International Information and Engineering Technology Association
Advancing the World of Information and Engineering

Study of Public Perception Toward End-of-Life Vehicles (ELV) Management in Indonesia

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ABSTRACT

An ELV is a vehicle that has reached the end of its service life or service due to age or because it is unable to be used due to a catastrophic accident and high repair costs. The current methods of destroying ELV vehicles are unregistered, disassembly, destruction, and disassembly. Each procedure must adhere to predetermined guidelines. The purpose of this study is to conduct a survey of dietary knowledge about end-of-life vehicles (ELVs) in Indonesia. As a result, the purpose of this research is to learn about ELV laws and their implementation in countries that have done so successfully, as well as to learn about public perception of ELV application in Indonesia. A literature search of ELV laws in neighboring countries was conducted, as well as a survey of 98 respondents in Jakarta, Bogor, Depok, Tangerang, and Bekasi. SPSS was used to analyze the survey results. The questions in this study were divided into four sections: respondents' backgrounds; knowledge of ELV; concerns about ELV; and ELV campaigns. The findings revealed that public awareness of the use of ELV was quite low. In general, it can be concluded that the application of ELV in Indonesia needs to be carefully studied before it is implemented in order for it to be accepted by the public. Additionally, more ELV-related campaigns are required to increase the knowledge and awareness of the Indonesian people.
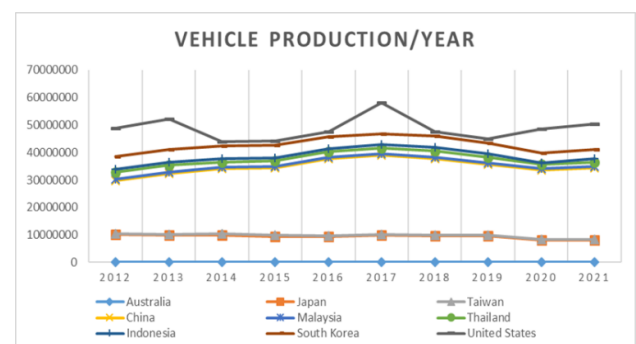
1. INTRODUCTION

According to Gardner et al. [1], Indonesia is the country with the highest per capita vehicle ownership in Southeast Asia. This means that most Indonesians have private vehicles like cars and motorcycles. Among them, motorcycles are the most preferred vehicles; this is characterized by motorcycles being considered more comfortable to use. However, this does not make the number of vehicles in Indonesia any less.

Although vehicle sales in Indonesia are slowly increasing, the country has more vehicle sales than Malaysia. According to the Organization Internationale des Constructeurs d'Automobiles (OICA), which tracks car manufacturing and sales worldwide, Indonesia ranked fourth in total automotive sales from 2012 to 2021 (see Figure 1). This demonstrates that Indonesia has the most advanced automobile industry in ASEAN.

The massive growth of Indonesia's automobile sector has offered numerous benefits to the country's economic growth. However, the beneficial influence of the automotive sector's rapid growth in Indonesia has directly increased the number of end-of-life vehicles. The impact of ELV on health is terrible. Kaminska [2], in her paper, explained that ELV waste contributes to human carcinogenic toxicity; this affects refraction and forms fine particles that can interfere with the lungs. ELV can also have an impact on water quality because

of the oil waste, coolant, and gear oil that are disposed of in place [3, 4].

Figure 1. Automobile production in the selecting countries country in the world

Implementing good ELV management to create a healthy environment, and being able to make the automotive sector better, is not always well-received [5-7]. In developing countries such as Indonesia, where most people prefer to use old or used vehicles for financial reasons, it is a significant obstacle to implementing ELV policies [8]. Low awareness of the environment is also a significant factor in the government's difficulty in making policies related to ELV management [9].
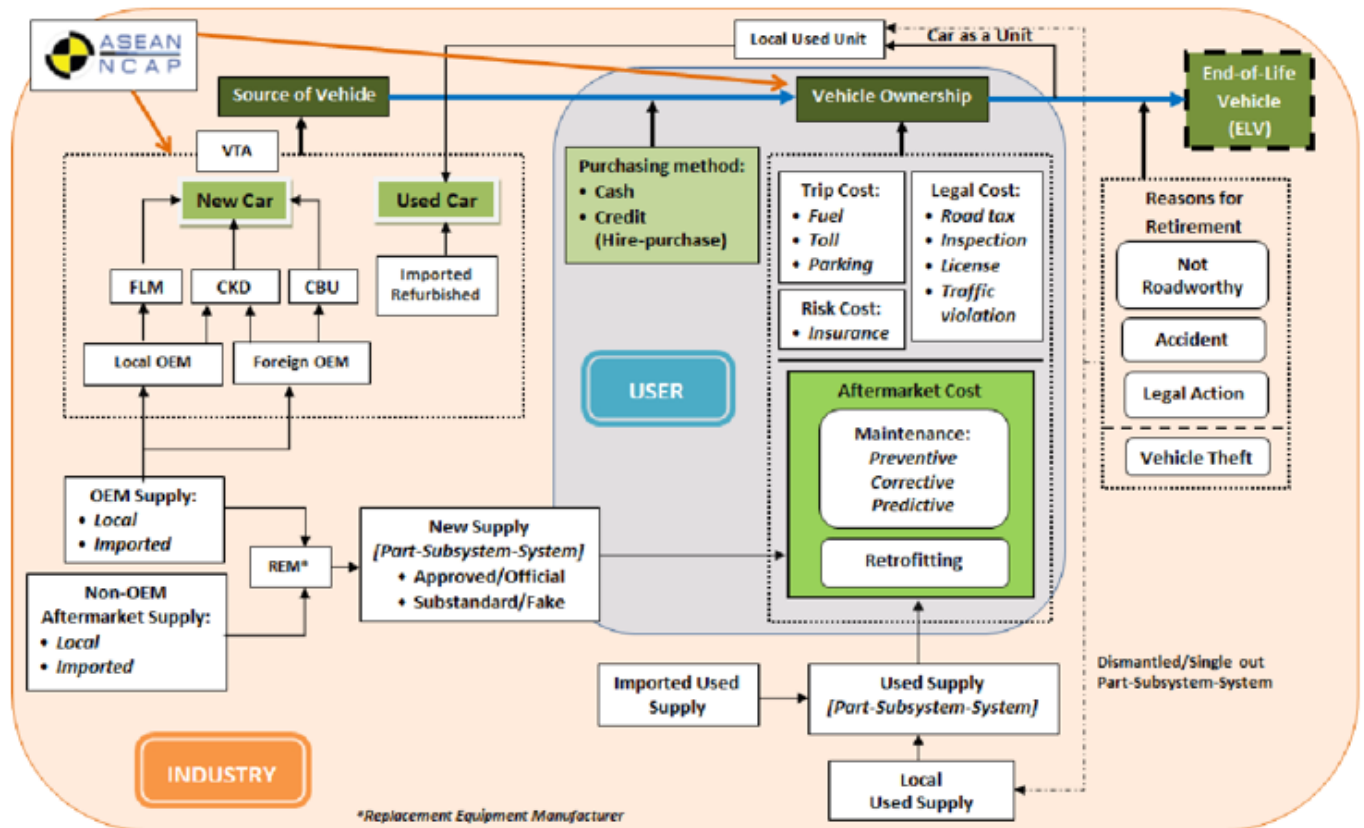
Figure 2. The automotive ecosystem

The ELV Policy was introduced for the first time by the European Union (EU) in September 2000 [10]. In Asia, Japan, Korea, and Taiwan have successfully implemented ELV policies to reduce the number of idle vehicles [11-14]. Nevertheless, it is unfortunate that the End-of-Life Vehicles approach was not yet implemented when the number of vehicles was increased from time to time, so the automotive ecosystem is unhealthy in Indonesia (Figure 2). Rather than applying the ELV process, the unused vehicles (old and/or broken vehicles) and unrepaired vehicles (due to financial issues) were left on the street [15].

Indonesia once wanted to implement vehicle emissions test regulations under Law 210 (1) No.22 of 2009 to reduce the number of vehicles that are not suitable for use. Still, this regulation was again revoked because of high public rejection by the public. The failure of emission test regulations in Indonesia has affected the high number of vehicles classified as ELV still used in Indonesia.

The purpose of this paper is to examine the public perception of End-of-Life Vehicles (ELVs) management in Indonesia, as well as to investigate public awareness and awareness of ELVs in Indonesia. The study was conducted in Jakarta, Bogor, Depok, Tangerang, and Bekasi (JABODETABEK) in Indonesia. A set of questions was designed to investigate respondents' background, knowledge of ELV, concerns about ELV, and ELV campaigns.

2. LITERATURE REVIEW

The end-of-life vehicle (ELV) procedure and the environmental impact of disposing of the resulting residue are global concerns. The environmental effects of ELV will grow in tandem with the advancement of the automotive sector [16,

17]. When abandoned vehicles began to cause considerable problems in European countries (EU), automobile recycling began to gain traction, and this problem was remedied when the crusher machine was built [18-20]. This equipment is used to smash the vehicle's hulk in order to retrieve the metal content.

Figure 3 summarizes the stages involved in the treatment of ELVs. The treatment processes begin with the depollution stage, which removes working fluids (e.g., engine oil) from an ELV, as shown in Figure 3. Following that, the ELV is routed through dismantling processes that remove any marketable pieces. The crushed vehicle hulk is then transported to a metal shredding factory, where metallic and nonmetallic ELV materials are separated [21].

ASR (automobile shredder residues) or 'fluff' is the residue produced by the shredding procedures of 'Aeraulic separator' and 'Eddy current separator' in Figure 1. ASR is defined as a primarily nonmetallic material that remains after ferrous and nonferrous metals are separated from shredder output (DTSC, 2014). Shredded foam, fabric, plastics, rubber, tires, glass, wood, accidental sediment and debris, and other nonmetallic components make up the majority of ASR. Table 1 depicts the typical ASR composition [22].

Table 1. Average composition of ASR [22]

| Material Type	Average composition (% weigh)
Plastics	35-55
Rubber	10-20
Metals	6-13
Textiles	7-15
Fines (paint, glass, sand)	10-20

To date, a variety of treatment programs have been applied

at the global level to recover nonmetallic elements from ELVs. Table 2 lists these therapeutic procedures, which are also referred to as 'ELV reclamation possibilities' in the current study [24-31]. These choices are classified as 'pre-shredding' ELV reclamation options (e.g., Option 3) and 'post-shredding' ELV reclamation options (e.g., Option 4) (e.g., Option 6) [23-27].

Countries that use ELV often have their own set of laws and regulations [27-29]. Each country can be considered to have the same recycling flow but with different techniques employed in the ELV process. Table 3 illustrates the countries that have enacted ELV recycling legislation, with most of the legislation enacted in response to earlier difficulties. Some concerns stem from an increase in abandoned automobiles, which causes a lack of ultimate disposal sites, illicit dumping, and environmental degradation. There are fees that must be incurred in order for ELV recycling to be implemented [32-35]. These parties are accountable for the costs in their respective nations; for example, in the EU, automotive producers and importers handle the charges. In some countries, the user handles the recycling cost [36, 37].

Table 2. International best treatment practice for recovery of nom-metallic materials of ELVs

Option	ElV's recovery options	References
Option 1	Deep ELV dismantling for the collection and reuse of non-metallic parts	(Kim et al. [26], Vermeulen et al. [25])
Option 2	Remanufacturing of non-metallic parts of ELVs	(Xiang and Ming [28], Gerrard and Kandlikar [24])
Option 3	Use of ELV plastics as reducing agents in blast furnaces	(GHK/Bios [29])
Option 4	Use of treated ASR as construction aggregate or other construction products	(European Parliement [30])
Option 5	Thermal treatment of ASR and its co-incineration with other waste streams	(US EPA [30], Vermeulen et al. [25])
Option 6	Thermo-chemical treatment of ASR (pyrolysis, and gasification)	(Jody et al. [24], Vigano et al. [31])
Option 7	Mechanical-physical separation of ASR to recover its materials	(Jody et al. [24], GHK/Bios [29])
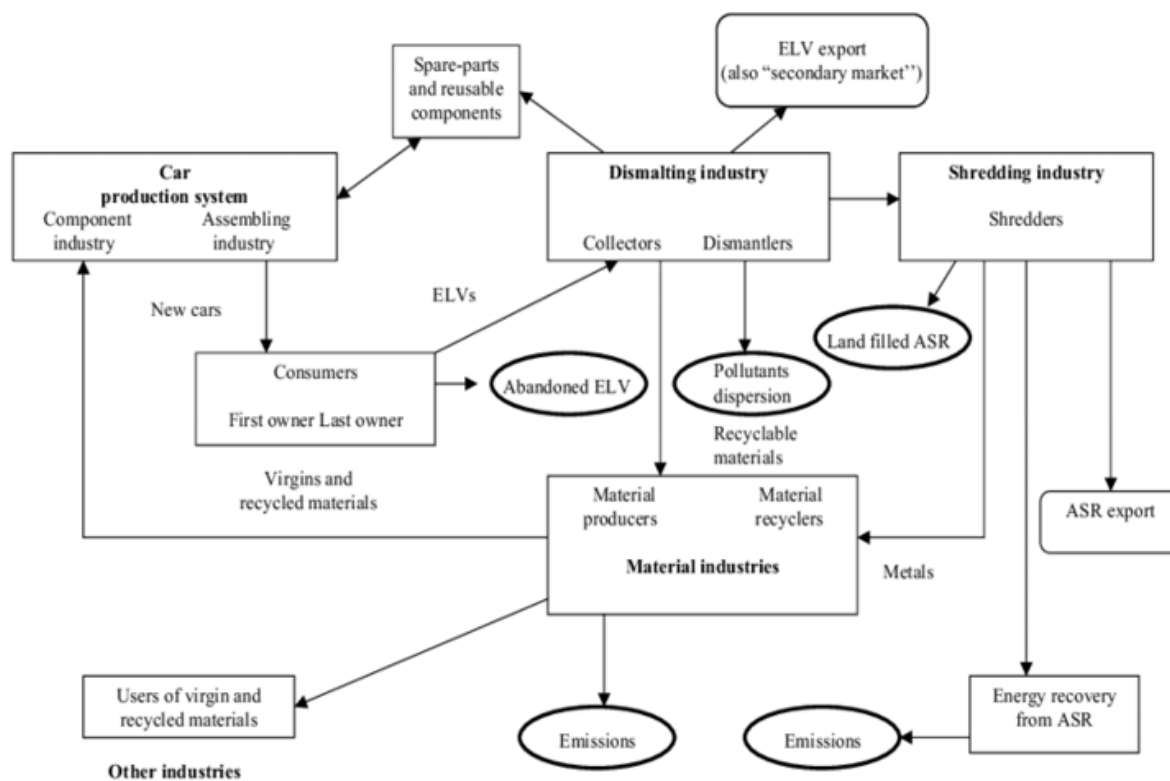
Figure 3. Processes involved in the treatment of ELVs [21]

Table 3. ELV systems in other countries (Vermeulen et al. [26])

	ELV Management system	Background of the management system	Parties responsible for recycling cost
EU	Law directive 2000/53/EC of the European Parliament and of The Council of 18 September 2000 on end-of-life vehicles (enforced in 2000)	Measure for increasing ASR. Measure for abandoned automobiles Environmental. Measures of dismantling sites	Automobile manufacturers and importers (if the recycling incurs a cost) finally users
Japan	Law for the Recycling of End-of-Life Vehicles (enforced in 2005)	Lack of financial disposal sites. Illegal dumping of ASR. Effective use of resources	Users
Korea	Law Act for Resource Recycling of Electrical/Electronic Equipment and Vehicle (enforced in 2008)	Measures for ELVs Effective use of resources. Management of information in ELVs	Automobile manufacturers and importers (if the recycling incurs a cost) finally users
China	Law End-of-Life Vehicle Recycling Regulation (enforce in 2001), Automotive Products Recycling technology policy (declared in February 2006)	Measures for illegal assembly, Effective use of resources, Measures for recycling economy	No regulation (traded as a valuable secondary resource)

3. METHOD

The purpose of this research is to investigate the public's awareness and understanding of ELV. This research is being conducted through the use of a survey questionnaire. The question is formatted as a closed-ended question. Respondents in this study were people aged 18 years or older and lived in the Jakarta, Bogor, Depok, Tangerang, and Bekasi (JABODETABEK) areas in Indonesia.

The questionnaire is divided into four sections. Part A discusses respondents' backgrounds, Part B discusses respondents' knowledge of ELV; Part C discusses respondents' concerns about ELV; and Part D discusses campaigns. Prior to the distribution of this set of questions The Cronbach's alpha test was used to assess the questionnaire's reliability among serious respondents. Based on these findings, the alpha coefficient for the questionnaire is 0.897. As a result, this question tool is classified as valid and can be used in this study. Furthermore, this questionnaire is distributed in two ways: first, the question device is entered into a Google form and shared via a communication app; second, a hard copy is also sent to the respondent.

The approach used in this study is a cross-sectional study with data collected in the field using online and offline survey methods. Percentage-shaped data was used to analyze respondents' background characteristics, ELV awareness, ELV concerns, and ELV campaigns.
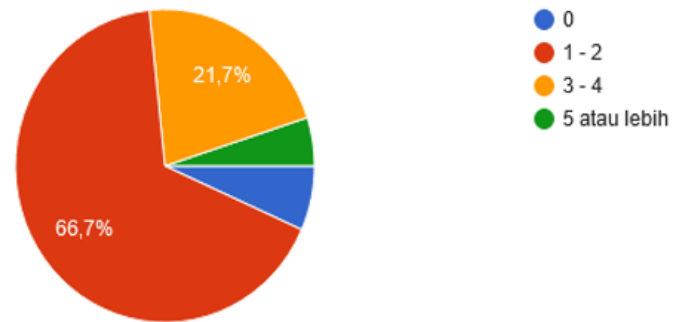
4. RESULT

Table 4. Result of the respondent's background

| Respondent Background	Total	Percent
Gender		
Male	71	72.45%
Female	27	27.55%
Age		
18-20 Years Old	4	4.10%
21-30 Years Old	14	14.30%
31-40 Years Old	25	25.50%
41-50 Years Old	10	10.20%
51-60 Years Old	36	36.70%
61 Years Old	9	9.20%
Working sector		
Civil Servant	48	48.98%
Permanent private employee	29	29.59%
Contract private employee	8	8.16%
Entrepreneur	13	13.27%
Income IDR		
< 2.500.000	14	14.30%
2.501.000 - 3.500.000	6	6.10%
3.501.000 - 4.500.000	7	7.10%
4.501.000 - 5.500.000	5	5.10%
5.501.000 - 6.500.000	2	2.10%
6.501.000 - 7.500.000	0	
7.501.000 - 8.500.000	5	5.10%
8.501.000 - 9.500.000	7	7.10%
9.501.000 - 10.500.000	7	7.10%
> 10.501.000	43	43.90%
Educational Level		
Senior High School	10	8.10%
Bachelor	28	28.60%
Post-graduate	60	61.20%

The first part of the questionnaire was analyzed to get the demographic background of the respondents. The majority of

respondents were men, with a median monthly salary of more than ten million. They represent the world of work like private and government workers (see Table 4). The highest percentage shows that respondents with the most increased education are undergraduates in education. In Chart 1, it can also be seen that most of the respondents have at least one or two cars.

Chart 1. Total car ownership

In the second part, a set of questions focuses on the respondent's knowledge of ELV. Based on this section, the results show respondents know Indonesia is trying to combat the large spike in older vehicles on the road, but on other questions, a high percentage shows that respondents do not know about ELV management. This shows that people in Indonesia know about the government's efforts to reduce the high use of vehicles classified as ELV in Indonesia, but they do not know about specific problems with recycling and the concept of ELV management. According to the results obtained in this study, the results about people's knowledge of recycling are the same as those stated in research journals in other developing countries. The results showed respondents had good basic and general environmental knowledge but had low knowledge of certain environmental issues. The results for part 2 are shown in Figure 4.
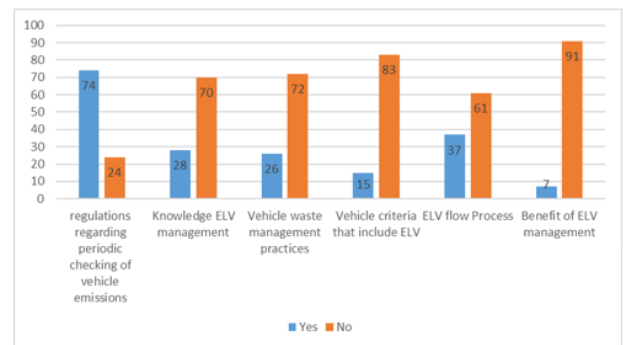
Figure 4. Result for the second part

The questionnaire's third section focused on respondents' concerns about ELV. A Likert scale is used in this section. According to the study's findings, most respondents refused to implement ELV in Indonesia. Respondents did not consent to disassembling their old vehicles. Most respondents do not know how to manage cars that have already been categorized as ELV, which can lead to many cars being abandoned in various locations. According to one survey, the public may be skeptical about the quality of repurposed products. In this investigation, the results were the same. Respondents were not confident that the ancient car was safe to drive, and they were also hesitant to use refurbished parts of the vehicle. Figure 5 shows the results for the third section.
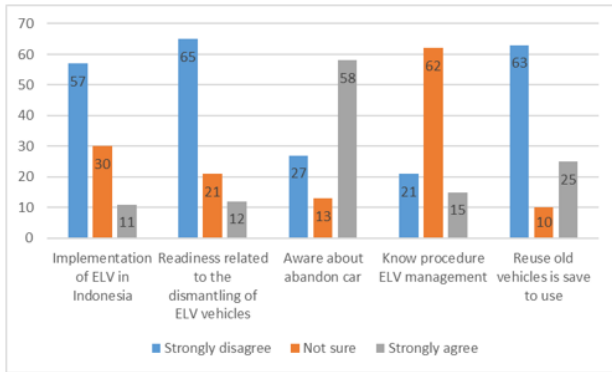
Figure 5. Result for the third section

The fourth component of the questionnaire focuses on an ELV awareness campaign. The Likert scale was used in this section. The greatest percentage indicates that respondents strongly disagree that they have ever seen a campaign advocating for the eradication of outdated cars. The campaign comes next. The majority of respondents feel that the campaign is vital for informing people about ELV and that Indonesia should have more ELV campaigns. When it comes to ELV exposure, the majority of respondents feel that it should begin in secondary school. Finally, the majority of respondents chose social media as the most appropriate vehicle for spreading the ELV campaign. Figures 6 and 7 show the results for the fourth section.
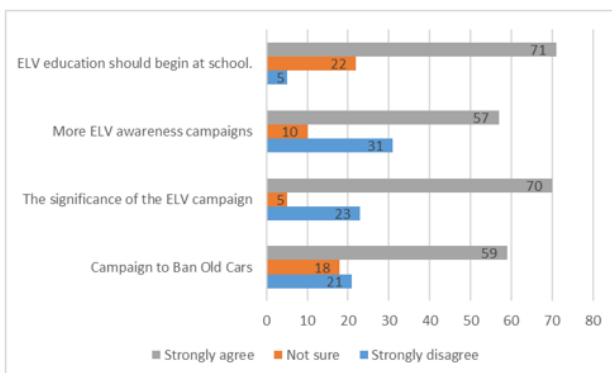

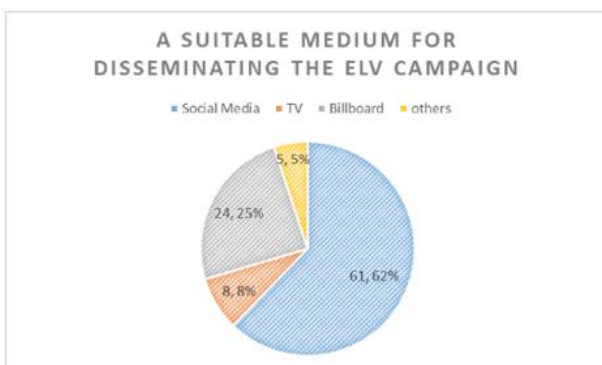**Figure 6.** Result for the fourth section (question 1-4)

Figure 7. Result for the fourth section (question 5)

5. DISCUSSION

The primary goal of this study is to learn about the public's knowledge of ELV. According to the findings of the study, a large number of respondents do not know what ELV is, although they do know that junk cars are recycled. An ELV is a vehicle that is no longer in operation. It is classified as an ELV based on one of two factors: the vehicle's age or the fact that it cannot be operated due to severe damage.

As mentioned earlier, respondents' knowledge of recycling on certain issues is lower than their knowledge of general recycling. This is supported by findings from research that state that people's knowledge of environmental knowledge in developing countries is quite high but not on specific issues, especially ELV. That is, respondents did not get good knowledge related to the concept of ELV. This condition occurs due to a lack of exposure to topics related to ELV. It is important to educate the public about the issues related to the concept of ELV.

The "End of Life Vehicle Recycling Regulation" was implemented in China in 2001. This law was passed in order to govern ELV recycling activities, strengthen ELV recycling management, and ensure safe road traffic. The Basic Environmental Law of Japan was implemented in 1993. This law defines the fundamental principles and foundations of environmental policies. In 2000, the Basic Law on the Establishment of a Good Material Cycle Society was promulgated under this law. This society is one that consumes fewer natural resources. The environmental impact is minimized to the greatest extent possible through the use of cycles and proper waste disposal. Both state programs were successfully executed. The programs that were put in place in both countries were a success. They were successful in reducing ELV in their country. The ELV concept has yet to be introduced in Indonesia. Based on the findings, the Indonesian government and the car industry should play a major role in promoting public awareness. The most important thing is to understand the media that is appropriate for disseminating knowledge to the general population. One thing that can be done are to create an awareness campaign.

Because today's society interacts more through electronic media, public community education can be done using electronic media. All ELV awareness and information campaigns can be promoted using social media. Government officials and industry participants must work together on all efforts aimed at educating the public. When ELV is implemented, this project will seek public support. In other words, the government can make an attempt by enacting ELV legislation, as has previously been done in other nations, such as Japan.

6. CONCLUSION

According to the data, most respondents do not agree to adopt ELV, and the majority of them do not understand what ELV is. To promote public understanding, knowledge, and awareness of ELV, the government and industry should design and implement more programs linked to ELV reuse.

The Indonesian government must play an essential role and act on ELV issues that have not been addressed by the Indonesian government. Authorities should do additional research and implement legislation and laws on ELV recovery, comparable to what other countries have done to lessen ELV concerns. To fulfil ELV goals, this endeavour should not only rely on the government but also be carried out by a variety of stakeholder.

The development of a public awareness campaign is also an important step that the Indonesian government must take right

away. Furthermore, this ELV-related campaign has the potential to increase community understanding of ELV and the benefits of ELV itself, which have previously been unknown to the community. This critical step must be taken in order to address issues concerning Indonesia's long-term economic development.

The Indonesian government can also adapt to countries that have succeeded in implementing ELV policies such as China, Japan, Korea, and the EU in designing future ELV policies. The right ELV framework will be assembled immediately, where this framework must adapt to the situation of society in Indonesia so that it is easily accepted by the public, given the increasing growth of the automotive sector in Indonesia. The right ELV policy steps are expected to make the automotive cycle in Indonesia good.

We must admit that this study has many limitations. First, this study also relies on data from online surveys, which is prone to bias. We also have a small sample size, so the data in this study cannot fully represent the state of public perception of ELV management in Indonesia. We also do not consider instruments in other countries' related perceptions of ELV.

There are various enhancements that can be made for future research. The target respondents are the things that can be improved in this research in the future. Target respondents can concentrate their efforts on the community and all automotive stakeholders. Respondents can be raised to a bigger number so that the results acquired are more detailed and specific to the researcher's title.

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