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An Assessment of Drivers and Barriers to Implementation of Circular Economy in the End-of-Life Vehicle Recycling Sector in India

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Abstract: The circular economy (CE) has been frequently in the news recently, as it offers a regenerative system that substitutes the end-of-life concept with restoration. Despite several benefits yielded by the CE from a triple-bottom-line perspective, India's end-of-life vehicle (ELV) recycling sector is striving against numerous impediments to implementing the CE approach. Therefore, this paper attempts to shine a spotlight on India's ELV recycling sector, to identify the potential drivers and barriers to CE implementation. This study has employed an explorative approach to determine the impediments and drivers regarding implementing CE in India's ELV recycling sector. This research reveals that economic viability (25 percent), environmental degradation (17 percent), and global agenda (15 percent) are the three leading primary drivers. In contrast, limited technology (18 percent), financial constraints (15 percent), and a lack of knowledge and expertise (12 percent) are significant barriers that thwart CE implementation in India's ELV recycling sector. This paper has made the first attempt to explore the drivers and barriers to implementing CE in the ELV recycling sector in India. Therefore, besides advancing our understanding of opportunities for and threats to implementing CE, this investigation may assist the Indian authorities in devising appropriate policies and strategies and developing a regulatory and legal framework that is conducive to CE and sustainability.

Keywords: end-of-life vehicle (ELV); recycling; circular economy (CE); drivers; barriers

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Citation: Molla, A.H.; Shams, H.; Harun, Z.; Ab Rahman, M.N.; Hishamuddin, H. An Assessment of Drivers and Barriers to Implementation of Circular Economy in the End-of-Life Vehicle Recycling Sector in India. *Sustainability* **2022**, *14*, 13084. https://doi.org/10.3390/su142013084

Academic Editors: Subrata Hait, Anshu Priya, Varsha Bohra and Nallapaneni Manoj Kumar

Received: 26 August 2022
Accepted: 18 September 2022
Published: 12 October 2022

1. Introduction

Globalization, the industrialized economy, continuous technological advancements, and surging demand for products expedite the rate at which vehicles are replaced, consequently engendering an overwhelming increase in abandoned vehicles [1]. Manufacturing vehicles requires a considerable quantity of non-renewable resources and substances. As natural resources are declining exponentially, vehicle manufacturing industries strive to keep raw material supplies steady [2]. Vehicles that are no longer operating, stripped, or wrecked due to mechanical failure, which are known as end-of-life vehicles (ELVs), contain myriad precious, rare, and industrially valuable materials and components. Besides holding significant economic value, ELVs also contain certain pollutants. Hence, sustainably handling ELVs is imperative to avoid their inevitable threat to society. Sustainability, which protects against the dramatic depletion of natural resources and preserves them for long-term application, relies heavily on the products and materials loop [3], which is inevitable in the case of a traditional linear economic system, where products and materials are dumped as waste after usage. For this purpose, several policies are implemented at the production and consumption stages, emphasizing the importance of waste minimization [4]. The annual production of vehicles was around 78 million new cars around the globe in 2020, which indicates a future deluge of ELV needs to handle [5]. ELVs present a risk and menace from an economic, social, and environmental perspective, as nearly 5% of industrial waste is generated by automobiles [4]. They represent hazardous waste with immense potential to pollute the environment if not properly disposed of [6,7]. One such practice is CE, which tends to work for "recycling, reusing, and recovering" materials from the manufacturing to consumption stages, instead of discarding them to pollute the environment, enhancing sustainability through restorative design [8,9] wherein products are reused, recycled, and reduced as an effective strategy for eco-friendly processing of ELVs [10]. The purpose of recovery is to avoid using virgin material resources [11]. CE, considering its triple bottom line, is a challenging field and is still in development with regard to ELVs. Using tactical and strategic principles, optimization, and interconnection among the different stakeholders in the supply chain are crucial and imperative [12] as much waste is generated in terms of personal cars and private entities [13]. This has led researchers to work on all aspects of ELVs, which are considered a growing research area. Several methods are adopted to achieve CE. One such method is closed loop supply chains (CLSCs), where products and materials are reused, recycled, and reduced ("3Rs") to protect the environment and minimize the economic impact [14]. However, adopting such practices in the case of ELVs poses significant challenges while working on materials flow in a closed-loop system [15]. This includes tactical, operational, and strategic stages such as production volume [16], along with government legislation and policies [17], human perception [18], and environmental issues [19]. Table 1 summarizes previous relevant research works in the context of this study.

Table 1. A summary of the previous works.

Author and Year	Objective	Methodology	Focus Area	Reference
Chakraborty et al. (2019)	To find out enablers and barriers in automotive product remanufacturing	Fuzzy interpretive structural modeling (FISM)	Indian market	[20]
Mohan and Amit (2018)	Recycling of ELVs in an unregulated market	System dynamics model	Indian market	[21]
Numfor et al. (2021)	Challenges and opportunities for ELV recycling	Review + SWOT analysis	Developing countries = 8; Nigeria; Cameroon; South Africa; Kenya, Mexico; Malaysia; India; Egypt	[22]
Sharma and Pandey (2020)	(1) To study the Indian ELV sector by focusing on hatchback automobiles (2) Estimating recycling units capability for recycling and recovering materials	SWOT analysis + Primary data collection through Interviews, On-site observations	Mayapuri market, India	[23]
Arora et al. (2018)	How to improve the sustainability of ELV management in the Indian market through a business model by engaging stakeholders	Framework based on shared responsibility including all stakeholders + SWOT analysis	Indian market	[24]
Ravi and Shankar (2017)	To analyze interactions among variables (enablers, indicators, inhibitors) affecting reverse logistics in automobile industries	Interpretive structural modeling (ISM)	Automobile industries	[25]
Luthra et al. (2011)	Identifying barriers to implementing GSCM in the Indian automobile industry	Interpretive structural modeling (ISM)	Indian automobile industry	[26]
Govindan et al. (2016)	Barriers evaluation for Indian automotive parts remanufacturing	The fuzzy analytic network process	Indian automobile industry	[27]
Nag et al. (2021)	Multi-theoretical framework to identify and evaluate drivers and sub-drivers of the circular supply chain in automotive industries in case of emerging economies	Grey DEMATEL	Emerging economies	[28]
Sinha et al. (2017)	(1) Empirical investigation of the Indian automobile industry (2) To identify the reasons behind the slow growth of remanufacturing businesses	Empirical study	India	[29]
Zhou, Fuli et al. (2019)	Identifying drivers in the Chinese ELV recycling business from three perspectives (1) government (2) consumers, and (3) recycling organizations	(1) Literature review (2) Interpretive structural modeling (ISM)	China ELV recycling business	[30]

Table 1. *Cont.*

Author and Year	Objective	Methodology	Focus Area	Reference
Hu, Shuhan and Zongguo Wen (2017)	(1) To evaluate the impact of treatment scenarios on society by analyzing three sectors: (a) the advanced formal sector, (b) the informal sector, and (c) the common formal sector (2) Modeling the cost of ELV treatment on social values in these three scenarios	Data collection through: (1) Literature surveys (2) questionnaires (3) site visits	China	[31]
Mamat et al. (2016)	(1) Developing a framework for establishing an ELV management system	(1) Survey of 300 respondents was factor analyzed using SPSS (2) Structural equation modeling for confirming linear relationship among those factors	Malaysia	[32]
Zhang and Chen (2017)	To prioritize four dismantling strategies for vehicle manufacturers, battery manufacturers, and ELV dismantlers, based on the survey	(1) Survey on ELV stakeholders (2) Analytical hierarchy process (AHP)	China	[33]
Sitinjak et al. (2022)	Identifying social factors for ELV acceptance	(1) Survey (2) SEM was used for the model estimation	Indonesia	[34]
Edun and Vermette (2021)	Investigating the effect of ELV tires by using them as building envelope material for residential building design	(1) Energy performance analysis (2) Life cycle analysis	Canada	[35]

Research suggests that products can be reused after their end-of-life stage by adopting CLSC principles [36]. Countries and organizations are focusing on the concept of the CE from an adoption and implementation point of view for efficient resource utilization. However, CE policies are primarily implemented in developed countries. The developing countries face several barriers in policymaking and when implementing CE principles [28], which are discussed in detail in Section 4. The Indian ELVs market is not regulated, since most firms have not as yet adopted recycling practices [24,28]. Being a vast market, implementing recycling processes and policies is imperative for achieving resource efficiency in the case of automobile components. Despite several benefits offered by the CE model from a triple-bottom-line perspective, India's end-of-life vehicle (ELV) recycling sector is striving against numerous impediments in implementing the CE approach holistically. The literature reveals that limited research has been performed to explore the potential drivers of and barriers to CE implementation in developing countries, especially in India, and little of the research has endeavored to address the issues that arise when implementing the CE in India from other industries' perspectives, based on a particular industrial zone in India. The characteristics of the drivers and barriers to CE implementation vary significantly, depending on the sector and regions; hence, the significance and implications of outcomes of the previously reported research are limited to that particular industry and zone. The lack of a comprehensive study that sheds light on the drivers and barriers of change from the ELV recycling industry perspective is prominent, although the ELV recycling industry in India is burgeoning at an exponential rate as India has one of the world's largest automobile markets.

The absence of an inclusive and general study that embraces prominent ELV recycling sectors across India and that can provide crucial outcomes in a broader sense is forcing the Indian authorities to devise and enact policy, legal, and technical frameworks uniformly across India to counter the issues thwarting the implementation of the CE approach and expedite sustainability in ELV recycling in India. Furthermore, the complete lack of explorative studies encompassing face-to-face interviews and field investigation to record the stakeholders' attitudes and aspirations toward CE and to reflect ground-level practices that yield more precise and reliable data and information about implementing CE in India's ELV recycling sector is conspicuous. Therefore, this paper attempts to shine a spotlight on India's ELV recycling sector holistically by including five prominent automobile hubs across India, to identify the potential drivers and barriers to CE implementation.

An explorative approach has been employed for this study, as it offers more accurate screening by capturing attitudes and recording the aspirations of stakeholders, which are instrumental for decision-making. Besides exploring the enablers and impediments, this research offers specific practical recommendations for implementing and enhancing the CE initiatives in the ELV recycling sector in India. Moreover, these research findings reflect the stakeholders' perceptions and aspirations regarding the ELV recycling system. Therefore, besides advancing our understanding of opportunities and threats for implementing CE, this investigation may assist the Indian authorities in devising appropriate policies and strategies and developing a regulatory and legal framework that is conducive to CE and sustainability. The findings of this study may encourage ELV enterprises and other sectors to embrace the CE framework since it provides a robust financial system that produces significant economic benefits while protecting the environment. The study is based on the following steps:

Step 1: Specific automobile hubs (five selected industrial zones) were focused on as the sample, which is discussed in Section 3.

Step 2: A mixed method research mode was adopted for this study based on primary and secondary research approaches, as shown in Table 2.

Table 2. The approach used to obtain information and data.

Indian City	ELV Sector	Stakeholder	Method and Tool	Sample Size
Kolkata (West Bengal)	• Mallick Bazar • Phoolbagan • Panagarh	■ Key stakeholder ■ Academician ■ Vehicle owner ■ Government-authorized agency ■ Expert ■ Individuals in general	✓ Structured questionnaire ✓ Focused group interviews ✓ Individual in-depth interview ✓ Field investigation	144
Chennai (Tamil Nadu)	• Boarder Thottam • Pudupet	■ Key stakeholder ■ Academician ■ Vehicle owner ■ Government-authorized agency ■ Expert ■ Individuals in general	✓ Structured questionnaire ✓ Focused group interviews ✓ Individual in-depth interview ✓ Field investigation	123
Mumbai (Maharashtra)	• Kurla West • Mumbai	■ Key stakeholder ■ Academician ■ Vehicle owner ■ Government-authorized agency ■ Expert ■ Individuals in general	✓ Structured questionnaire ✓ Focused group interviews ✓ Individual in-depth interview ✓ Field investigation	112
Delhi (Delhi)	• Mayapuri • Jama Masjid	■ Key stakeholder ■ Academician ■ Vehicle owner ■ Government-authorized agency ■ Expert ■ Individuals in general	✓ Structured questionnaire ✓ Focused group interviews ✓ Individual in-depth interview ✓ Field investigation	98
Jamshedpur (Jharkhand)	• Jugsalai • Jamshedpur	■ Key stakeholder ■ Academician ■ Vehicle owner ■ Government-authorized agency ■ Expert ■ Individuals in general	✓ Structured questionnaire ✓ Focused group interviews ✓ Individual in-depth interview ✓ Field investigation	83

Step 3: A structured questionnaire was developed, and data was gathered through surveys based on specific research questions, which is discussed in Section 3.

Step 4: The data is analyzed in detail in Section 4.

Step 5: The managerial implications of the findings and a few practical recommendations are discussed in Sections 5 and 6, respectively.

In order to interlink the literature and the survey results, this study aims to answer the following research questions, based on step 3.

RQ1: What drivers enable CE implementation for the ELV recycling sector in India?

RQ2: What barriers hinder CE implementation for the ELV recycling sector in India?

The article is based on the following structure: Section 2 provides the background to this study, Section 3 gives the methodology, Section 4 is related to the critical findings and analysis, Section 5 provides a discussion of the managerial implications of this study, and Section 6 offers practical recommendations. Section 7 presents the research limitations of this study, Section 8 offers future prospects and suggestions, and Section 9 is the final section, presenting our conclusions.

2. Literature Review

Sustainability is not an easy task to achieve. Waste is being generated at lightning speed around the globe. This has brought the attention and focus of academia and professionals who are looking at sustainability and technology within such a context [37,38]. Consumer priorities and the demand for new vehicles have resulted in a need for the proper disposal and treatment of ELVs. Automobiles are made of several parts and different materials, such as ferrous metals, plastic, glass, rubber, fluids, and other materials [39,40]. In addition, most vehicles are composed of iron, which can be traded and utilized as a valuable secondary resource [41]. However, Tarrar et al. (2021) [40] suggest that a state-of-the-art disassembly unit is imperative for implementing sustainable strategies. This is mainly due to the threats posed to the environment by toxic materials and chemicals during the recycling and recovery process [5]. For such purposes, the treatment process of ELVs comprises depollution, shredding, and dismantling [42]. On the other hand, several strategies, including recycling, reusing, and reducing, commonly known as the 3Rs, are considered the primary way to achieve sustainability in the ELVs industry [30]. The 3Rs have different implementation stages. Reuse is where products and materials can be reused elsewhere, while recycling comes later in the waste hierarchy [5]. As a result, this will help the vehicle industry in terms of efficient resource utilization and saving energy [43]. Therefore, several countries are imposing laws for vehicle recovery by creating legal requirements [6,37,44], as there is a high probability of illegal transportation and processing of ELVs, considering the diverging interests of stakeholders and actors in the end-of-life (EOL) system. The generation of waste at the end of a product's life cycle is a considerable problem exacerbated by increased consumption as the number of vehicles increases around the globe, especially around Asia, considering its immense population [45]. ELVs are generating waste in terms of fuel, volume, resource consumption [46], and environmental threats [19], due to this increased consumption [47]. The ELV's life cycle can be divided into five stages: pre-production, production, distribution, usage, and disposal [48].

Zhang and Chen (2017) [33] conducted a survey based on key stakeholders for ELV by prioritizing dismantling modes, such as direct shredding, manual dismantling, dismantling machines, and disassembly lines for the Chinese market. Their paper was based on a case study approach by selecting particular 17 automobile enterprises involved in manufacturing, dismantling, and recycling in Shanghai, China. Kayikci et al. (2021) proposed a sustainable CE policy based on four aspects: "technology", "consumers", "policy", and "producers", working on a macro level that focused on the automotive industry [49]. Sitinjak et al. (2022) [34] performed a study based on a survey concerning the societal factors affecting the public's acceptance of ELVs in Indonesia. They identified that people have a lack of knowledge and poor attitudes, societal trust, and perceptions about ELV management. Nitish et al. (2019) found that most of the Indian ELV market is not regulated;

the ELV sector is handled informally by scrapping and dismantling parts for recovery, refurbishment, and recycling after being sold to the second-hand market [24].

Tarrar et al. (2021) [40] performed a literature review to study ELV treatment and dismantling systems. They identified four key areas for improvement in ELV management. These areas comprise: (1) battery recycling, (2) workforce for each unit, (3) the structure of ownership and investment, and (4) plastics recycling. Both plastics and battery recycling are related to the economic and environmental aspects of sustainability. The ELV share in total plastic waste is around 5% [6]. D'Adamo et al. (2020) [37] performed a linear regression model identifying the correlation between generated and recycled volumes of ELVs. Their estimated result for generated and recycled ELVs is around 9.3 and 8.3 million tons, respectively, as projected to 2030. Jang et al. (2022) [5] employed statistical data analysis to conduct a study based on sample collection from five ELV shredding facilities in South Korea. They identified two main challenges in the recycling process: (1) a lack of economic incentives, and (2) no proper support systems for low-value materials. Most recently, Nag et al. (2021) [28] investigated the drivers of circular supply chains with a focus on the emerging economy, based on the grey-DEMATEL approach. They recommended several drivers, such as "circular value marketing", "circular services", "circular product design", and "reverse flow drivers". Agyemang et al. (2019) [50] identified several drivers and barriers in the context of Pakistan's automobile manufacturing industry. According to their findings, "profitability share", "cost reduction", and "business concerns" are the top three drivers, while the top three barriers to the implementation of CE principles are "unawareness", "financial and cost constraints", and a "lack of expertise".

Gardas et al. (2018) [51] analyzed the barriers to reverse logistics (RL) in the case of oils obtained from automobile service stations. Their results showed that "inadequate government policies", "a lack of top management commitment", and "organizational policies" were the most significant barriers while adopting the interpretive structural modeling technique. These results were based on developing an interrelationship between obstacles and drivers. J. Li et al. (2014) [38] performed a study on recycling and pollution control in the case of ELVs in China. They studied the current laws and regulations for ELV management, identified several potential problems, and proposed various solutions. Such identified barriers can hinder the transition process of ELV recycling. It is evident that customers will buy refurbished products rather than expensive new ones. As Macarthur (2013) [52] suggested that new product sales may well decrease due to increased sales of refurbished products. Conversely, Mohan and Amit (2018) [21] proposed that the combination of automobiles with enhanced technology, government-enforcing environmental regulations, and high incomes led to shortened life-cycle automobiles, ultimately leading to increasing numbers of ELVs. Another issue is the role of RL in recycling ELVs, as significant barriers can slow or hinder the effectiveness of the whole process [51].

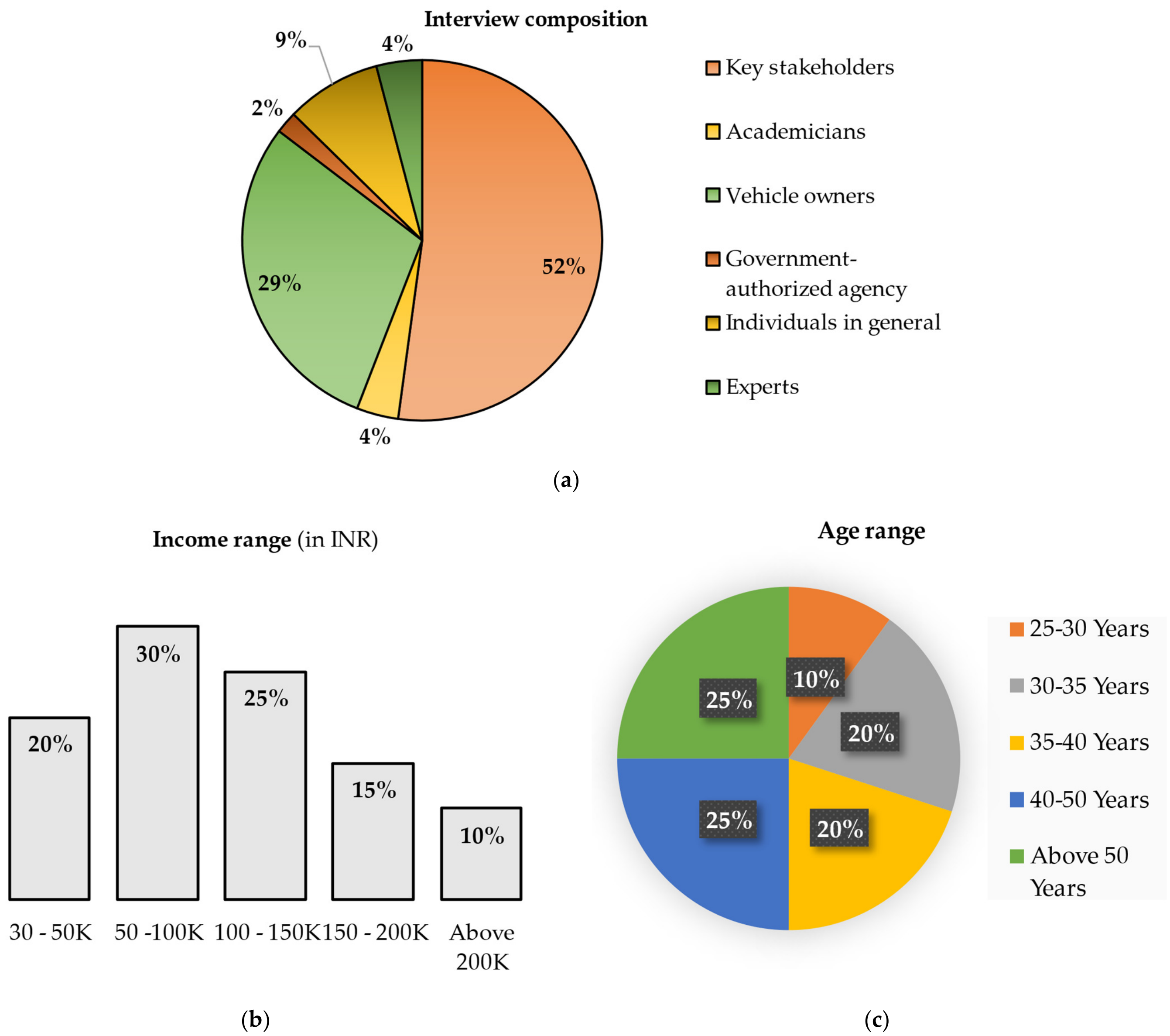
3. Methodology

This study has employed an explorative approach to determine impediments and drivers to implementing CE in the ELV recycling system in India. It incorporates research design and sampling, data collection, quantitative, qualitative, secondary research, and data analysis.

3.1. Research Design and Sampling

This study aims to determine the potential general drivers and barriers to implementing CE in the ELV recycling system in India. This study delves into the five fastest-growing automotive sectors in India's major cities, namely, Kolkata, Chennai, Delhi, Mumbai, and Jamshedpur, to identify the barriers and drivers to India adopting the circular economy in the ELV recycling system in the broader sense. This study has adopted a mixed method that entails quantitative and qualitative research to meet the objectives of this study. For the purposes of determining the sample of individuals concerned, this study uses a stratified and systematic sampling technique. For this investigation, we interviewed a total of

560 selected respondents, incorporating key stakeholders, government agencies, experts, academicians, vehicle owners, and general individuals. The authors developed a well-structured questionnaire that has been reviewed and approved by eminent professionals in the CE and sustainability fields (see Appendices A–C for more details), then sent this questionnaire to the chosen respondents to glean data and relevant information regarding the present research aims. The data were collected and stored in a well-organized way for ease of analysis. For the data analysis, descriptive statistics that employed the weighted-average method, together with inferential statistics, were performed to investigate and develop a profound understanding of the drivers and barriers to implementing CE in the ELV recycling system in India. A thematic analysis has also been carried out to interpret the interviews and group discussions. Figure 1 provides specific demographic information for the survey sample, while Table 2 illustrates the approach used to gather information and data.



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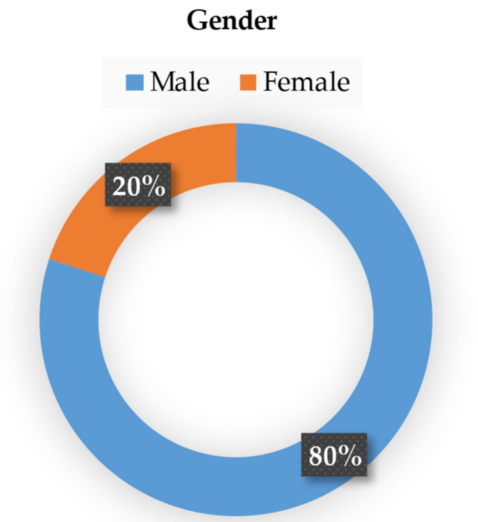

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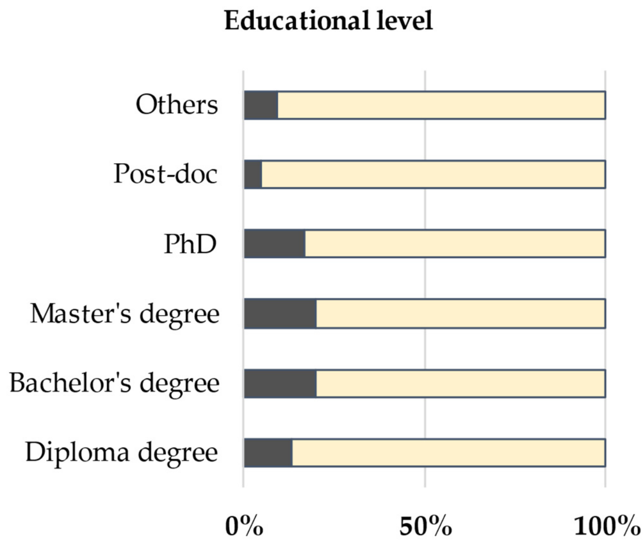

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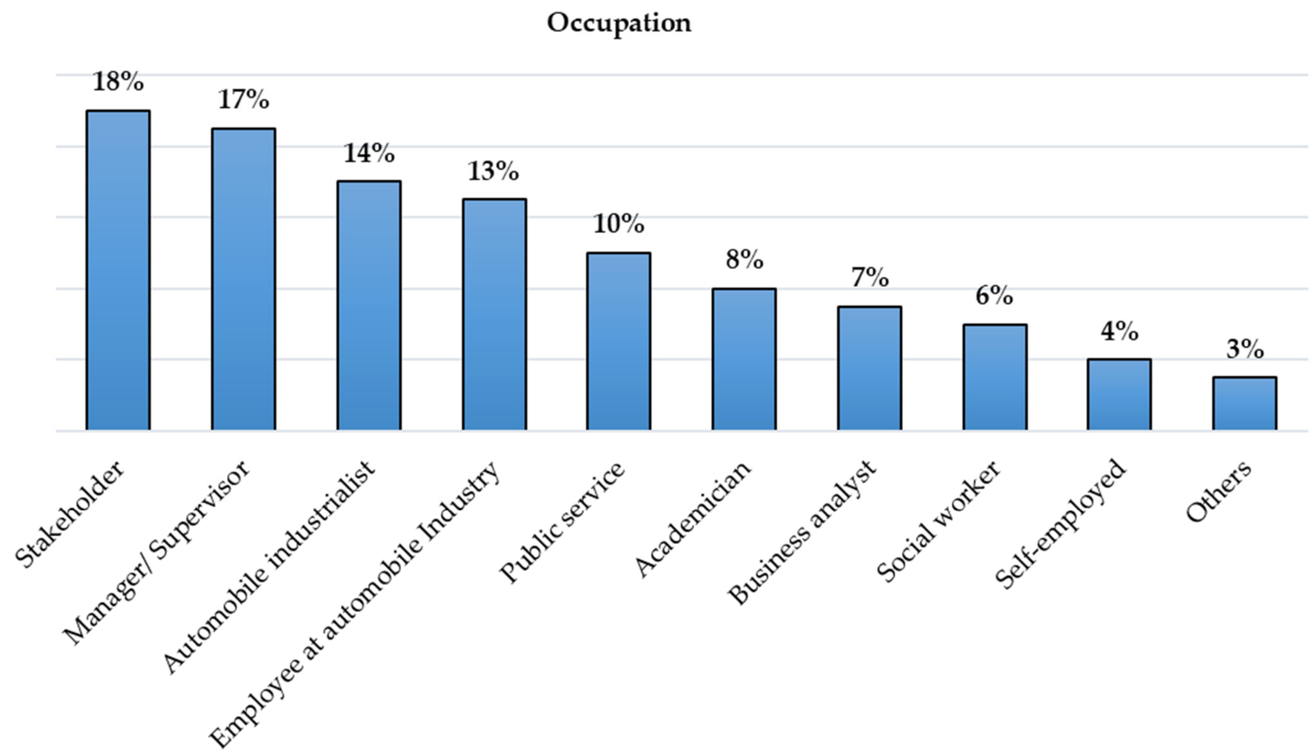

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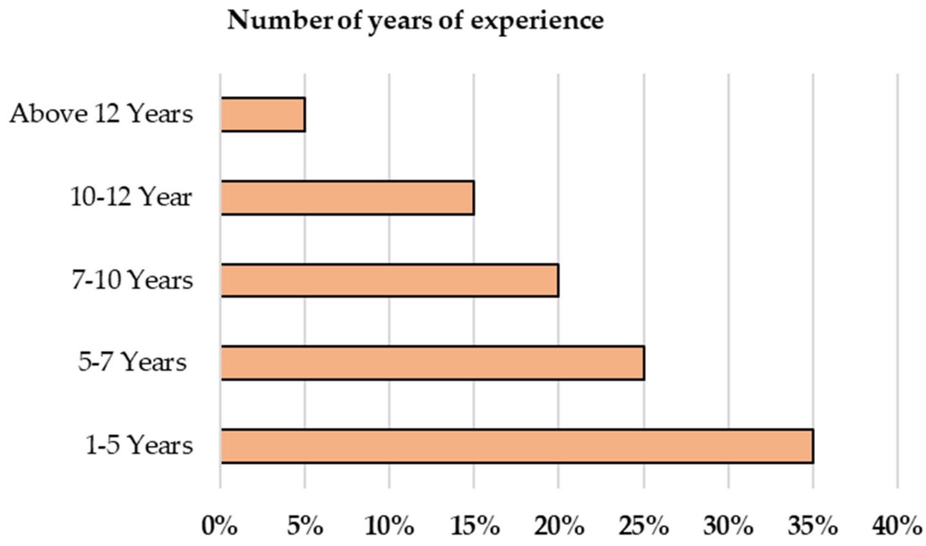

(**g**)

Figure 1. Demographic data for the survey sample: (**a**) interview composition; (**b**) income range; (**c**) age range; (**d**) gender; (**e**) educational level; (**f**) occupation; (**g**) stakeholders' number of years of experience in ELV recycling.

3.2. Data Collection

This study has employed certain methods for data collection. The data collection method for this research entailed interviews with structured questionnaires, focus group interviews, individual in-depth interviews, and field investigations. Table 2 provides details of the procedures for data collection. Figure 2 illustrates the overall methodology used in this research. Structured interviews have been performed by deploying questionnaires to obtain data and information from participants. A pilot test was performed before the actual data collection to assure the accuracy and precision of the data. Focus group interviews have been conducted to elicit general information about the practices, opinions, and aspirations of the stakeholders. Individual in-depth interviews and a two-way organized conversation have been carried out to gather information regarding the objective assessments of this study. Field investigation is instrumental, as it reveals the actual, precise, and authentic information and practice of the organization. This research has conducted field investigations to obtain information about current practices of enterprises, the new strategies the organization will implement, present market trends, raw-material availability, marketing methodologies, the application of existing technology, frameworks, infrastructure, guidelines, and direction.

3.3. Quantitative Research

This study adopts quantitative research methods to conduct objective measurements by sending out a carefully structured questionnaire to the selected survey participants. The survey questionnaire comprises three sections: impediments that thwart the implementation of the circular economy in India's ELV recycling sector, drivers toward the circular economy, and supplementary data for enhancing our in-depth understanding of the subject matter. The collected data were stored systematically. Descriptive statistics were employed to analyze the data. This research has applied the weighted-average method to quantify and analyze the data obtained from the sample. The qualitative data is instrumental in evaluating and identifying the critical factors regarding implementing the circular economy in India's ELV recycling sector and yields critical real-life data that is imperative for ensuring appropriate and effective decision-making and strategies [50].

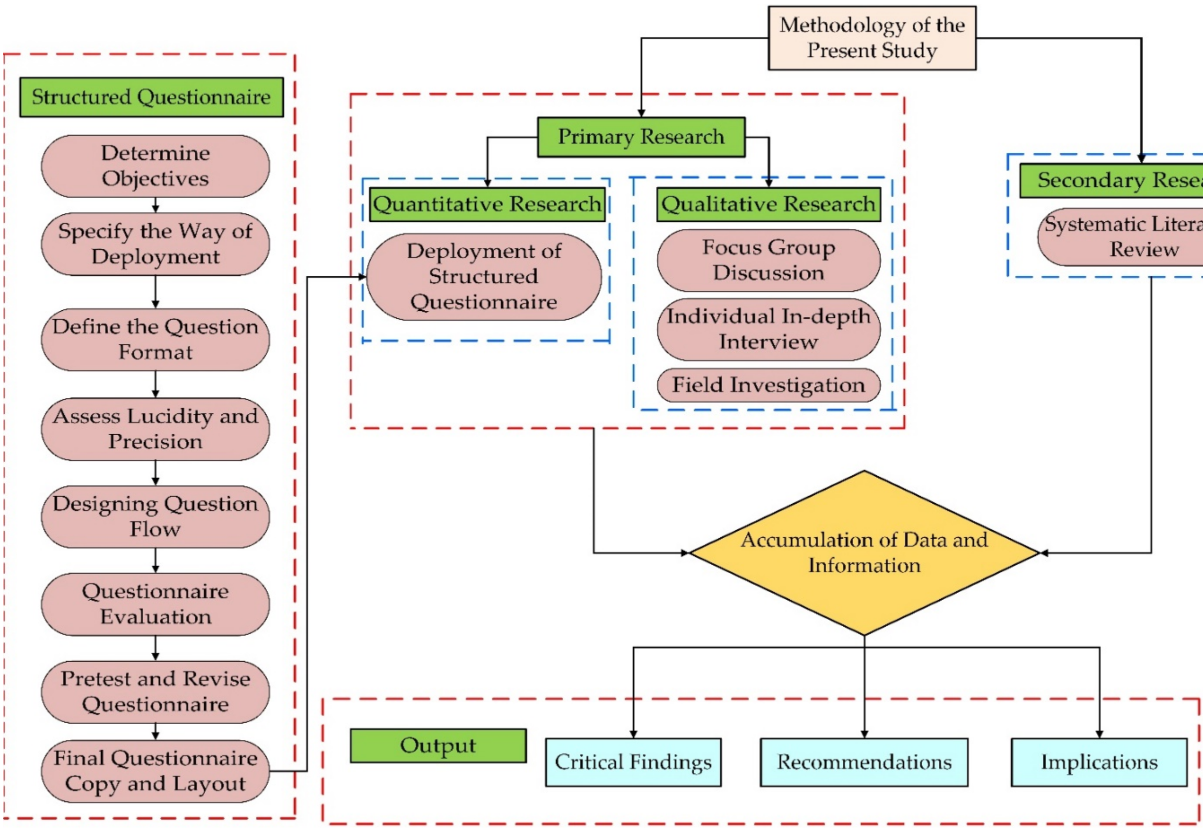

Figure 2. The overall methodology of this study.

3.4. Qualitative Research

This research employs the qualitative approach to investigate ELV recycling comprehensively. The qualitative analysis included focus-group interviews, individual in-depth interviews, and field investigations with survey participants to glean information and data regarding India's ELV recycling system. The authors performed a thematic analysis to interpret and analyze the interviews and group discussions. Focus-group interviews, together with personal interviews, revealed actual practices, whereas the field investigations provided crucial insights into the potential barriers and drivers to adopting the circular economy nationwide in the ELV recycling system in India [53,54].

3.5. Secondary Research

Secondary research is essential to this study's methodology and is a prerequisite step to collecting primary data [55]. This research has extensively explored the relevant literature to examine and evaluate the current landscape of available information on ELV recycling practices in India and gain insights into general industry trends. Secondary research yielded a robust foundation for this investigation and enabled the development of a comprehensive understanding of India's ELV recycling system from the circular economy perspective, and aided the research and sample design in this investigation. Secondary research assists in the interpretation of data collected from quantitative as well as qualitative research.

3.6. Data Analysis

Analyzing data to extract insights for rational decision-making is a crucial step of this investigation. Analyzing collected primary qualitative and quantitative data is a convoluted and arduous process. To examine and gain a thorough understanding of the factors that facilitate and impede the implementation of CE in India's ELV recycling system, descriptive statistics, which use the weighted-average method, along with inferential statistics have been employed to interpret and analyze the quantitative data obtained from the sample, while the interviews and group discussions have been interpreted using thematic analysis. This investigation employs sophisticated software to perform high-quality analysis. This study used Microsoft Excel and SPSS to analyze the quantitative data, while it employed ATLAS and Nvivo software to interpret the qualitative data.

4. Critical Findings and Analysis

This section reveals the critical findings and analyzes the results from the perspective of the research objectives.

4.1. Drivers That Enable CE implementation in India's ELV Recycling System

Figure 3 demonstrates the potential drivers for implementing CE in the ELV recycling system in India; among the identified potential drivers that facilitate the CE initiatives in the ELV recycling system in India, economic viability is the leading enabler for primary stakeholders involved in ELV recycling that is necessary for them to embrace and adopt the CE initiatives. In contrast, productivity and stability are the least significant drivers in India for adopting CE in the ELV recycling system. Drivers are classified into internal and external drivers, according to their characteristics [56].

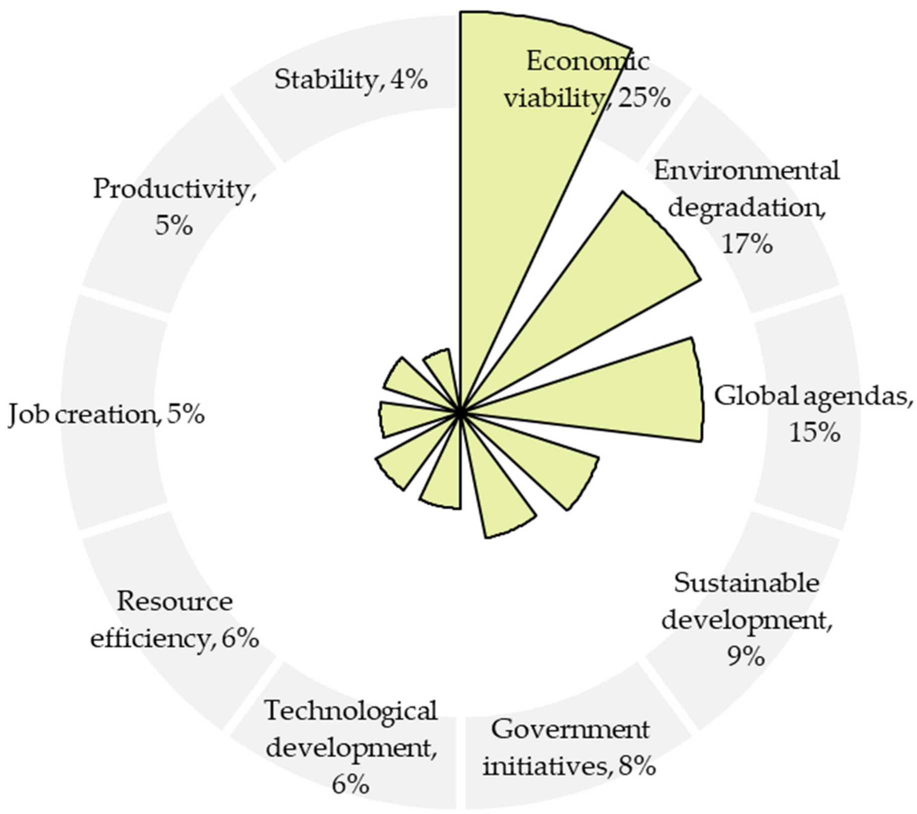

Figure 3. Drivers that enable CE implementation in India's ELV recycling system.

4.1.1. Internal Drivers

The internal potential drivers in implementing CE in the ELV recycling sector encompass various factors, from economic viability to productivity. These internal factors are elucidated in detail below.

Economic Viability

Figure 3 reveals the finding that several stakeholders favored embracing and implementing the CE in the pursuit of economic viability, gains in profit, and an approach to boosting the market share. This perspective is consistent and congruous with the observations reported in the current literature, as the central concept of CE is to recycle components in an environmentally friendly way to maximize economic gain and conserve natural resources [57]. Exactly one-quarter of the total responses from survey participants revealed that financial benefit is the more significant driver of implementing CE than improving the quality of the environment. Interacted stakeholders perceived CE as an approach to enhancing recycling and recovery rates from ELVs while preserving natural resources and safeguarding the environment. Respondents viewed the CE as an approach to developing closed-loop business systems that facilitate more significant economic gain while minimizing resource consumption. Hence, it is conspicuous that stakeholders have underscored the economic viability of adopting and implementing CE in the ELV recycling system in India.

Environmental Degradation

The interviewed respondents considered that concern for mitigating environmental degradation caused by the complex interaction of socio-economic, industrial, and technical activities is a crucial factor for adopting CE in India's ELV recycling system. The mitigation of environmental deterioration is the top priority of the United Nations' sustainable development goals and the primary objective of the CE concept [58,59]. Figure 3 clearly shows that the significant majority of survey participants (17%) perceive that implementing the CE in India's ELV recycling system is a pragmatic approach to handling ELVs and making the harmful waste generated from ELV dismantling operations more environmentally friendly. Therefore, it is significant that survey respondents have underlined the environmental degradation issue in terms of adopting and implementing CE in the ELV recycling system in India, which complies appropriately with the present literature and the country's sustainable development objectives [60].

Sustainable Development

Sustainable development is a roadmap for a better, more sustainable future for everyone on this planet, intertwined and inextricably linked with CE [61,62]. A significant number of survey respondents (9%) saw sustainable development as a potential driver in adopting and implementing CE in the ELV recycling system in India. The inappropriate handling of ELVs causes environmental degradation and generates a significant amount of harmful waste; hence, the sustainable handling of ELVs is of paramount importance [63]. Many stakeholders involved in ELV recycling have expressed a propensity toward adopting a sustainable development model to safeguard the environment, optimize the use of resources, and maximize materials recovery and recycling rates.

Technological Development

Technological development significantly impacts materials extraction rates from ELVs and reduces landfill waste [64]. India has witnessed phenomenal technological advancement, consequently becoming a technological hub worldwide. In total, 6% of survey respondents considered that technological progress is also a significant driver for adopting and implementing the CE in ELV recycling systems in India, as it enables higher materials recovery and recycling rates and, consequently, increases economic gain.

Resource Efficiency

Natural resources are declining dramatically; hence, optimum resource use is paramount. The core concept of the CE is the optimum use of resources [65]. The participants' responses revealed that a total of 6% of total survey respondents perceived that efficiently utilizing resources is a substantial driver for adopting and implementing the CE in India's ELV recycling sector, as it enables the sustainable use of the world's limited resources while respecting the environment.

Job Creation

Implementing the CE sustainably creates employment as it proposes a robust economic model by creating new markets and products. Of the total survey respondents, 5% considered that creating jobs is a crucial driver for implementing the CE in India's ELV recycling system, as the Indian authority has been endeavoring to create jobs for its youth.

Productivity

The traditional linear "take-make-dispose" strategy is prevalent in the ELV recycling sector in India, as it is in other developing countries. The CE provides a paradigm framework by operating via a closed-loop system to enhance productivity while respecting the environment [66,67]. In total, 5% of all respondents believed that the CE has the significant potential to improve the productivity of businesses and customers as it entails swiftly moving away from a reliance on natural resources toward recycling and repurposing resources after a product's life cycle is complete, through the existence of a practical framework and innovation. CE can also substantially mitigate the emissions from manufacturing and industrial hubs, which reduces the negative impact on the environment and enhances productivity.

Stability

CE involves sustainable production and consumption, which eventually cherishes and nurtures stability; the primary goal of CE is to create stability in the business arena. Of all the surveyed participants, 4% deemed that CE has tremendous potential to create stability by employing new business paradigms and technology and by mitigating pollution in the ELV recycling sector in India.

4.1.2. External Drivers

The ELV recycling industry has external drivers for implementing the CE, which extend from global agenda to government initiatives. Below, each of these external elements is addressed in greater depth.

Global Agenda

As the CE promotes the sustainable handling of waste and the safe use and conservation of natural resources, much more interest is being poured into the CE worldwide. International authorities are encouraging nations to adopt and implement the CE approach to enhance our planet's sustainable development, offering various incentives for promoting the CE. Overall, 15% of the survey respondents reported that global agenda for promoting sustainable development for the welfare of our future world play an imperative role in adopting and implementing the CE in ELV recycling in India.

Government Initiatives

A significant majority of the interviewed respondents (8%) considered that government initiatives inspired stakeholders involved in the ELV recycling system and also believed that initiatives from the authorities that encouraged adopting and implementing a CE in ELV recycling are significant and crucial. The Indian authorities have taken initial steps to promote and adopt the CE in different areas by enacting legislation and providing guidelines [68]. Even though many stakeholders perceive that the Indian government has taken a few rudimentary steps, these steps can lead to the swift adoption of the CE.

4.2. Barriers That Impede CE Implementation in India's ELV Recycling System

Figure 4 reveals the significant barriers that thwart CE implementation in India's ELV recycling system, as perceived by respondents. Like the potential drivers, the perceived barriers are split between internal and external impediments [69]. Among the identified significant barriers that hinder the CE's implementation in India's ELV recycling sector, limited technology is the leading impediment to embracing and adopting CE initiatives. In contrast, the lack of industrial collaboration and support is the least significant barrier to adopting a CE in India's ELV recycling sector.

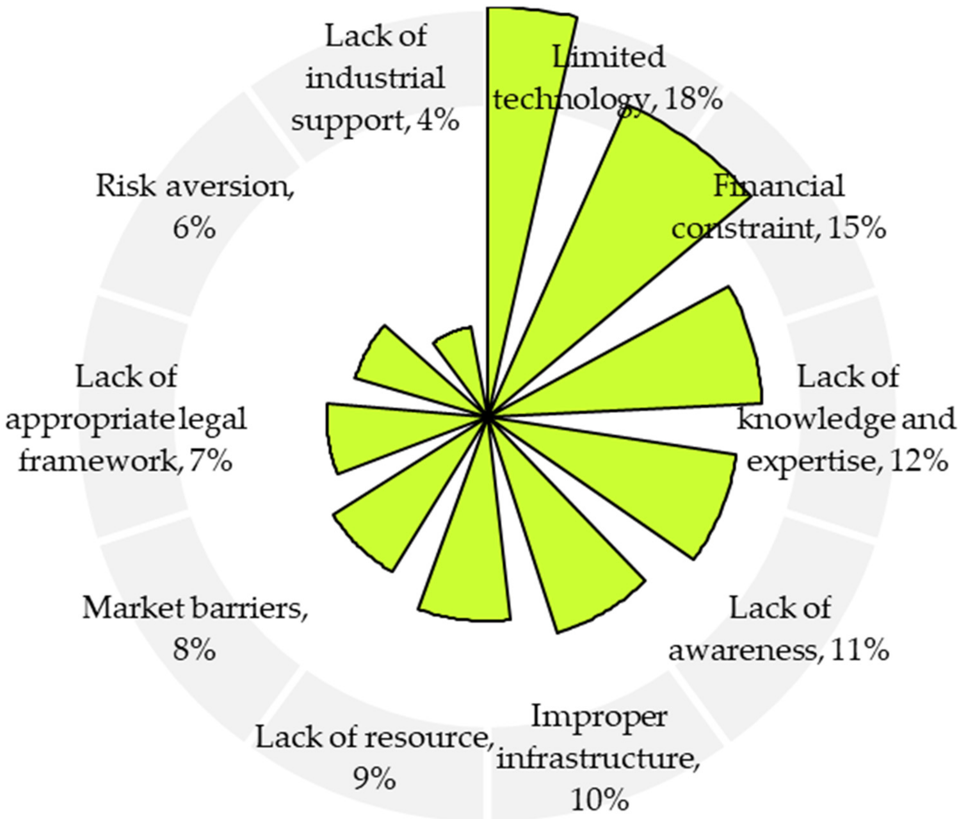

Figure 4. Barriers that impede CE implementation in India's ELV recycling system.

4.2.1. Internal Barriers

Internal potential barriers to implementing CE in the ELV recycling sector encompass a wide range of factors, from technological constraints to a lack of awareness. These internal factors are elucidated in detail below.

Limited Technology

Figure 4 reveals that significant respondents perceive limited technology as the primary hurdle for transitioning from linear to circular economy initiatives in India's ELV recycling sector. This prerequisite factor for adopting CE in India's ELV recycling sector is yet to meet. Overall, 18% of participants expressed concern regarding inadequate and poor technology, which consequently became the most significant obstacle to CE implementation in the ELV recycling sector in India. Our detailed interviews recorded stakeholders' aspirations in terms of the ELV recycling system, revealing that stakeholders expressed discontent with the lack of advanced technology, which prompts limited materials recovery and recycling rates. This perspective is consistent and harmonious with the observation reported in the present literature that poor technology is a prevalent cause for adopting a CE in developing and developed countries [70]. Stakeholders need and seek technological assistance from the government to enhance the recycling rate and sustain the business.

Financial Constraints

Figure 4 reveals that a substantial number of survey participants considered that at the initial stages of CE implementation, stakeholders involved in ELV recycling considered that the expenditure would be significantly increased as they would need to invest in making operations more sustainable. Overall, 15% of the respondents voiced concerns regarding economic constraints that can hinder the adoption of CE approaches in India's ELV recycling sector, which consequently became the second most significant obstacle to CE implementation. Our investigation revealed that stakeholders recognized that reconstructing and re-designing ordinary plants for sustainable operations requires substantial investment; most stakeholders are currently going through financial difficulties, especially after the COVID-19 pandemic. Hence, it is conspicuous that stakeholders have underscored the financial constraints for adopting and implementing a CE in the ELV recycling system in India. Recent research has emphasized how costs and economic conditions play a crucial role in impeding the adoption of CE projects as this is a common hindrance and prerequisite factor when implementing a CE [71,72].

Lack of Knowledge and Expertise

Figure 4 demonstrates that the lack of comprehensive knowledge and the relevant expertise for the transition from a linear to a circular economy is a significant setback for adopting the CE in the ELV recycling sector in India. The ELV recycling industry in India has yet to overcome this setback in adopting a CE. Overall, 12% of participants voiced their concern over the absence of thorough knowledge and the appropriate expertise to transition from a linear to a circular economy; consequently, this has emerged as one of the primary barriers to CE adoption in India's ELV recycling industry. Our thorough interviews documented the ambitions of stakeholders in the ELV recycling system, revealing that stakeholders expressed resentment at the lack of advanced expertise to enhance materials extraction rates, resulting in low rates of materials recovery and recycling. This viewpoint is in line with the observations reported in the current literature [53].

Lack of Awareness

A lack of awareness regarding the CE and its benefits is an obtrusive impediment to adopting the circular economy approach. The discussion about the CE is as yet confined to research works, and few attempts have been made for its implementation in real-world enterprises [73,74]. Figure 4 reveals that a significant number of respondents (11%) perceived that a lack of awareness and promotion regarding the CE is one of the primary obstacles that hinder the adoption of a CE in the ELV recycling sector in India. Our detailed interviews documented the aspirations and attitudes of stakeholders in the ELV recycling system, highlighting that significant stakeholders still have little knowledge and vague concepts about the CE approach and its benefits, especially regarding long-term viability. The Indian authorities have yet to promote and increase awareness at the ground level.

Improper Infrastructure

Proper and adequate infrastructure is paramount for adopting a CE approach, but the absence of an appropriate and proper infrastructure is prevalent in India's ELV recycling sector [75]. Overall, 10% of the interviewed respondents perceive inappropriate infrastructure as a primary impediment to embracing the CE in the ELV recycling sector and ranks fifth among all potential obstacles. The interviewed stakeholders stated that they were carrying out operations involved in ELV recycling without proper infrastructure, and no appropriate guidelines from authorities have been provided to them. Appropriate infrastructure is the foundation of modern civilization; hence, inappropriate infrastructure in the ELV recycling sector causes significant pollution, wastes resources, and endangers our planet [76].

Lack of Resource

Lack of resources is a perennial issue in the ELV recycling sector in India; it thwarts sustainability in ELV recycling and affects materials extraction rates. Contrary to the traditional materials and process flows in a linear economy, the CE separates economic output from the dwindling and limited resources of this planet and creates a resilient system that requires a closed chain of product flow. This requires a significant initial investment from stakeholders; such investments encompass human resources development, economic assets, sophisticated technologies, proper infrastructure, and industrial symbiosis and collaboration. Figure 4 reveals that overall, 9% of respondents believe that the lack of different resources is one of the primary impediments to transitioning from linear to circular economy initiatives in India's ELV recycling sector. During the detailed interviews, a substantial number of respondents stated, "We are striving to have viable resources to sustain our business in the long term; hence, effectively implementing the CE is an arduous task", whereas developed countries such as the US, Japan, and the EU have significant viable resources for adopting the CE in practice [4,77,78].

Market Barriers

The market demand and economic gains play an imperative role in adopting the CE in the ELV recycling sector in India. The demand for recycled components in the automobile market attracts substantial investment in ELV recycling industries [79]. A significant number of respondents perceived that the market for recycled components and remanufacturing parts for the automobile is a fledgling one, but this is still one of the primary hurdles for transitioning from linear to circular economy initiatives in India's ELV recycling sector. This prerequisite factor for adopting a CE in India's ELV recycling sector is yet to be met. Figure 4 shows that overall, 8% of interviewed participants expressed concern regarding the market for recycled products. During the detailed interviews with respondents, a substantial number of respondents said that "there is no market for recycled and remanufactured components near to us; we must go far when selling recovered and recycled products".

Risk Aversion

Many researchers are skeptical about the implementation of the CE in real-world business; they consider that the implementation of CE would be associated with risks and uncertainties as it is still in an embryonic stage [77,80]. Overall, a total of 6% of respondents believed that the CE is in an embryonic stage and requires significant time to fledge for real-world business applications. According to the interviewees, transitioning from the linear economy to the CE involves inherent uncertainties and great risks. In interviews, one of the stakeholders said, "We have to change all set-ups and business policies for adopting the CE approach, it involves extra investment and needs assistance and guidelines from authorities; hence, immediately, we would not adopt CE in our business until we get well-documented pieces of evidence."

4.2.2. External Barriers

External potential barriers to implementing CE in the ELV recycling sector are the lack of appropriate legal framework, industrial support, and collaboration. These external factors are elucidated in detail below.

Lack of Appropriate Legal Framework

The lack of an appropriate legal framework is a perennial issue in the ELV recycling sector in India, one that thwarts sustainability in ELV recycling and affects materials extraction rates. Informal ELV recycling centers predominate in India's ELV recycling sector; their operation does not comply with any standard guidelines, and economic gains drive only their business; a lack of framework is prevalent in ELV recycling industries [23]. CE creates a viable and robust pioneering financial system, which may require a closed loop of product flow that necessitates an appropriate legal framework [81–83]. Figure 4 reveals that overall, 7% of respondents perceived that the lack of an appropriate legal framework impeded transitioning from linear to CE initiatives in India's ELV recycling sector. During the interview, respondents stated, "The lack of an appropriate legal framework is strangling sustainability and making it more challenging to implement CE in the ELV recycling sector in India."

Lack of Industrial Support

Industrial cooperation is imperative for adopting the CE in the ELV recycling sector in India. The lack of collaboration between ELV recycling and the parent automobile manufacturing industries is prominent. Figure 4 demonstrates that, overall, 4% of respondents believed that the lack of industrial support and collaboration hindered transitioning from linear to CE initiatives in India's ELV recycling sector. The interviews revealed that respondents expressed resentment for not receiving any assistance from the parent automobile manufacturing industry. The lack of collaboration between the ELV recycling industry and the parent automobile manufacturing industry made the implementation of the CE more strenuous and cumbersome.

5. Discussions and Managerial Implications

As the circular economy offers numerous benefits to society according to different aspects that yield opportunities to ameliorate the environmental quality, secure the raw materials supply, bolster economic growth, and reduce the application of non-renewable resources; hence, in developed countries, such as the European Union (EU), Japan, China, and the USA, the authorities have taken several initiatives to adopt and advance the CE approach, and the enterprises and stakeholders are also firmly committed to implementing and enhancing CE initiatives [5,7,41,58,63]. Nonetheless, in India, many stakeholders have expressed a keen inclination toward adopting the CE, but they are not well-equipped to do so as yet [23,68].

This research determines and yields a critical, insightful interpretation of the potential drivers and barriers to implementing the CE in the ELV recycling sector in India, which may be instrumental in developing a subsequent legislative policy and framework to expedite the transition from the linear economy to the CE. This paper has determined ten potential drivers; out of all the potential drivers identified, economic viability is the prime factor in persuading and encouraging the principal stakeholders in the ELV recycling sector in India to embrace and implement CE initiatives. The primary stakeholders and enterprises have expressed their concerns regarding environmental degradation, which is a crucial aspect of their corporate value; environmental degradation, along with other significant factors, including global agenda, sustainable development, government initiatives, technological development, and resource efficiency, urges the top management of several industries to adopt and implement the CE approach. Conversely, productivity and stability are the least important factors that influence the implementation of CE initiatives in the ELV recycling sector in India. These findings are consistent with contemporary research [50,62,65,72].

However, this research also sheds light on the significant barriers that thwart CE implementation in India in the form of an ELV recycling system. Several ELV recyclers are withdrawing from adopting and implementing the CE in their business because of limited technology [84]. ELV recyclers should upgrade their technology to enhance material recycling and recovery rates. Financial constraints have emerged as a prominent hindrance; the CE operates on a closed-loop system that requires significant investment to develop the system for implementing a CE. The Indian authorities can offer financial aid to the primary stakeholders to adopt and implement the CE approach. The lack of knowledge and expertise of key stakeholders regarding the CE approach impedes the implementation of CE in the business, although the authorities have been showing great interest. Numerous ELV recyclers are unaware of and oblivious to the CE approach; this lack of awareness is thwarting the implementation of the CE in the ELV recycling sector in India [49,85]. The Indian authorities need to initiate a campaign to enhance awareness and knowledge regarding CE. This program may be conducive to implementing the CE initiative in the ELV recycling sector in India.

The present study's findings reveal that the majority of obstacles as well as enablers for implementing CE initiatives in the ELV recycling sector in India comprise internal rather than external factors. As these internal factors are instrumental, the ELV recyclers should take into account all the primary internal factors that thwart the transition from the linear economy to the CE. The enterprise can control and resolve internal obstacles by modifying its mission, vision, operations, and performance, whereas the government should control the requisite external factors to facilitate the implementation of the CE in India's ELV recycling sector.

6. Recommendations

This research has made a few practical recommendations for implementing and enhancing the CE initiatives in the ELV recycling sector in India; the recommendations can be organized into five themes, as below.

6.1. Development of an Appropriate Framework for the CE

Implementing the CE in India's ELV recycling sector requires a practical framework to meet the CE's goals and enhance the CE initiatives. With the application of information and communication technologies, an innovative framework needs to be developed to enhance sustainability and facilitate the implementation of a CE [86,87]. That framework appropriately encompasses the development of concepts and key terminology, setting targets, identifying indicators to assess enhancements toward the goals, designing a proper methodology, data collection and analysis, enhancing materials recovery, and protecting the environment. The lack of an appropriate framework can thwart the enhancement of CE initiatives and sustainability in ELV recycling. Therefore, the government of India should develop a "common reference framework" for all stakeholders to achieve set goals, evaluate progress, monitor the materials recycling and recovery rate, identify the waste, and eventually monitor and assess the environmental impact.

6.2. Waste Prevention and Using Waste as a Resource

One of the primary aspects of the CE initiative is to emphasize resource recovery from waste through recycling, but the authority should underscore waste prevention. The administration may enact the policy to reduce waste through actions that entail monitoring and data collection, promoting public awareness, and enhancing technology, while respecting the environment. The authorities may revise the policy for the age of obsolescence of vehicles and develop proper guidelines regarding ELVs. The management should perform a cost-benefit analysis of waste to understand the better values that can be extracted from waste. Switching focus from waste to resource management is imperative for extracting higher values from waste or ELVs. This transition can be facilitated by enacting policies, such as prohibiting dumping sites and landfills, the mandatory deregistration of vehicles, nurturing extended producer responsibility (EPR), enhancing the recycling rate, developing a market for recycled and remanufactured components, and promoting sustainability in ELV recycling.

6.3. Foster Excellent Governance

The absence of appropriate regulations that can adequately govern India's ELV recycling sector is prevalent, and India's ELV recycling sector is dominated by the informal sector, which hinders the sustainability of the ELV recycling sector, whereas developed countries, such as Japan, the EU, China, and the USA, have already introduced legislation regarding waste and ELVs and have issued proper guidelines to stakeholders. The Indian authorities should urgently introduce the relevant legislation to govern the ELV recycling sector toward sustainability. Implementing the policy will enhance the CE initiatives by promoting and sharing best practices, enhancing responsible consumption, and extracting higher values from ELVs.

6.4. Taxation and Subsidies

Taxation and subsidies are instrumental in achieving higher resource recovery efficiency and in sustainably disposing of hazardous substances. The tax will prompt the vehicle owner to embrace more sustainable practices, whereas incentives will encourage the vehicle owner to dispose of the vehicle in a sustainable and environmentally friendly way and urge stakeholders to adopt the CE approach. Overall, tax and subsidies are conducive to implementing the CE in the ELV recycling sector in India.

6.5. Assist the Business Sector

The CE operates on a closed-loop system; hence, transforming the business from a linear economy to a CE necessitated a significant change in the operating system; the ELV recycler needs financial aid from the authorities to upgrade the instrument. Besides financial assistance, ELV stakeholders require information about best practices and guidelines from the authorities. Collaboration between the vehicle manufacturer and the ELV recycler significantly impacts materials extraction and recovery. Therefore, the Indian government should take the initiative of collaboration between vehicle manufacturers and ELV recyclers as a crucial step to meeting resource recovery objectives in support of the CE.

7. Research Limitations

This research has certain potential limitations.

- This study has focused exclusively on the ELV recycling sector in India; hence, the implications of the present research findings may be limited to the Indian subcontinent.
- This research has selected five prominent automobile hubs, namely, Kolkata, Chennai, Mumbai, Delhi, and Jamshedpur, to determine the potential drivers and barriers to CE implementation in India's ELV recycling sector. By including more automobile sectors throughout India, this research could have provided more accurate outcomes.
- This study has interviewed a total of 560 selected respondents to perform objective measurements; a larger sample size might have yielded more precise findings.
- A literature review is essential for developing the foundation of any research; very little research has been performed about the drivers and barriers to implementing the CE in ELV recycling in India. The lack of contemporary literature in this research area might have made the selection of drivers and barriers a little harder and more limited.

8. Future Prospects and Suggestions

Based on the current literature review and the potential limitations of this research, this study suggests certain proposals for future study to advance the CE initiatives and facilitate the adoption and implementation of the CE.

- This study has identified the drivers and barriers to implementing the CE in the ELV recycling sector in India. However, the co-relationship between drivers and obstacles, as well as the impact of these drivers and barriers to sustainability from Indian market perspectives, require further investigation.
- The drivers and barriers to implementing the CE alter significantly depending on the country in question. The development of a better understanding of the nature of the drivers and barriers to implementing the CE and their impacts on sustainability in different countries, especially between developed and developing countries, prompts further exploration.
- The lack of an appropriate framework thwarts the achievement of sustainability in the ELV recycling sector. A sustainable, multi-faceted framework blending the CE and the Internet of Things (IoT) for the ELV recycling sector needs to be developed to facilitate sustainable development.
- Limited technology is a perennial issue that constrains the material recycling and recovery rates from ELVs. Advanced technology is required to maximize material recycling and recovery rates and meet sustainability goals. Hence, further study is necessary to address technological issues to expedite sustainable development.
- Designing an appropriate value chain for ELV recycling is imperative for adopting and implementing CE initiatives. The vehicle manufacturers and ELV recyclers are operating on different value chains, which is a primary hindrance to implementing CE initiatives in the ELV recycling sector and needs further exploration.

9. Conclusions

The CE yields a regenerative mechanism that replaces the end-of-life concept with restoration. India's end-of-life vehicle (ELV) recycling sector is encountering several challenges in implementing the CE initiatives, despite numerous benefits offered by the CE from a triple-bottom-line perspective. The literature reveals that limited research has been performed to explore the potential drivers and barriers to CE implementation in developing countries. Therefore, this study has made attempts to investigate the potential drivers and barriers to implementing the circular economy in the end-of-life vehicle recycling industry, to promote the sustainability of the ELV recycling sector in India by employing an explorative approach that encompasses qualitative, quantitative, and secondary research. The findings of this research reveal that economic viability, environmental degradation, global agenda, and sustainable development are the prime drivers that encourage enterprises to adopt and implement the CE initiative, while limited technology, financial constraints, a lack of knowledge and expertise, and a lack of awareness are the primary impediments hindering enterprises from adopting and implementing the CE initiative. This study provides a critical and insightful interpretation of the potential drivers and obstacles for the stakeholders and top management of the enterprises, which can be crucial in developing a subsequent policy, strategy, and framework to expedite the transition from the linear economy to a CE. Moreover, based on these observations, this research has offered certain insightful recommendations for implementing and enhancing CE initiatives in the ELV recycling sector in India.

These research findings reflect stakeholders' perceptions and aspirations regarding the ELV recycling system. Therefore, besides advancing the understanding of opportunities and threats for implementing the CE and raising awareness about the CE, this investigation may assist the Indian authorities in devising appropriate policies and strategies and developing a regulatory and legal framework conducive to the CE and sustainability. The outcomes of this study may inspire ELV enterprises, as well as other industries, to adopt the CE paradigm as it offers a resilient system of economy that generates substantial economic benefits while respecting the environment. India's ELV recycling sector is dominated by informality, driven by financial gain only, regardless of environmental quality; this research may lead to a change in the attitudes of informal enterprises as a CE offers sustainability as well as profitability.

This research has delved into India's ELV recycling sector exclusively; hence, further investigation may emphasize the findings' relevance to other large-scale as well as small and medium enterprises (SMEs). This study focuses solely on India's ELV recycling industry, and the implications of the findings may be limited to the Indian subcontinent.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su142013084/s1. Supplementary data: Survey and demographic data of this study.

Author Contributions: Each author's contributions are listed as follows: conceptualization, A.H.M. and Z.H.; methodology, A.H.M.; software, A.H.M. and H.S.; validation, A.H.M. and H.S.; formal analysis, A.H.M.; investigation, A.H.M.; resources, Z.H. and A.H.M.; data curation, A.H.M.; writing—original draft preparation, A.H.M. and H.S.; writing—review and editing, Z.H., M.N.A.R. and H.H.; visualization, A.H.M. and H.S.; supervision, Z.H., M.N.A.R. and H.H.; project administration, Z.H.; funding acquisition, Z.H. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Transdisciplinary Research Grant Scheme TRGS/1/2020/UKM/02/1/1 and UKM internal grant GUP-2018-012.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available in this published article and Supplementary Material.

Conflicts of Interest: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Primary Survey Questions

1. What are the drivers that could enable circular economy implementation for the end-of-life vehicle recycling sector in India?
    (a) Economic viability
    (b) Environmental degradation
    (c) Global agenda
    (d) Sustainable development
    (e) Government initiatives
    (f) Technological development
    (g) Resource efficiency
    (h) Job creation
    (i) Productivity
    (j) Stability.
2. What are the barriers that could hinder circular economy implementation for the end-of-life vehicle recycling sector in India?
    (a) Limited technology
    (b) Financial constraint
    (c) Lack of knowledge and expertise
    (d) Lack of awareness
    (e) Improper infrastructure
    (f) Lack of resource
    (g) Market barriers
    (h) Lack of appropriate legal framework
    (i) Risk aversion
    (j) Lack of industrial support.

Appendix B. Interview Questions

1. Do you have any idea about sustainability?
2. Do you have any idea about the circular economy?
3. Do you know about end-of-life vehicle (ELV) recycling?
4. Has the ELV recycling business expanded or shrunk in the last ten years?
5. Have you upgraded the types of equipment to enhance the recycling rate from ELV?
6. Is there any supporting industry for raw materials nearby you?
7. Do you know that ELV dismantling causes environmental problems?
8. Do you follow proper guidelines for disposing of hazardous waste?
9. Have you been getting any government subsidies?
10. What types of assistance do you want from the government?

Appendix C. Demographic Questions

1. What is your gender?
2. What is your age?
3. To which Indian state do you belong?
4. What is your education level?
5. What is your occupation?
6. What is your income range?
7. Do you own a vehicle?
8. How long have you (stakeholders) been involved in the ELV recycling sector?

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