those with salaries between R\$ 2,641.00 and R\$ 5,280.00 (25.31%), R\$ 5,281.00 and R\$ 7,920.00 (15.43%), and R\$ 7,921.00 and R\$ 10,560.00 (13.58%). With regard to marital status, most respondents were single (23.46%), followed by married (17.28%) and living with a partner (17.28%).

In the next stages of the analysis, these data will be compared and correlated, providing a more comprehensive view of the interactions between socio-economic variables and the willingness to adopt an ecologically sustainable oil change service. The meticulous approach of individual analysis and subsequent cross-checking of this data will contribute to a deeper understanding of consumers' motivations and behaviors towards sustainability.

Based on consumption habits, the evaluation contributes to a deeper understanding of consumer preferences and the possible influences that shape their decisions. Of the 162 respondents, 95.71% indicated that they already own or have owned a vehicle, demonstrating a potential for adherence to the oil change service. When asked if they had ever taken their vehicles in for an oil change, 144 of the participants (88.34%) answered positively and only 11 people (6.75%) mentioned that someone else in the family is responsible for this task. This statistic suggests that the majority of respondents recognize the importance of having their oil changed regularly.

One notable aspect of consumer habits is the attention paid to the manufacturers' oil change recommendation. Among those interviewed, 123 people (75.46%) said that they usually comply with this recommendation, changing oil according to the specified period, and 29 participants (17.79%) admitted to following the recommendations most of the time, while 5 (3.07%) said they didn't pay any attention to it. This contrast indicates a variety of approaches to vehicle maintenance, which demonstrates the need for research to fill the gaps related to the economic viability of the process of implementing reverse logistics for lubricating oils and all the costs involved in this process (Paydar, Babaveisi & Safaei, 2017). In this sense, the analysis of consumption habits therefore suggests that the vast majority of participants recognize the importance of oil changes and try to follow the manufacturers' recommendations. This disposition can directly influence the acceptance of an ecologically sustainable oil change service, as consumers already have a history of engagement in vehicle maintenance.

With regard to the Knowledge and Evaluation of Competition block, the analysis of these answers provides

a significant insight into the underlying influences and motivations that guide the choice of places to change automotive oil. By considering the factors that impact this decision, it is possible to better understand how consumers perceive and evaluate the available options.

When analyzing the interviewees' responses to this block, it is worth noting that the majority of interviewees (81.60%) expressed a preference for having their oil changed at trusted places where they are already used to having the service carried out. This finding suggests the importance of building a relationship of trust between the customer and the service provider, indicating that loyalty is influenced by past experience. In addition, analysis of the data reveals that service plays a significant role in the motivation to choose a place for an oil change. Around 70 participants (42.94%) cited service as a decisive factor, highlighting the relevance of the customer experience in the choice process.

Concern about price also emerged as a key consideration for many respondents. Approximately 28 respondents (17.18%) highlighted price as one of the main motivators for choosing an oil change location. This finding underscores the importance of price competitiveness in the automotive service market. Recommendations, both from gas station attendants and acquaintances, proved to be influential for a significant proportion of those interviewed. Around 23.31% of respondents indicated that recommendations play an important role in their decision-making, indicating the importance of third-party opinions in shaping choices. It is noteworthy that the option of concern for the environment was not a decisive factor for the interviewees, as only 7 (4.32%) of the interviewees said that this would be a factor in their choice of location for the service.

**If you choose a place to have your car's oil changed, what motivates your choice?**

Service	43,21%
Recommendation	23,46%
Price	17,28%
Proximity to your home	5,56%
Concern for the environment	4,32%
Vehicle warranty	1,85%
Cost-effectiveness	1,23%
Service	0,62%
Quality	0,62%
Confidence	0,62%
I've never owned a car	0,62%
I don't have a car	0,62%
<b>Grand Total</b>	<b>100,00%</b>

**Table 3:** Answers to the questionnaire on motivation for choosing an oil change  
 Source: authors of the survey (2023)

Thus, the analysis of the data related to Knowledge and Evaluation of Competition revealed the interaction of factors that guide the choice of oil change locations, which should be analyzed together with the other blocks to provide a more complete understanding of the dynamics of consumer decisions, allowing a clearer picture to be drawn of the influences that shape consumer preferences and motivations in relation to sustainability and environmentally responsible practices.

The last block analyzed was the Business Concept Test, where the answers provided valuable insights into consumers' receptiveness to the ecologically sustainable oil change service and their willingness to pay more for this service, especially considering the variables of legislation, disposal and collection.

By assessing the attitudes and considerations of the participants, it is possible to understand the feasibility and potential success of introducing a service focused on sustainability. Initially, when asked whether they had considered disposing of the lubricating oil and waste generated, we found that 108 participants (66.26%) said they had not considered this aspect, while 54 (33.14%) said they had already considered disposing of the oil. This

split in responses suggests that a significant proportion of consumers may be less aware of the proper disposal of this waste, creating an opportunity for education and awareness-raising.

With regard to the existence of specific legislation for the disposal and collection of lubricating oil, 95 participants (58.28%) said they were aware, while 67 (41.02%) said they were unaware. As the PNRS made it compulsory to properly manage lubricating oils and waste (Batista et al., 2019), it is clear that there is a gap in consumer awareness regarding the obligation of establishments to comply with disposal rules. This distribution reveals that a considerable proportion of those interviewed are already informed about the regulations, which may indicate a growing awareness of environmental issues, but may be a warning sign for the service offered, and it is necessary to assess the willingness of these consumers to pay.

When asked about their willingness to change their vehicle's oil at a place that does not follow the appropriate waste disposal standards, 113 participants (69.33%) said they would not stop changing the oil, while 49 (30.06%) said they would stop if the place did not follow the existing legislation and standards. This result is a warning sign, as Brazil has experienced exponential growth in its automobile fleet and consequently in the amount of hazardous waste generated, especially lubricating oils, the incorrect disposal of which causes extremely serious damage to the environment (Oliveira & Magrini, 2017). This result suggests that, although a significant portion of those interviewed value compliance with disposal regulations, the majority still consider oil changes to be a priority and that proper disposal would not be a decisive factor when choosing where to change the oil.

On the other hand, a sustainability approach seems to find greater acceptance when we consider the willingness of participants to adopt an ecologically sustainable oil change service. Approximately 132 respondents (81.00%) stated that they would be interested in a service that disposed of waste correctly and had less impact on the environment, even if this meant a slightly higher price. This shows that if the workshop manages to implement an efficient waste management system, it will help to attract new customers and also help to preserve the environment (Marques, Marques & Silva, 2015). This suggests that environmental awareness can be a significant motivating factor for adhering to a sustainable service, which is directly reflected in the answer to the next question.

When asked about the maximum amount they would be willing to pay extra for this sustainable service, the

majority of participants (61.35%) indicated that they would be willing to pay up to 10% more. In addition, a considerable portion would be willing to extend this amount, with 23 respondents (14.11%) indicating a willingness to pay up to 15%, while 7 participants (4.29%) would consider paying up to 20% more. On the other hand, a minority would choose not to pay an additional amount, with 25 respondents (15.34%) saying they would not be willing to pay more for an ecologically sustainable service. A small group (7 participants, corresponding to 4.29%) were willing to pay more than 25% for a sustainable service.

These findings constitute a crucial element in shaping the pricing and communication strategy of the service, with a view to meeting the different mentalities and motivations of consumers in relation to sustainability, since a properly carried out RMSP makes it possible to improve not only economically, but also technologically, It is based on simple, low-cost actions that combine sustainable development and preservation of the environment. Not only should the company's turnover be assessed, but also the costs of all the adjustments needed to provide environmentally friendly services (Dacroce, Fujihara & Bertolini, 2016).

<b>What is the maximum amount you would be willing to pay extra for an ecologically sustainable lube oil change service?</b>	
I wouldn't be willing	15,43%
Up to 10%	61,73%
Up to 15%	14,20%
Up to 20%	4,32%
More than 25%	4,32%
<b>Grand Total</b>	<b>100,00%</b>

**Table 4:** Answers to the questionnaire on willingness to pay extra for sustainable services  
**Source:** authors of the survey (2023)

## 5. HYPOTHESIS TESTING

After analyzing the data from each block, the data was submitted to test the previously formulated hypotheses. The comprehensive and detailed information obtained by investigating the four blocks, as well as the attitudes towards the concept of an ecologically sustainable oil change service, provide a solid basis for evaluating these hypotheses. Our focus is on verifying the consistency

between the hypotheses and the patterns observed in the data collected. In order to rigorously test the hypotheses, we chose to use ACTION STAT statistical software, version 3.6. It was chosen because of its ability to carry out statistical analysis, allowing a precise and detailed approach to the relationships between variables. The use of this tool gives robustness to the evaluation of the hypotheses, ensuring reliable and substantial results that support the conclusions of this study.

To test Hypothesis H1, we used the proportion test, a statistical technique suitable for assessing the association between categorical variables, where the hypothesis is rejected when the p-value is less than 0.05 ( $\alpha = 0.05$ ). In this case, the variable analyzed refers to the motivation for choosing a place to get an oil change. It was found that only 25 of the respondents indicated price as the main factor in their choice. This result showed a significantly low p-value (p-value =  $1.37E-18$ ), which suggests strong statistical evidence to reject the hypothesis. Therefore, based on this analysis, the initial assumption that consumers have price as the main factor in choosing where to change their vehicle's oil is not confirmed.

To estimate the validity of Hypothesis 2 (H2), which asks whether there is a significant difference between consumers willing to pay more for an ecologically sustainable oil change service, with correct waste disposal and less environmental impact, the proportion test was used. The variable considered was the participants' willingness to pay extra for this type of service. The analysis showed that 82.10% (133) of the respondents were willing to pay extra, while 17.90% (29) were not. The test resulted in a p-value of  $3.06E-16$ , which suggests a statistically significant difference between the proportions. Therefore, these results support H2, demonstrating that there is a significant difference between consumers willing to pay more for an ecologically sustainable oil change service. This contributes to an informed perception of consumers' willingness to adhere to more sustainable practices.

The last test carried out to validate hypothesis H2.1 explored consumers' willingness to accept an increase of at least 10% in the cost of services related to ecologically sustainable oil changes. To examine this, we analyzed the variable that asked participants about the maximum amount they would be willing to pay extra for the ecologically sustainable lube oil change service. The proportion test was used to determine whether a significant proportion of consumers were willing to pay this extra. The results were revealing, with a p-value of  $2.17E-18$ , rejecting the null hypothesis and showing that there is a marked

willingness among consumers to accept a minimum 10% increase in the cost of ecologically sustainable services. The success ratio in the sample, calculated at 0.8447, confirms this trend, and the lower (0.7888) and upper (0.9007) limits of the success ratio offer a reliable range of results. Based on these findings, it can be concluded that respondents are inclined to consume a more sustainable service, even with a modest increase in costs.

## 6. DISCUSSION

In short, this study sought to analyze the factors that influence the acceptance of an ecologically sustainable oil change service in the city of Catanduvas/PR. Through the data collected in four blocks, it was possible to obtain valuable information about consumer attitudes, motivations and preferences in relation to motivation, consumption habits and environmental sustainability.

The findings in relation to the socio-economic profile of the participants revealed a diverse sample in terms of age group, level of education and salary distribution. This diversity demonstrates the representativeness of the sample and enriches the understanding of the nuances that permeate the acceptance of sustainable services in different demographic groups.

With regard to consumption habits, the results showed a significant awareness of the importance of regular oil changes, with the majority of participants following the manufacturers' recommendations. Awareness of the importance of regular oil changes was also evidenced in the studies by Marques, Marques and Silva (2015). These studies pointed to the need for greater environmental awareness of the waste management practices adopted by garages, seeking to promote environmental preservation through their own activities. This is in line with the results found in this study. The attention given to the recommendation, as well as the concern about price, reinforced the complexity of the considerations that shape consumer choices. However, the lack of emphasis on concern for the environment as a decisive factor indicated an opportunity for additional awareness-raising and education. This result reinforces the conclusions made in the study by Nascimento, Teixeira, Menezes and Alves (2016), which indicate that more than half of the respondents are aware of the crucial role of environmental management, but many lack substantial knowledge, although they still carry out appropriate actions for the proper disposal of waste.

With regard to knowledge and evaluation of the competition, it was possible to gain a detailed insight into the underlying influences on the choice of oil change locations. The preference for trusted locations, the role of customer service and the influence of recommendations highlighted the importance of past experiences and reliability in the consumer's decision. Awareness of the existence of specific regulations revealed a gap in the awareness of some participants, highlighting the need for more comprehensive educational approaches. The willingness to pay a slightly higher price for an environmentally conscious service reflected a growing awareness of the importance of sustainability. However, the willingness to change oil at non-compliant disposal sites highlighted the complexity between valuing sustainability and the practical and cost-benefit considerations that consumers take into account.

Examining the responses related to the business concept test provided decisive information on consumers' receptiveness to a sustainable service.

This is in line with the results pointed out by Dacroce, Fujihara & Bertolini (2016), who stated that adaptations in organizations do not occur only to comply with legal requirements, but also due to the awareness of entrepreneurs and changes in the profile of consumers.

After carrying out the statistical tests to validate the three hypotheses formulated, the consumer's willingness to pay extra and accept an ecologically sustainable oil change service were verified. In the first test, when checking the influence of price on the choice of oil change location, it was found that only a minority of respondents pointed to price as the main factor. This result, reinforced by the low p-value ( $1.37E-18$ ), contradicts the initial hypothesis, indicating that price is not the main motivator in decision-making.

Turning to the second test, which concerns consumers' willingness to pay more for an ecologically sustainable service, the extremely low p-value ( $3.06E-16$ ) shows a significant difference between consumers willing to pay more for an ecologically sustainable oil change service. This result, which is supported by the proportions observed (82.10% in favor and 17.90% opposed), supports Hypothesis 2 and indicates that there is a solid basis for consumer adherence to more sustainable practices.

Finally, the third hypothesis, which aimed to assess consumers' willingness to accept a minimum 10% increase in the cost of ecologically sustainable services, was also supported by the results. The proportion test had an extremely low p-value ( $2.17E-18$ ), indicating a statistically significant difference between consumers. These results,

together with the proportions observed (84.47% in favor and 15.53% opposed), confirm that consumers are willing to accept a modest increase in costs in order to subscribe to a more sustainable service.

In relation to these findings, it is essential to note that the survey carried out by Seramim, Zanella, Araujo and Bertolini (2016) revealed that 35.29% of consumers rejected paying extra and that in the survey carried out by Dacroce, Fujihara & Bertolini, 2016, the vast majority of consumers would only accept paying a 5% price increase. These results reinforce the understanding that willingness to pay more should not be the only factor considered to attract consumers who prioritize environmental issues.

Thus, the results indicate that factors such as price, willingness to pay more for sustainable practices and acceptance of increased costs are interconnected and influential in consumer choice. These findings have significant effects for the implementation strategy of this service, supporting the need for a sustainable and conscious approach to meet consumer preferences and promote environmentally responsible practices.

Based on the data collected from the questionnaires and the hypotheses tested, it is clear that implementing sustainable actions in the process of changing automotive lubricating oil is feasible and can be widely accepted by consumers. Analysis of the information from the questionnaires revealed a significant willingness on the part of consumers to adhere to an ecologically sustainable service, with correct waste disposal and less environmental impact. At the same time, the results of the statistical tests confirmed that consumers are willing to pay more for a sustainable service, even if this involves an increase in costs.

These findings indicate the importance given by consumers to choosing reliable locations, quality service and consideration of environmental factors. The socio-economic profile of consumers also suggests a diversity of age groups, levels of education and income, which provides a solid basis for implementing strategies that cater to different consumer profiles.

Therefore, all the results found in this study corroborate previous studies, such as the results pointed out by Seramim, Zanella, Araujo and Bertolini (2016), which highlight the viability based on consumers' willingness to pay more for services in a mechanic's shop that adopts environmentally sustainable practices and the studies by Dacroce, Fujihara and Bertolini (2016) which point out that implementing accessible and effective practices to reduce environmental impacts attracts consumers and has proven viable, generating profit for the company.

## 7. FINAL CONSIDERATIONS

This study makes a significant contribution by demonstrating, through robust statistical tests, the willingness of consumers to adhere to ecologically sustainable services when changing their car's oil, even with an increase in costs. In addition to providing information for companies in the sector, these results enrich the academic field by broadening the understanding of consumer motivations and behaviors, and can serve as a basis for future research exploring sustainable practices in various industries and contexts.

One gap highlighted in this research was the scarcity of studies addressing the relevance that consumers attach to these sustainable practices. In this context, this research seeks to fill this theoretical void, contributing to the understanding and deepening of the subject, as well as to the knowledge base around consumers' willingness to pay more for environmentally conscious oil change services.

Therefore, considering the willingness of consumers to adhere to these practices, even at a higher cost, and the results obtained, it is feasible to implement sustainable actions in the automotive lubricant oil change process. The willingness shown by consumers to pay more for an ecologically responsible service, combined with growing environmental awareness and the search for more sustainable practices, provides a favorable environment for adopting practices that not only benefit the environment, but also contribute to the company's positive image and customer loyalty, consequently bringing economic gains to the company. Thus, entrepreneurs can obtain satisfactory results by adapting their establishments to offer ecologically correct services and investing in advertising, so that consumers are aware of the offer.

Thus, this study helps to understand the motivations, attitudes and behaviors of consumers in relation to the scope researched. The findings highlight the importance of environmental awareness and education strategies, as well as the need to align the offer of sustainable services with consumer expectations. Implementing an efficient waste management system can not only attract customers, but also contribute to economic, technological, occupational safety and environmental improvements. In the constantly evolving scenario of environmental awareness and the search for more sustainable practices, the results of this study have significant implications for companies seeking to incorporate ecologically conscious principles into their business models.

As a contribution to the field of studies related to

consumer behavior and corporate sustainability, the article offers a detailed analysis of the factors that influence the acceptance of an ecologically sustainable oil change service, filling a gap in the understanding of these motivations in relation to environmentally responsible practices in the automotive sector.

In addition, the conclusions drawn about consumers' willingness to pay more for a sustainable service and the practical considerations involved in choosing oil change locations offer valuable insights for companies looking to develop business strategies in line with growing environmental awareness. Commercial associations, through their sectoral chambers, can create programs to promote sustainable companies and publicize them to the population.

These contributions not only inform business practices, but can also influence public policy by highlighting the importance of environmental education and awareness for sustainable behavior change on the part of consumers. In this way, public authorities have the possibility of creating subsidies and programs for companies in the sector that adopt sustainable practices and adhere to environmental programs.

This study offers several promising directions for future research at the intersection of consumer behavior and corporate sustainability. Further exploration is suggested in the search for effective environmental education and awareness strategies that can be implemented by companies to better inform consumers about the proper disposal of waste and the positive impacts of sustainable practices.

In addition, longitudinal studies that follow the evolution of consumer attitudes and behaviors over time would allow for a more in-depth understanding of trends in the adoption of ecologically sustainable services. Also, considering the growing importance of environmental issues in consumer decision-making, a future study could investigate the relationship between a company's perceived sustainability and its reputation and loyalty on the part of consumers.

Such future research has the potential to further enrich our understanding of the influences between consumer behavior and corporate sustainability practices.



## REFERENCES

- Bertolini, G. R. F., Rojo, C. A., & Lezana, Á. G. R. (2012). Modelo de análise de investimentos para fabricação de produtos ecologicamente corretos. **Gestão & Produção**, 19, 575-588.
- Conselho Nacional do meio ambiente, **Atos normativos/resolução 362**. <http://conama.mma.gov.br/>, acesso em 14/05/2023
- Dacroce, N. P., Fujihara, H. M., & Bertolini, G. R. F. (2016). Resíduos de oficina mecânica: proposta de gerenciamento de resíduos sólidos—LP Radiadores e Baterias LTDA. **Revista da Micro e Pequena Empresa, Campo Limpo Paulista**, 10(2), 97-113.
- Departamento de Trânsito do Paraná. (2022, abril). Frota - Março de 2022. Recuperado de [https://www.detran.pr.gov.br/sites/default/arquivos\\_restritos/files/documento/2022-04/frota\\_marco\\_de\\_2022](https://www.detran.pr.gov.br/sites/default/arquivos_restritos/files/documento/2022-04/frota_marco_de_2022), acesso em 14/05/2023
- Dorsa, Arlinda. (2020). O papel da revisão da literatura na escrita de artigos científicos. **Interações (Campo Grande)**. 21. 681-683.
- Gonzaga, N., da Silva, R. N., & De Andrade, L. P. (2021). Gerenciamento de Resíduos do Óleo Lubrificante: Uma Revisão Sistemática da Literatura. **Revista de Gestão Social e Ambiental-RGSA**, 15.
- de Almeida Pires, J. M., & da Silva, J. L. G. (2016). Logística reversa: uma ferramenta estratégica para o desenvolvimento sustentável. **Revista Brasileira de Gestão e Desenvolvimento Regional**, 12(5).
- do Monte Batista, C. M., de Oliveira, F. D. B., de Oliveira, C. M. R., de Moura, J. J., & dos Santos, M. D. S. F. (2019). Análise do ciclo logístico reverso do óleo lubrificante pós consumo em Teresina-Piauí. **Sistemas & Gestão**, 14(3).
- Gardas, B. B., Raut, R. D., & Narkhede, B. (2018). Reducing the exploration and production of oil: Reverse logistics in the automobile service sector. **Sustainable Production and Consumption**, 16, 141-153.
- Gonçalves, D. M. (2013). **Análise da viabilidade de implementação de um sistema de recolha seletiva de óleos lubrificantes usados** (Doctoral dissertation, Faculdade de Ciências e Tecnologia).
- Gupta, A. K. (2022, December). Prioritizing Barriers for Reverse Logistics of Lubricating Oils using Fuzzy AHP. **In 2022 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)** (pp. 1233-1236). IEEE.
- Martins, H. M. (2005). **A destinação final das embalagens de óleo lubrificante: o caso do Programa Jogue Limpo** (Doctoral dissertation, Master's dissertation). Universidade Estadual do Rio de Janeiro, Rio de Janeiro).
- Müller, A. C. M., Presrlak, M. I., & Bertolini, G. R. F. (2016). Proposta de intervenção na gestão de resíduos sólidos de uma oficina mecânica do Oeste do Paraná. **Revista Inovação, Projetos e Tecnologias**, 4(1), 97-113.
- Nascimento, J. F., Teixeira, V. V. N., de Menezes, J. E. C., & Alves, K. R. C. P. (2016). A importância do gerenciamento de resíduos sólidos e sua logística reversa nos postos de combustíveis da cidade de Campina Grande-PB. **Revista Produção e Desenvolvimento**, 2(1), 64-76.
- Oliveira, M. C., & Magrini, A. (2017). Life cycle assessment of lubricant oil plastic containers in Brazil. **Sustainability**, 9(4), 576.
- Paydar, M. M., Babaveisi, V., & Safaei, A. S. (2017). An engine oil closed-loop supply chain design considering collection risk. **Computers & Chemical Engineering**, 104, 38-55.
- Paredes-Rodríguez, A. M., Grisales-Aguirre, A. F., & Sánchez-Zambrano, D. A. (2022). Gestión de riesgos operacionales en el proceso de logística inversa del aceite vehicular usado. **Revista Facultad de Ingeniería**, 31(61), e13869-e13869.
- Pinheiro, J.I.D., da Cunha, S.B., Carvajal, S.R. & Gomes, G.C. (2009). **Estatística Básica: A arte de trabalhar com dados**. Rio de Janeiro—RJ, 175-208.
- Rebelatto, P.H., Fagundes, A. B., Pereira, D., Beuren, F. H., de Campos, D. B., & da Silva, M. C. (2016). Sistemas

de logística reversa em implantação no Brasil: Uma análise comparativa dos acordos setoriais de embalagens plásticas de óleos lubrificantes e lâmpadas fluorescentes de vapor de sódio e mercúrio e de luz mista. **Revista ESPACIOS** | Vol. 37 (Nº 24) Ano 2016.

Ribeiro, J. J. K., Chaves, G. D. L. D., & Muniz, E. P. (2018). Avaliação da coleta de óleo lubrificante usado e contaminado: Estudo de caso no município de São Mateus-ES. **Revista Gestão & Tecnologia**, 18(1), 269-282.

Santos, R. M., & da Conceição, A. L. (2017). Implantação e análise da viabilidade de um sistema de gerenciamento de resíduos em oficina mecânica no município de Vargem-SC. **Revista Argumento**, 18(27), 20-40.

Schuelter, L. M., Fernandes, C. W. N., & de Sena Taglialha, S. L. (2016). Óleos lubrificantes automotivos residuais: um estudo de caso em logística reversa. **In Colloquium Exactarum**. ISSN: 2178-8332 (Vol. 8, No. 2, pp. 69-84).

Sencovici, L. A., & Demajorovic, J. (2015). Entraves e perspectivas para a logística reversa do óleo lubrificante e suas embalagens. **Revista de Gestão Ambiental e Sustentabilidade**: GeAS, 4(2), 83-101.

Seramim, R. J., Zanella, T. P., Araujo, M. D. P., & Flor Bertolini, G. R. (2016). Investment analysis on environmental actions in mechanical workshop. Reunir – **Revista de administração contabilidade e sustentabilidade**, 6(2), 97-108.

Tan, L. P., Johnstone, M. L., & Yang, L. (2016). Barriers to green consumption behaviours: The roles of consumers' green perceptions. **Australasian Marketing Journal**, 24(4), 288-299.

Tristão, J. A. M., Tristão, V. T. V., & Frederico, E. (2017). O processo de reciclagem do óleo lubrificante. **Revista Ibero-Americana de Ciências Ambientais**, 8(2), 224-238.

Triviños, A. N. S. (1987). **Introdução à pesquisa em ciências sociais: a pesquisa qualitativa em educação**. São Paulo: Atlas.

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