INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN ECONOMICS & MANAGEMENT SCIENCES

OPEN ACCESS JOURNAL

Vol 14, Issue 4, (2025) E-ISSN: 2226-3624

Used Part Dealers' Acceptance of Remanufactured ELV Components in Malaysia's National Car Industry

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DOI Link: http://dx.doi.org/10.6007/IJAREMS/v14-i4/26852

Published Online: 26 November 2025

Abstract

An End-of-Life Vehicle (ELV) is defined as the vehicle that is not operational anymore, is too old or too damaged beyond economical repair, and repairs are not worth the costs anymore. In Malaysia, the high volume of vehicles in use has increased the number of ELVs. Used Part Dealers (UPDs) help manage the components of ELVs in the country. The expectations and acceptance of remanufactured ELV products by UPDs was the focus of this research, specifically on Malaysia's national cars, the Proton Wira. Qualitative data was collected through field observations and semi-structured interviews while structured surveys involving 33 UPDs provided quantitative data. The acceptance of remanufactured products was highly positive. More than 90% of respondents agreed on the following claims: part prices should be based on the condition of the part (EX5: 93.9%)), proper dismantling documentation is needed (EX12: 100%), and ELV environmentally unsound practices should be avoided (EX7: 91%). In addition, over 87% of UPDs expressed preference for remanufactured parts from Proton Wira, specifically for high-value remanufactured components which included the gearbox (93.9%), alternator (93.9%), and distributor (93.9%). The factor analysis further substantiated these findings (KMO = 0.512; Bartlett's Test, $p < 0.001$), confirming that acceptance in the market is widespread, thus statistically significant. These findings highlight the value of UPDs in the promotion of sustainable automotive practices in terms of offering inexpensive substitutes to new components. This study highlights the increasing industrial significance of ELV remanufacturing and serves as a resource for policymakers, industry

players, and advocates of sustainability on the need to reinforce the ELV management in Malaysia.

Keywords: End of Life Vehicle (ELV), Used Part Dealers, Product Acceptance, Re-manufacturing, Malaysian Case Study

Introduction

The number of vehicles in the world is increasing. With every increase in the number of cars sold, the number of vehicles that are no longer in use (end-of-life vehicles) also increases (Mohan and Amit, 2020; Chaabane et al., 2021; Chong et al., 2023b). Vehicles are day-to-day commodities and the need to manufacture more vehicles is ever increasing. The tendency to manufacture more vehicles and more new models will inevitably lead to an increase in End-of-Life Vehicles (ELVs) each year (Yadav et al., 2022). ELVs are subject to specific rules and regulations that depend on the conditions surrounding each country's automobile industry. According to Wong et al. (2018), ELVs can emerge through natural wear and tear or through premature means, which includes damage from accidents, explosions, floods, or even theft. An ELV is a deregistered vehicle which is still going to be treated or recycled in the country using approved methods. It is a vehicle that is or will be dumped by the owner. The vehicle is classified as ELV due to two reasons. It is either of a certain age or has so much damage that it can no longer be utilized (Raja Mama et al., 2018; Smith et al., 2019; He et al., 2024). They are scrap and can be thrown away. All the components and parts of the vehicle are also waste. Also, Khan et al. (2021) explained that a vehicle becomes classified as an ELV when it meets certain specifications. Time and mileage are two of the conditions. A vehicle will be retired when it has reached the end of its useful life, which may be determined by age or mileage.

The Malaysian automobile market has experienced substantial growth in tandem with the country's economic development. Consequently, the influence of End-of-Life Vehicles (ELV) has expanded alongside the increasing number of vehicles on Malaysian roads (He et al., 2024). The rising demand for used parts is particularly noteworthy, driven by vehicle owners opting for cost-effective alternatives to new components. Among the preferred products at used part dealers are essential car components such as alternators, distributors, crankshafts, and power steering pumps. These items consistently demonstrate high popularity and demand. However, challenges arise as certain used part products may periodically be out of stock due to the robust market demand, making their procurement a potential difficulty. This study specifically delves into the end-of-life spare parts of the Proton Wira, a widely favored vehicle in Malaysia and unfortunately, a preferred target for thieves. As indicated in Figure 1, showcasing the top 10 most stolen cars in Malaysia for 2020, the Proton Wira's popularity contributes to its strong demand for used parts. Despite the availability of used components, Proton Wira spare parts remain relatively expensive. The paper aims to investigate the acceptance of ELV products among car-used part-dealers, with a particular focus on the National car, known as the Proton Wira.

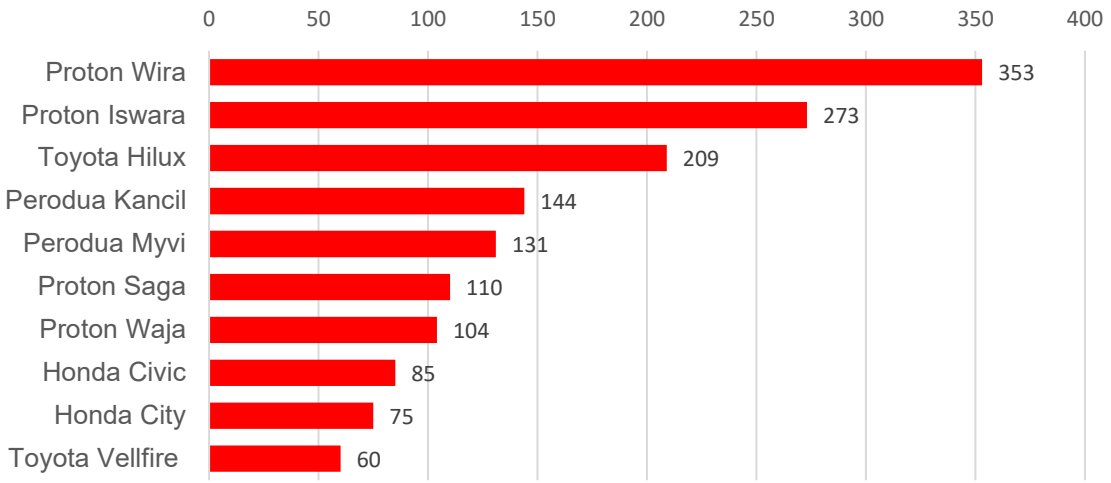

Figure 1 Top 10 most stolen cars in Malaysia (Jerrica, 2021)

Subsequent sections will elaborate on the significance of ELV to Malaysia, the research methodology employed, the results obtained, and the ensuing discussions. The paper will conclude with implications for the study within the broader body of knowledge.

The Significance of End-Of-Life Vehicles to Malaysia

There are very few studies focused on the management or strategies for implementing ELV policy in Malaysia, according to a thorough study of the literature. The country's research on end-of-life vehicles (ELV) stretches back to the mid-2000s. On the other hand, it was more adapted toward the automotive industry. In 2009, Malaysian researchers began to pay more attention to ELV management studies. According to Kassim et al. (2020) this was most likely related to the intention to implement a required regulation requiring all vehicles over 15 years to be inspected annually. By 2030, the private automobile market would be saturated and would end up having up to 12 million vehicles on the road. This situation could result in the arrival of 500,000 automobiles with ELV classification in Malaysia. At the same time, Azmi and Tokai (2017) stated that the number of ELVs is expected to rise significantly.

Aside from the increasing number of ELV-certified local cars, since Malaysia is one of the nation’s actively importing ELVs from other countries, mostly Japan, the number of ELV-certified cars imported into Malaysia has increased. Malaysia imports a huge quantity of car spare parts, making it a key hub for the region's auto parts trading activity. Dismantling, repair, part separation, and disposal are all important operations in the ELV recycling industry in the nation. Domestic or imported automobiles from other countries, particularly from Japan, are the source of these ELV disposal activities. Malaysia has 36.3 million registered automobiles, according to the Ministry of Transportation (Paultan, 2023). This figure also includes automobiles, motorcycles, and commercial vehicles like trucks and buses. As a result of this situation, demand for spare parts will rise (Khan et al., 2021).

Cars having ELV status are often taken to an ELV processing facility for resolution. The vehicle's leftover components will either be kept as spares or scrap. Examining, disinfecting, and dismantling ELVs at a facility designated for this purpose are all part of the ELV treatment

procedure. In addition to some by-products, this method will eventually yield materials that can be recycled or reused. ELV components that are still in excellent functioning order are referred to as reusable things. Before being sold to other firms, the recyclable ELV pieces will be segregated by material type. This includes iron, plastic, and other materials (Khan et al., 2021). All aspects of ELV recycling are administered and monitored in Malaysia by 5,000 small businesses associated with the Malaysian Automotive Recyclers Association (MARAA). However, because Malaysia is one of the countries that is still developing its recycling business, there are several challenges that have been identified as limiting the growth of this business. When it is determined that the Malaysian car recycling sector is uncontrolled and operates without a structured and regulated ELV management procedure, a problem develops (Tahir et al., 2024).

Used Part Dealers

A single car has almost 30,000 pieces if you count every single one down to the tiniest screw (Morello et al., 2011). With such many components and sophisticated arrangements, the risk of a car failing or performing poorly is family due to a variety of variables. Along with this, used supplies can be classified as either domestic or imported. Used part dealers are those who collect parts from cars in the system, such as trade-in operations, cars that are no longer roadworthy, cars involved in wrecks, particularly in 'total loss' instances, confiscated cars owing to legal action, and parts gained from car theft. Imported used supplies are typically derived from the 'half-cut,' which refers to cars that have been sliced in half for salvage reasons. Users can, for example, request specific sections from the half-unit to the front-end, which includes the engine, radiator, and transmission unit; the back end, which includes the fuel tank, fuel pump, and part of the exhaust system or purchase the entire half-unit.

A used car part dealer means any individual who engages in the business of dealing in used products for the primary goal of profit but does not include a person who trades in used goods or precious metals. A person who is in the business of buying, selling, exchanging, or dealing in old motor car parts and has a physical location in this state where they do so. Used part dealers are a subset of the automotive sector that handles the replacement of automobile parts after the original manufacturer's warranty on the vehicle has expired. Online vehicle part transaction datasets provide a wealth of information about individual purchases as well as specifics about the parts themselves. Trends and patterns produced from automotive transaction research are utilized to better inform the industry, such as when specific car parts are purchased and, as a result, which parts should be kept in stock at different times of the year to anticipate increased sales (Molla et al., 2023).

Understanding returned products is essential for establishing a profitable goods-supply firm (Azmi and Tokai, 2017; Abidin et al., 2024; Chong et al., 2023a; Sitinjak et al., 2023; Sulaiman et al., 2023). Returns could be problematic for a business for a variety of reasons, such as the cost of restocking, deciding whether a product is suitable for resale, the future cost sales, and so on. However, while returns are inconvenient for a firm, they should assist part dealers to increase their turnover and profitability. These can be utilized to better inform the industry. Part of the dealers' turnover and business are heavily influenced by return rates. Supplier parts can be compared to estimated factory standards to determine which parts can be matched to cars that weren't designed to be matched to in the first place This highlights

the potential profitability for a used part provider, as they can resale these parts to other automobiles with little or no modification.

Vehicles achieving ELV status, as well as those requiring repair after an accident, are often in the second quarter of their lifespan, since they're no longer covered by full insurance and it is less cost efficient to invest in new parts. In future years, there will be a significant need for replacement parts for older vehicles across the world, as well as a continuance of the used part industry's growth trend. Another driving factors for the Malaysian used part dealers to become involve in ELV is that the Government financial assistance for renewable energy installations. Renewable energy installation could be very beneficial to used part dealers (MIDA, 2024). Many dealers have implemented renewable energy on-site, but to varying degrees and with various technologies. Volkswagen, for example, gets one-third of its energy from renewable sources across the board; the percentage attained at specific locations varies based on local renewable sources and can reach 100% when hydroelectric power is available (Volkswagen Group, 2024). When the government likes a dealer's or manufacturer's concept and project proposal and sees a lot of potential for large profit from such an investment, the government will help them finance it. As a result, financial support from a third party or the government may be demonstrated to be extremely valuable to larger firms in the event of end-of-life vehicles.

Proton Wira

The Proton Wira was launched as a four-door saloon on May 21, 1993. The Proton Wira is a rebadged Mitsubishi Lancer, 1992 6th generation Lancer with slightly different appearance. Figure 2 shows an example of a Proton Wira car.

Figure 2 Example of Proton Wira car (original model)

The Mitsubishi Lancer-based Proton Wira performed admirably as Malaysia's second national automobile. The Proton Wira is one of the company's best-selling vehicles. During the Wira's 16-year manufacturing run from 1993 to 2009, the company sold 952,215 units (Proton Group, 2024). It was a well-built vehicle with low maintenance costs. A secondhand Proton Wira can now be obtained from around RM3,000 to RM6,000 (Muday.my, 2025). Despite its age and bad reception, the Wira, like the Saga before it, had consistently served to the requirements of countless Malaysians. Its adaptable chassis allows it to serve several functions depending on the demands of its owner. It may be a solid family vehicle, a daily drive for work, a first car for new drivers, or an entry-level performance vehicle for individuals interested in modifications. One of the reasons there are so many Proton Wira’s on the road today is that there are so many used parts and Original Equipment Manufacturer (OEM)

replacement parts available for owners to keep their old reliable operating. However, according to the source, Proton and local third-party manufacturers have permanently discontinued production of Wira components because the demand has long been dropping. This makes continual spare component manufacture unprofitable. It's been 13 years since the last Wira was released, and 29 years since the first model was manufactured. Wira components are no longer cost effective for OEMs, hence they are focusing on newer models. Although the Wira shared similar components with the Mitsubishi Lancer on which it was based, replacement parts for the Japanese model are likewise no longer available on the market, as that generation of Lancer was created more than 30 years ago.

Finding spare parts for Proton Wira owners has become increasingly challenging in recent years, leaving the junkyard as the sole recourse. Compounding this difficulty is the unfortunate reality that the Proton Wira remains the most pilfered vehicle in Malaysia, according to the Vehicle Theft Reduction Council of Malaysia (VTREC) (The Star, 2023). Shockingly, a car is stolen in the country every 1 hour and 15 minutes, resulting in 20 stolen automobiles daily in 2020. The Proton Wira stands out as the favored model among thieves, ranking first as the most stolen car in Malaysia due to the high demand for its spare parts. The demand for Proton Wira parts remains robust, driving up their prices even in the used parts market. Notably, essential components like the gearbox command prices ranging from RM800 to RM1000, while the cylinder head can fetch around RM250-RM300. The carburetor and distributor, priced at RM150 each, emerge as the most sought-after used parts items. Additional key components include the alternator at RM80, the air conditioner pump at RM150, and the crankshaft at approximately RM200. In addition to the scarcity of spare parts, the Royal Malaysian Police (PDRM) has identified Proton Wira's as one of the preferred vehicles among thieves. This stems from the sheer prevalence of Wira's on the roads, making it challenging to distinguish one from another and contributing to their unfortunate popularity among criminals.

Methodology

There are three main methods used for data gathering as follows:

Used Part Dealer Visit / Field Observation

Field observation refers to the active situation of interest where the relevant facts, actions, or behaviors are recorded by either a person or a mechanical device. This technique provides means to verify and nonverbally express feelings, discern interpersonal connections, perceive intra-group communication, and determine temporal allocation across multiple activities. This technique is expected to illustrate a better and clearer perspective about auto-used parts dealers on ELV. Additionally, it assists in assessing their procedures in handling used parts. Observations yield reliable information about the processes used by workers in dismantling vehicles and selling used parts in the junkyard.

Semi-Structured Interview

Semi-structured interviews are another method to gather data and conducted in this research project. Semi-structured interviews are a good way to gather data from similar backgrounds or experiences to discuss a specific topic of interest. Semi structured interviews are more flexible than structured interviews because the question asked is not fixed to the protocol. Interviewers have the room to ask additional information such as respondent background to relate with the study while they also can be friendlier to the respondent.

Interview in a semi structured method is essential to research tasks that are personal to participant and can lead to participant trust and can gain specific information regarding the question. For this study, the target group to implement this method is generally the person in charge mainly in the junk yard. The interview is essential to analyze the expectation of ELV product for used car parts dealers in Malaysia. All data have been handled in accordance with ethical standards. Some information remains undisclosed due to confidentiality concerns expressed by the respondents. The study is conducted with an exclusive focus on academic purposes.

Questionnaire Survey

A questionnaire is simply a tool for collecting certain information about a particular issue. It is mainly made up of a list of questions which include clear instructions and space for answers or administrative details. This method is very effective and valuable as it can develop certain crucial data and research procedures. This survey questionnaire is the method used to gather data about End-Of-Life Vehicles. 33 respondents are involved in this initial study. The questionnaire focuses on the respondent information as starting then followed by some information about ELVs. The questions are generated through the development of the literature review as well.

Results And Discussions

Expectation of ELV Product for re-manufacturing

There are 14 elements on expectation of End-Of-Life Vehicle product from auto used part dealers that have been identified, and all of these have been denoted as EX1 to EX14 in the questionnaire as shown in Table 1. The respective respondents need to give their perspective based on a rank from 0 to 5 which comes with “not applicable” to “strongly agree” which indicates to the extent of agreement towards the expectation of ELV products from auto used part dealers. The results from the survey showed that the respondents agreed that all of 14 elements in the questionnaires of expectation of ELV product (EX) were in the junk yard. Then all those expectations of ELV products ranks are calculated in percentage units and tabulated. These percentages are obtained by calculation through SPSS software.

Table 1
Expectation of ELV Product between used part dealers

No.	Expectation of ELV Product	Frequency (%)			
		Not Applicable	Disagree	Not Sure	Agree
EX1.	The ideal life span for a vehicle is 10 years	-	21.2	36.4	42.4
EX2.	Determining the vehicles have reached its ELV by life span only	-	30.3	30.3	39.4
EX3.	Auto used part dealers are important in ELV practices	-	-	3.0	96.9
EX4.	ELV parts should be accident free	6.1	3.0	9.1	81.8
EX5.	Used part items price are determine by its condition	-	-	6.1	93.9
EX6.	Used part items are determine by its condition	-	-	12.1	87.8
EX7.	Consider the environment issues in process of ELV parts.	-	-	9.1	91
EX8.	Increase the used part item trade-in	12.1	6.1	27.3	54.6
EX9.	Prefer exporting the used part items to other country	-	-	24.2	75.7
EX10.	Prefer imported vehicles of ELV parts from other country	-	-	3.0	97
EX11.	Prefer used part items from cars only	6.1	12.1	6.1	75.7
EX12.	Need proper documents of the car to dismantle the vehicles	-	-	-	100
EX13.	Need customers details for selling/buying the ELV parts	-	-	36.4	63.7
EX14.	Accepting broken used part items	-	6.1	51.5	42.4

Factor Analysis of Expectation of ELV Product

As noted in Chaabane et al. (2021), the IBM SPSS factor analysis procedure was utilized. The analysis was conducted based on principal components analysis with Varimax rotation, discontinuity eigenvalues of more than 1, and factor loadings of 0.5. The Varimax rotation method was chosen because it can simplify complex variables and improve yield expectations. In the first test, the Kaiser-Meyer-Olkin (KMO) test was 0.512, which is more than 0.5. This shows the sufficiency of the sample as all indicators are inter-related to the same factor. Simultaneously, Bartlett's test of sphericity p-value=0, which is less than 0.05. This shows that the data contains a substantial relation to the subscale and is suitable and sufficient for factor analysis. The results of the KMO and Bartlett's tests are in Table 2.

Table 2
Results of Kaiser-Meyer-Olkin (KMO) and Bartlett's Test

KMO measure of sampling adequacy	Bartlett's test of sphericity		
	Approximate Chi-square	df	Sig.
0.512	237.829	91	0.000

After the initial trial, the remaining 14 indicators of EX became uni-factorial. These indicators were consolidated into three factors, with loadings ranging from 0.216 to 0.872. A KMO measure of 0.512 is more than adequate. As presented in Table 3, indicators EX5, EX13,

EX8, EX6, and EX7 were assigned to the first factor with loadings between 0.531 and 0.872. This factor captured the greatest variation (eigenvalue 3.466; cumulative variation 21.988%). The second factor was composed of EX9, EX4, EX11, EX2, EX1, EX12, and EX13, with factor loadings between 0.216 and 0.822, for a total eigenvalue of 3.019 and cumulative variation of 43.394%. The third factor contained only two EX indicators, EX14 and EX10, which had loadings between 0.319 and 0.426, bringing the total cumulative percentage to 59.553%.

Table 3
Results of Factor Analysis for Expectation of ELV Product

Factor	Indicator of EX	Item loading	Cumulative Percentage	Eigenvalues
G1	EX5	0.872	21.988	3.466
	EX13	0.808		
	EX8	0.785		
	EX6	0.779		
	EX7	0.531		
G2	EX9	0.822	43.394	3.019
	EX4	0.710		
	EX11	0.654		
	EX2	0.529		
	EX1	0.460		
	EX12	0.425		
	EX3	0.216		
G3	EX14	0.426	59.553	1.853
	EX10	0.319		

Preferable Auto Used Part

There are 7 elements on Preferable used auto part from auto used part dealers that have been identified, and all of these have been denoted as PR1 to PR7 in the questionnaire as shown in Table 4.7. All the preferable auto used parts are based on literature review that have been stated previously. According to the survey's findings, all seven of the preferred auto part (PR) criteria were viewed by respondents as important surveys. The ranks of all these preferred used auto parts are then determined in percentage units and tabulated as shown in Table 4. These percentages were calculated using the SPSS software.
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Table 4
Preferable auto used part items for used part dealers

No.	Preferable auto used part	Frequency (%)			
		Not Applicable	Disagree	Not Sure	Agree
PR1.	Prefer vehicles used part items for ELV	-	-	15.2	84.8
PR2.	Prefer used part items from abandoned vehicles	3.0	3.0	3.0	90.9
PR3.	Prefer used part items from total accident vehicles	-	-	15.2	84.8
PR4.	Prefer used part items from the vehicles which reached its life span	-	-	9.1	90.9
PR5.	Prefer used part items from vehicles that effected by flood	-	42.4	42.4	15.2
PR6.	Prefer accepting used part items from theft vehicles	3.0	78.8	6.1	12.1
PR7.	Prefer used part items from Proton Wira	-		12.1	87.9

Preferable auto used part from Proton Wira

The questionnaire, as shown in Table 5, contains 12 elements on Preferable auto used part from Proton Wira from auto used part dealers, all of which have been identified and denoted as PUW1 to PUW12. All the preferable auto used parts from Proton Wira are based on literature reviews that have been stated previously. The survey's results show that respondents thought the twelve preferable auto parts from Proton Wira (PUW) criteria were all very essential. The rankings of each of these preferable auto's parts used from Proton Wira are then calculated in percentage units and summarized as shown in Table 5. Using the SPSS application, these percentages were determined.

Table 5
Preferable auto used part items from Proton Wira between used part dealers

No.	Preferable part	Frequency (%)			
		Not Applicable	Disagree	Not Sure	Agree
PUW1	Brake lamp	-	-	12.1	87.9
PUW2	Crank shaft	-	3.0	24.2	72.7
PUW3	Steering	-	-	42.4	57.5
PUW4	Head lamp	-	-	9.1	90.9
PUW5	Radiator fan	-	-	9.1	90.9
PUW6	Intake manifold	-	6.1	6.1	87.9
PUW7	Brake booster pump	-	3.0	6.1	90.9
PUW8	Gearbox auto	-	-	6.1	93.9
PUW9	Engine	-	3.0	6.1	90.9
PUW10	Alternator	-	-	6.1	93.9
PUW11	Distributor	-	-	6.1	93.9
PUW12	Cylinder head	-	-	6.1	93.9

Conclusion

This study shows that Used Part Dealers (UPDs) in Malaysia are generally accepting remanufactured ELV parts, especially the Proton Wira parts. The study also shows that over 90% of the respondents agree with condition-based pricing, pricing with environmental factors, and documentation sufficiency, these demonstrate that UPDs and the market are ready to engage in the circular economy. The demand of remanufactured ELV parts such as gearboxes, alternators, and distributors are available and affordable to the consumers and demand to sustainable automotive practice implies commercial the demand for remanufactured ELV products.

On the positive side of this study, there are gaps in the areas of structured regulations, coordinated supply chains, and public understanding of ELV practices. These concerns require more than the involvement of UPDs. Future research in this area should include ELV owners, as they supply vehicles, local authorities with enforcement and recycling practices, and laws and policy that provide the legislative and economic control of ELV as means of transport. These gaps will help build a more complete understanding of the ELV ecosystem.

For prospective research, the establishment of the first sustainable supply chains for the ELV industry will be of particular importance. Here, the goal will be to develop a coordinated approach to handlers that incorporates each of the elements of collection, dismantling, remanufacturing, and resale. Regulatory frameworks and incentive structures have proven to be useful in identifying forms of comparative international best practices in driving sustainable comparative analysis. The use of integrated environmental and economic assessment tools together with supply chains will certainly strengthen the proposed research, and the advocacy for sustainable ELV industry will position Malaysia in research leadership beyond the role of UPDs to a more competitive and resource-efficient international ELV industry.

Acknowledgement

This research was funded by a grant from Malaysia Technical University Network (MTUN), Ministry of Higher Education of Malaysia (MTUN/2023/UTEM-FTKIP/CRG/MS0001).

Conflict of Interest

Authors declare that there is no conflict of interest regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: study conception and design: Wan Hasrulnizzam Wan Mahmood; data collection, analysis and interpretation of results: S. Subramaniam, Muhd Ridzuan Mansor, Mohd Khairul Nizam Suhaimin; draft manuscript preparation: Wan Hasrulnizzam Wan Mahmood, Mohd Azham Azmi, Hadi Abdul Salaam, Ahmad Husni Mohd Shapri. All authors reviewed the results and approved the final version of the manuscript.

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