sustainability

MDPI

Review

A Review of Challenges and Opportunities for End-of-Life Vehicle Recycling in Developing Countries and Emerging Economies: A SWOT Analysis

Solange Ayuni Numfor [1,*], Geoffrey Barongo Omosa [2], Zhengyang Zhang [1] and Kazuyo Matsubae [1]

[1] Graduate School of Environmental Studies, Tohoku University, Sendai 980-8572, Japan; zhengyang.zhang.a8@tohoku.ac.jp (Z.Z.); kazuyo.matsubae.a2@tohoku.ac.jp (K.M.)
[2] School of Engineering and Architecture, Meru University of Science and Technology, Meru 972-60200, Kenya; gomosa@must.ac.ke
* Correspondence: numfor.solange.ayuni.t7@dc.tohoku.ac.jp

Abstract: The importance of recycling end-of-life vehicles (ELVs) has been widely acknowledged as a means of reducing ELV waste to the environment. This reduced environmental waste contributes to achieving a number of UN SDGs, including the creation of sustainable cities. The recovery of secondary resources, such as metals, from the recycling of ELVs also reduces over-dependence on primary resources. This promotes efficient resource utilization and resource conservation. While recycling systems have been established and laws governing ELV recycling have been implemented in some developed countries, there are no such systems in much of the world, and regulations are few if any. To determine the challenges and opportunities for ELV recycling in developing countries, the literature on ELV recycling processes and activities was reviewed, and a SWOT analysis was done based on the data compiled from the literature, to identify the strengths, weaknesses, opportunities, and threats. From the SWOT analysis, the common features identified as opportunities were large market size, low labor cost, and the presence of recyclers of ELV parts. The common strengths were identified to be the vehicle registration system, vehicle manufacturing, ELV legislation, ELV recycling, and the waste management system. In the case of weaknesses, the identified features were the technological capacity, waste regulatory framework, vehicle deregistration, ELV regulatory framework, environmental impact and pollution, and the lack of access to information regarding ELVs, and ELV recycling infrastructure. The common threats were perceived as the little attention given to ELV recycling by the governing authorities, the difficulty of doing business, and political and social instability. The results of the SWOT analysis also showed that the opportunities were considerable and the threats were significant for all of the countries in this study. The weaknesses were significant in Nigeria and the other developing countries, and the strengths of the emerging economies tended to be greater. While weaknesses and threats were clearly identified by the SWOT analysis, the SWOT analysis also revealed the strengths and opportunities for recycling ELVs in developing and emerging countries.

Keywords: end-of-life vehicle (ELV); recycling; developing countries; emerging economies; challenges; opportunities; SWOT analysis

Citation: Numfor, S.A.; Omosa, G.B.; Zhang, Z.; Matsubae, K. A Review of Challenges and Opportunities for End-of-Life Vehicle Recycling in Developing Countries and Emerging Economies: A SWOT Analysis. *Sustainability* **2021**, *13*, 4918. https://doi.org/10.3390/su13094918

Academic Editors: Vincenzo Torretta and Elena Magaril

Received: 15 February 2021
Accepted: 23 April 2021
Published: 27 April 2021

1. Introduction

The reuse and recycling of end-of-life vehicles (ELVs) has made these vehicles a vital source of secondary raw materials for use in industry [1]. This helps in closing the sustainable resources loop and decreases the demand for primary raw materials. In the wake of the regulations for the recycling of ELVs through the 2000 European Union Directive (EU Directive), many countries have implemented similar policies, with efficiencies varying from country to country [2,3]. The EU Directive on ELVs considers the environmentally friendly dismantling of ELVs, the methods for recycling, and also has clear targets for the

reuse, recovery, and recycling of ELVs and their components [3]. According to the EU Directive 2000/53/EC (the ELV Directive), vehicle manufacturers are required to minimize the use of such hazardous materials as mercury, lead, hexavalent chromium, and cadmium in the production of vehicles [3,4]. In addition, the EU member states are required to set up ELV collection systems and transfer these ELVs to established authorized treatment facilities. This directive is designed to reduce contamination in the environment and to curb emissions, as well as to facilitate recycling and reduce the need for the proper disposal of these hazardous substances [4]. The definition of an ELV is a vehicle that has reached the end of its useful life and requires proper treatment [5].

Some EU member states have made significant advances implementing ELV recycling measures. According to a report by the United States Environmental Protection Agency, the producer responsibility scheme in Sweden, a pioneer in ELV recycling in Europe, requires vehicle manufacturers to collect ELVs at no cost to the vehicle owner, and also to establish a management system [5]. Also, the Dutch automobile industry established the Auto Recycling Netherland (ARN) company for the collection of scrap cars, management of ELV dismantling and recycling, by partnering with vehicle dismantling companies [6]. This company is financed through the collection of waste disposal fees as part of the vehicle registration process. It was also reported that, approved ELV centers in each prefecture in France, are responsible for ELV recycling and issuing a certificate of destruction to the ELV holders [7]. In addition, each vehicle manufacturer must establish a network of authorized ELV collection and distribution centers across the country.

According to the United Nations Conference on Trade and Development, and the United Nations World Economic Situation Prospects, country classification, Cameroon, Kenya, Nigeria, Egypt, India, Malaysia, Mexico, South Africa, are listed as developing countries [8,9]. Due to the low incomes and poor public transport infrastructure, most developing countries import second-hand vehicles [10]. Since many of these second-hand vehicles are barely roadworthy when they arrive in the country, and they are then driven on poorly maintained roads, many of them reach the end of their useful lives after a short period of use. In Kenya, ELVs are stockpiled at police station yards, despite the potential for these unclaimed stockpiled ELVs to be utilized as sources of secondary materials through recycling [11]. In Egypt, financial incentives are being offered to the owners of automobiles in a national program to promote ELV scrapping and recycling [12]. Through this program, many older taxis have been replaced with new vehicles. However, the Central Bank restricted access to foreign exchange to prevent the further devaluation of the Egyptian pound, resulting in a downturn in businesses and other economic activities in the country [13]. In Central African countries like Cameroon, little attention is given to recycling and waste management [14]. In such countries, vehicles are abandoned or disposed of illegally, and the dismantling of these vehicles is undertaken by the informal sector.

A country with an emerging economy is a developing country [15]. In this study, we included India, Mexico, Malaysia, Nigeria, and South Africa, which are considered developing countries with emerging economies [16], In these countries, the ELV recycling system is not well established. The situation in most developing African countries is not unlike that in Nigeria, where it has been reported that ELVs are abandoned by their owners, and are left to litter the streets of urban areas, construction sites, and other areas in the country [10]. In Malaysia, vehicles are used for undefined periods regardless of the condition or age of the vehicle, in some cases resulting in vehicle failure and risks to the safety of the driver and other road users [17]. In India, ELVs are handled by the informal sector, where they end up at scrap yards, illegally and improperly dismantled for parts recovery, and then sold on the second-hand market after refurbishing or material recovery for recycling [18]. While some ELV regulations have been implemented in India, ELV management is still characterized by the absence of standard procedures, indeterminate deregistration, and above all, the ineffective and unsustainable management of ELVs [18]. In Mexico, ELV recycling is characterized by poor dismantling practices, uncontrolled depollution, and management of hazardous waste, poor shredder procedures, causing

high environmental concerns [19]. In South Africa, ELV recycling is promoted through the concept of extended producer responsibility, where a memorandum of agreement between manufacturers, recyclers, and the Department of Environment Affairs and Tourism is being developed to ensure the collection, reuse, and recycling of ELV components such as waste tires, glass [20].

The management of ELVs in developing countries has been investigated in some studies. In their investigation into the management of automobile waste in developing countries, Nwachukwu et al. reported that a properly developed concept of mechanical village is an opportunity for developing countries to implement environmentally friendly automobile waste management [21]. However, given the underdevelopment of mechanical villages in developing countries, the authors suggested that the United Nations and automobile exporters should consider assisting developing countries to establish environmentally friendly mechanical villages. In another study on the sustainability of ELV recycling in India, Nitish et al. revealed that while weak legislation, ambiguous vehicle deregistration were impediments to progress, the setting up of automotive industry standards to regulate the types of material used in vehicles and minimum rates for reuse, recovery, and recycling of ELVs was a promising development [18]. The United Nations Industrial Development Organization (UNIDO) also stressed that it was vital to work towards establishing a circular economy by promoting recycling and recycling industries in developing countries due to the many serious waste management system challenges and pressures faced by those countries [22]. UNIDO further reported that the low cost of labor cost and the existence of strong (though informal) recovery and remanufacturing sectors provides a competitive advantage in these countries for further development, providing efforts are properly controlled.

The purpose of this paper is to evaluate the challenges and opportunities of ELV recycling in developing countries. To this end, the existing literature and reports on the current situation in a selection of countries have been reviewed. Among the developing countries of Africa, Cameroon and Kenya are considered the hubs for Central and East Africa, respectively [23], South Africa is considered the hub for Southern Africa [24], and Egypt is not only the hub for Northern Africa but the tech-hub for all of Africa [25]. Nigeria is also a giant economy in Africa [25] and a hub for West Africa. The challenges for the management of ELVs in India, Mexico, and Malaysia, developing countries also considered emerging economies [26], have been reported some in nation-based studies [17–19]. A SWOT (strengths, weaknesses, opportunities, and threats) analysis was completed for these countries to evaluate the challenges and to determine the scope of the opportunities for the recycling of ELVs. For a wider understanding of the issues involved in the recycling of ELVs, the laws and systems pertaining to ELV recycling in a number of developed countries are presented. It is expected that this analysis will provide an opportunity for policy-makers in developing countries to consider the status quo in other countries facing similar economic, technological, and environmental problems, and to find the path to the effective recycling of ELVs in their country. In this study, the challenges and opportunities of implementing ELV recycling in these countries are outlined, and a relatable context is created that can be applied to other countries which identify with the challenges (weaknesses and threats) and opportunities (and strengths) identified in those countries.

ELV Recycling Activities

The reprocessing of the materials in ELVs requires the vehicles to be collected, to be depolluted, and dismantled, the materials to be sorted and shredded before being thermochemically processed, and the disposal of some of the material [27,28]. A flowchart for the environmentally sound process of recycling ELVs is provided in Figure 1 below, where processes are in plain shapes and outcomes in grey shapes.

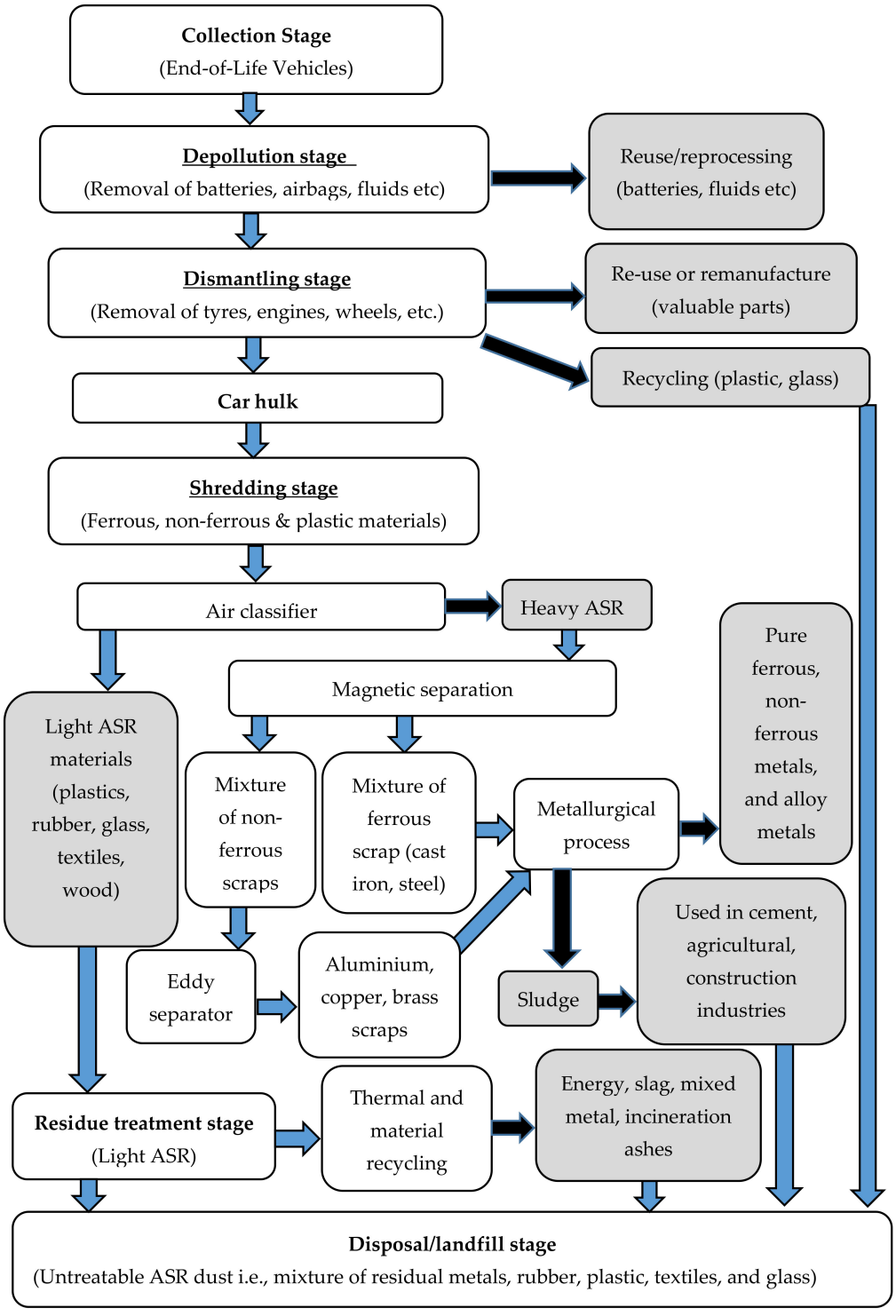

Figure 1. Flow chart for ELV processing.

As shown in the figure, collection is the first stage of ELV recycling. However, the collection operation varies from country to country. In Japan, owners of ELVs are obliged to bring these vehicles to registered ELV-collecting companies, which then hand over the ELVs to registered chlorofluorocarbon-collecting companies for the removal of chlorofluorocarbons (CFCs), and then the airbags are removed and the vehicles are dismantled by licensed auto-dismantling companies [29,30]. The dismantled vehicles are processed into auto automotive shredder residue (ASR), collected upon payment by authorized automakers, along with the CFCs and airbags [29,30]. In most countries in the EU, the manufacturer

is responsible for establishing the network for collecting and recycling ELVs, while an information system is in place to monitor and enumerate ELV numbers [6,7].

The collection operation also differs among developing countries. India has some mandatory requirements for collecting ELVs. The last owner of a vehicle is mandated to hand over the vehicle to an authorized agent or authorized collection and dismantling center when this owner considers the vehicle to be at the end of its service life [31]. This authorized collection and dismantling center pays the last owner according to the value of the vehicle and then is responsible for the depollution and dismantling of the vehicles. The reusable parts recovered are sold in the after-market, while other hazardous components, such as air bags, CFCs, reactors, etc., are supposed to be disposed of properly [31].

A system that requires the voluntary surrendering of ELVs is better for an organized nationwide ELV collection and recycling system. The scrap metal act set up in 2015 in Kenya provides ELV recycling to be equally achieved by small scale scrap dealers, auto garages, and parts vendors: these parts vendors scavenge for valuable part/components for re-selling as second-hand parts while the remaining "invaluable" parts of the vehicles are collected by individual scrap dealers who in turn sell them to the few existing foundries for melting and production of secondary products, such as fencing wires, parts/components, and other cast products [32]. Nigeria and Cameroon have an unco-ordinated approach to ELVs recycling [10,14]. The scrap scavengers go to different mechanic workshops collecting and buying disassembled and removed scrap components and then supply the scrap to the smelting companies [10]. The iron and steel are used to produce concrete reinforcement rods, the flat steel sheets are used for the building and construction industry, and the aluminum is smelted for the production of cooking utensils [8]. Old vehicle batteries are used both internally, and some are exported to countries like China where they are remanufactured, recycled and the cell components may be reused [10].

When ELVs are collected and received at the reprocessing center, the liquids (motor oil, brake oil, refrigerant) are drained (depollution stage) and the hazardous pollutants are extracted separately. ELVs contain quantities of mercury, cadmium, chromium, zinc, and other hazardous material which cause environmental damage and contaminate not only the soils and waterways but also the other resources if they are not properly extracted. The valuable materials are then extracted in a mechanical/manual dismantling step: in recent times, some plastics, as well as the ferrous and non-ferrous metal fractions, are considered valuable [33]. These materials recovered from the ELV dismantling stage are considered valuable recyclable components and are supplied for reuse in other vehicles (motor parts, batteries, fuel, etc.) or for further recycling (tires, valuable metals, carpets, etc.) in different quantities and qualities. The level of mechanization at the dismantling stage depends on the costs of labour and availability of large-scale technology [34]. The remaining hulk of the vehicle is crushed and broken up into fist-sized pieces by large shredders in the shredding stage. The shredded material is then separated into ferrous metals for material recovery as well as non-ferrous metals (heavy automotive shredder residue (ASR)) and other materials (light ASR) by way of complex machinery, such as magnetic separators, air classifiers, and infrared systems. [35]. The processing of scrap in smelters usually involves the production of secondary steel in electric arc furnaces (EAF), which use 100% shredded scrap, or basic oxygen furnaces (BOF), which use up to 20% scrap as a cooling agent [36]. In Europe, plastics derived from automobiles and electronics are sorted, refined, and blended by a limited number of specialist plastics converters [37]. Composite materials and fibers typically require further treatment to reach the acceptance criteria for further refining. Aluminum and copper are melted at dedicated installations together with other materials from other product streams, including construction scrap, WEEE derived metals, and production waste. Finally, the automobile shredded residue (ASR), a predominantly non-metallic material that remains after separating ferrous and nonferrous metals from shredder output, is typically treated and disposed of in landfill sites according to the environmental regulations of these countries [38]. Within the overall

ELV recycling chain, the management of ASR is one of the most problematic steps and further technological developments are required [39].

The laws pertaining to the recycling of ELVs determine the activities undertaken in each country. In a study focused on waste management in Asia, Serrona et al. found that the laws in many countries in Asia were quite similar to those in Japan and South Korea [40]. The first ELV law passed in Japan in 2005 requires end users to pay necessary fees and surrender ELVs for recycling, while an information system is in place to monitor airbags, refrigerant gas, and also the automobile shredder residue. The ELV recycling law passed in 2007 in South Korea requires manufacturers to provide technical support and develop recycling technologies, while an information system is in place to check ELVs according to types and weight. It has been reported that the ELV recycling law passed in the EU in 2000 was the basis for the other similar legislation passed in countries like Korea and Japan [2,34].

2. Materials and Methods

The challenges and opportunities of ELV recycling in a number of different developing countries were evaluated by a SWOT analysis. A SWOT analysis allows the 'strengths', 'weaknesses', 'opportunities', and 'threats' of a plan, organization, business activity or a project to be evaluated, where strengths and weaknesses are internal factors, opportunities, and threats are external factors [41,42]. According to Gurel et al., a SWOT analysis is a useful mechanism for analyzing various situations since it allows the environmental and organizational factors to be identified by determining the resource deficiencies and capabilities, the market advantage, and external threats [41]. In another study on the value of the SWOT analysis, it was noted that this technique allows for a detailed understanding of situations by determining the relevance of the data available and that this allows the context to be well-established [43]. In a SWOT analysis, the strengths of an organization are its vital capabilities, weaknesses are what it does incompetently or poorly, opportunities are advantages for achieving its goals, while threats are conditions that hinder or jeopardize the realization of its activities [41,43].

We examined the SWOT components of three selected developing countries, Cameroon, Egypt, and Kenya, as well as five selected developing countries with emerging economies, Mexico, South Africa, Nigeria, India, and Malaysia. Some basic statistics are given in Table 1.

Table 1. Summary of basic statistics per country.

Country and References	GDP (Billion USD)		Average Change in GDP Growth Rate (%)	Inflation Rate (%)		Public Debt (% of GDP)		Total Population (Millions)	Vehicles in Use/Registered/Per Capita/(Millions)
	2018	2021	2011–2020	2018	2021	2018	2021	2020	
Cameroon [44–48]	38.7	44.41	4.0	1.1	2.3	39.5	45	26	0.347 (in 2015)
Kenya [46,47,49,50]	87.80	101.05	5.1	4.7	5.2	59.3	72	53	3.2 (in 2018)
Nigeria [46–48,51,52]	398.16	466.88	2.3	12.1	12.7	27.7	35.5	206	11 (in 2017)
Egypt [46–48,53,54]	250.25	374.89	3.6	20.9	6.2	92.7	90.6	102	10 (in 2018)
India [46,47,55–59]	2000	2000	6.1	3.43	3.75	69.6	89.9	1300	253 (in 2017)
Malaysia [46–48,60,61]	358.71	380.26	4.4	1	2.4	55.5	66	32	13 (in 2015)
Mexico [46,47,62–65]	1000	1000	1.5	4.9	3.3	53.6	65.6	128	50.6 (in 2019)
South Africa [46–48,66,67]	368.29	317.19	0.8	4.62	3.88	56.7	82.8	59	9 (in 2015)

The SWOT analysis for each country involved a literature review of research into ELV recycling and other issues relevant to ELV recycling in these countries. The literature reviewed is summarized in Table 1. The literature reviewed included peer-reviewed publications by exploring search engines, Google Scholar, Multidisciplinary Digital Publishing Institute (MDPI), Journal of Material Cycles and Waste Management (JMCWM), ScienceDirect journals and books, International Journal of Engineering and Advanced Technology

(IJEAT), Wiley online library, and International Institute for Industrial Environmental Economics (IIIEE) reports. Also, by exploring search engines, the reviewed literature included reports and Statistical databases, World Bank, International Finance Corporation (IFC), Trading Economics, United Nations Industrial Development Organization, United Nations Conference on Trade and Development (UNCTADSTAT), Statistica, Worldometer, International Monetary Fund (IMF), Santander Trade Markets, Expert Environmental. The references were also explored to source additional information, with the key words in searches as "End-of-life vehicle recycling in developing countries". Three developing countries selected are considered hubs in Africa: Cameroon for Central Africa, Egypt for North Africa, and Kenya for East Africa. South Africa, an emerging economy, is a hub for Southern Africa. Nigeria, an emerging economy, is a hub for West Africa. There have been a number of nation-based studies reported for the poor management of ELVs in India, Malaysia, and Mexico. The literature reviewed was classified for each country, and then subclassified under each SWOT component, strengths, weaknesses, opportunities, and threats, as shown in Table 2. The SWOT components for each country were reviewed, and the common factors were identified and expounded for every country under each SWOT component. The common strengths, weaknesses, opportunities, and threats were identified based on the authors' findings from the reviewed literature on each country.

Table 2. Summary of references for SWOT analysis per country.

Countries	Sources	Year	Strengths	Weaknesses	Opportunities	Threats
Cameroon	Global recycling 2304 [14]			✓		✓
	Achankeng [68]	2004	✓	✓		
	Manga and Forton [69]	2008	✓	✓		✓
	Cameroon Vision 2035 [70]	2009		✓		
	Countries in the world by population [47]	2020			✓	
	Chia [71]	2015			✓	
	Desmet and Parente [72]	2010			✓	
	Scrap Monster [73]				✓	
	The World Bank, Doing Business [74]	2020				✓
	BTI Cameroon Country Report [75]	2020				✓
	Trading Economics [76]					✓
	The World Bank in Cameroon [77]	2019				✓
	Africa Center for Strategic Studies [78]	2018				✓
	Index of Economic Freedom [79]	2020			✓	
Kenya	Muiruri [9]	2014		✓		
	Draft National e-waste management strategy [80]	2019	✓			
	National sustainable waste management policy, revised draft [81]	2019	✓	✓		
	Draft National automotive policy [82]	2019	✓	✓		
	Countries in the world by population [47]	2020			✓	
	Tabitha [83]	2020			✓	
	The World bank Kenya [84]	2020				✓
	Trading Economics [85]					✓
	The World Bank, Doing Business [86]	2020				✓
	Waste Management Companies in Kenya. [87]				✓	

Table 2. *Cont.*

Countries	Sources	Year	Strengths	Weaknesses	Opportunities	Threats
Nigeria	Agbo [10]	2011	✓	✓	✓	
	Nathaniel and Rachael [88]	2017		✓		✓
	The World Bank, Doing Business [89]	2020				✓
	Center for the Study of the Economies of Africa [90]	2019				✓
	Tomola and Oladapo [91]	2016				✓
	Human Rights Watch [92]	2012				✓
	Bomes Resource Consulting [93]	2020				✓
	The World Bank, Doing Business [94]	2020				✓
	Countries in the world by population [47]	2020			✓	
	Waste and Recycling Companies in Nigeria [95]				✓	
Egypt	Scrapping and Recycling old vehicles in Egypt [10]	2015	✓			
	Harraz and Galal [96]	2011	✓	✓		✓
	Trading Economics [97]					✓
	The World Bank, Doing Business [98]	2020				✓
	Directorate-General for External Policies [99]	2018				✓
	Michele [100]	2020				✓
	Countries in the world by population [47]	2020			✓	
	Chia [71]	2015			✓	
	Desmet and Parente [72]	2010			✓	
	Waste and Recycling Companies in Egypt [101]				✓	
India	Arora et al. [18]	2019	✓	✓	✓	✓
	Naik [102]	2018	✓	✓	✓	✓
	Countries in the world by population [47]	2020			✓	
	Chia [71]	2015			✓	
	The World Bank, Doing Business [94]	2020				✓
	The Political Economy of Development in India since Independence [103]	2009				✓
	Kaushik [104]	2020				✓
Malaysia	Azmi et al. [17]	2013		✓		✓
	Yen [105]	2020				✓
	The World Bank, Doing Business [94]	2020				✓
	Shameem et al. [106]	2017	✓	✓	✓	
	Countries in the world by population [47]	2020			✓	
	Desmet and Parente [72]	2010			✓	
Mexico	Cruz-Rivera [19]	2007	✓	✓	✓	✓
	Cruz-Rivera and Ertel [107]	2009	✓	✓		✓
	Bomes Resource Consulting [93]	2020				✓
	The World Bank, Doing Business [94]	2020				✓
	The World Bank, Doing Business [108]	2020				✓
	Vargas-Hernandez [109]	2020				✓
	Nishino [110]	2016	✓			
	Countries in the world by population [47]	2020			✓	

Table 2. *Cont.*

Countries	Sources	Year	Strengths	Weaknesses	Opportunities	Threats
South Africa	Annexure [20]	2005	✓	✓	✓	✓
	Bomes Resource Consulting [93]	2020				✓
	The World Bank, Doing Business [111]	2020				✓
	Cilliers and Aucoin [112]	2016				✓
	Baskin [113]	2018	✓			
	South Africa's automotive industry [114]	2012	✓			
	Countries in the world by population [47]	2020			✓	

The results of the SWOT analysis revealed there were some common factors in the discussions on ELV recycling in the various scenarios in the eight countries subject to the analysis. These factors were rated for each country based on the information provided in the literature. The common strengths in the scenarios of the eight countries considered in this review were ELV legislation, waste management system, vehicle registration system, ELV recycling, and vehicle manufacturing (see Table S1). The common weaknesses were identified to be the waste regulatory framework, ELV collection, ELV recycling infrastructure, technological capacity, vehicle deregistration, environmental impact and pollution, and the lack of access to information regarding ELVs, and the ELV regulatory framework (see Table S2). In the case of opportunities, the common features were the large market size, recyclers of ELV parts, low labor cost, and the presence of an informal sector (see Table S3). The common threats were perceived as the little attention given to ELV recycling by the governing authorities, difficulty of doing business, and political and social instability. (see Table S4). The applicability of these categories was rated from 0 to 2 based on the findings from the literature review, where 0 is "none", 1 is "some", and 2 is "considerable". When a 0 rating is assigned, it implies the level of applicability of the feature is low in that country. Likewise, a rating of 1 indicates a moderate situation, and a rating of 2 indicates a high applicability of the feature in that country. For strengths, a higher rating indicates that the country is in a stronger position with regard to the recycling of ELVs. For opportunities, a higher rating equates to a greater opportunity. For weaknesses, the higher the rating, the greater the weakness. For threats, a higher rating equates to a greater threat. The review process of the SWOT analysis is summarized in Figure 2.

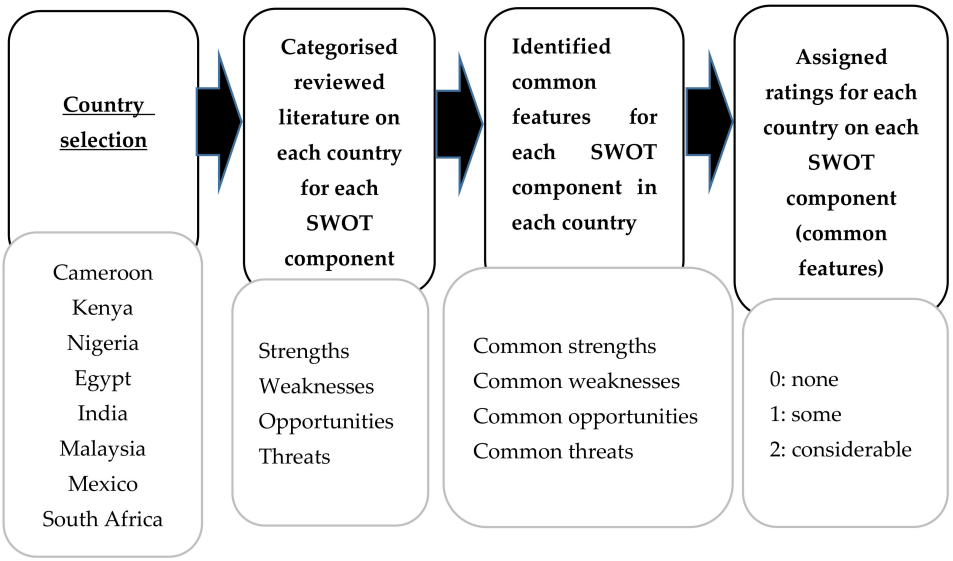

Figure 2. The Review Process of the SWOT Analysis.

3. Results

3.1. Results of the SWOT Analysis

3.1.1. Strengths

Legislation in Cameroon requires the Ministry of Environment, Nature Conservation and Sustainable Development (MINEP) to oversee waste issues by investigating pollution and requiring environmental impact studies [68,69]. Also, the Ministry of Territorial Administration and Decentralization (MINTAD) oversees the municipal councils responsible for the control of industrial waste, and other municipal solid wastes [69]. Kenya has a National Legislative and Regulatory Framework for Waste Management [80]. It is also bound by a number of international conventions and multilateral waste-management agreements which require clear national waste policies, and a proposal has been made for legislation regarding automotive waste [81,82]. Considering the large population of Nigeria, and its large economy, it is reasonable to assume that Nigeria has a considerable number of ELVs for recycling. Plus, it has been reported that Nigeria imports a large number of vehicles annually, most of them second-hand [10], which are barely roadworthy and reach the end of their useful lives after a short period of use. This ensures the supply of ELVs, which is a motivational factor for ELV recycling businesses to emerge and thrive, unlike when ELV numbers are relatively small and yet cause environmental pollution. In Egypt, cash rewards and loans are given to automobile owners, taxi owners in particular, to purchase new taxis which use natural gas with the aim of reducing the use of gasoline and fuel, and air pollution [12,96]. India has passed national legislation and has established automotive industry standards for ELVs (AIS 129). The Central Pollution Control Board (CPCB) Guidelines were prepared to provide guidance for the collection and dismantling of ELVs by authorized centers. Legislation has also been passed with regard to the disposal of hazardous waste and for the management of other types of waste: these laws provide a framework for dealing with ELVs. It should also be noted that India has a vehicle registration system, which makes the management of ELVs easier [18,102]. It has been reported that in Malaysia, a hub for the trade of vehicle used parts, the process for ELV deregistration is rather ineffective, but that there are some dismantling facilities where a small percentage of ELVs are recycled by small companies under the umbrella of the Malaysian Automotive Recyclers Association, although they often do not adhere to standard work practices [106]. Studies on Mexico show that ELVs are categorized as special waste under the General Law for the Prevention and Integral Handling of Waste (the LGPGIR) [19]. A number of scrap yards and body shops/repair businesses, which are mostly driven by market conditions, carry out ELV recycling for the recovery and sale of valuable components and materials, though the lack of standardization results in the improper management of ELVs [107]. Mexico is also regarded as a hub for the manufacturing and supply of automobiles to the NAFTA zone [110]. In an effort to reduce and manage waste in South Africa, South Africa implemented a The Memorandum of Agreement on Waste Tyres [20] and has banned the import of second-hand cars [113]. Since there are vehicle assembly plants in South Africa [114], efforts by the South African government to ensure so-called "Extended Producer Responsibility" are also expected to reduce the burden on the environment presented by non-recycled ELVs.

The SWOT analysis of strengths per country is shown in Figure 3. In this case, a higher rating indicates that the country is in a stronger position with regard to the recycling of ELVs. As vehicles are manufactured in India and Mexico, they have been rated 2 for this category. Also, Malaysia and South Africa have been rated 1.5 for this category, because of the assembling of vehicles and manufacturing of vehicle components in these countries. Along with South Africa, these countries have higher ratings, at 1.3, for their vehicle registration systems, 1 for ELV legislation and ELV recycling, based on the infrastructure in place in these countries, and 1.5 for waste management. Egypt was also assigned a rating of 1.5 in response to its cash reward initiative for buying low emission cars. As can be seen in Figure 3, Nigeria, Kenya, and Cameroon were assigned low ratings. The strengths

of developing countries classified as emerging economies, excluding Nigeria, were rated more highly than countries not considered to have emerging economies.

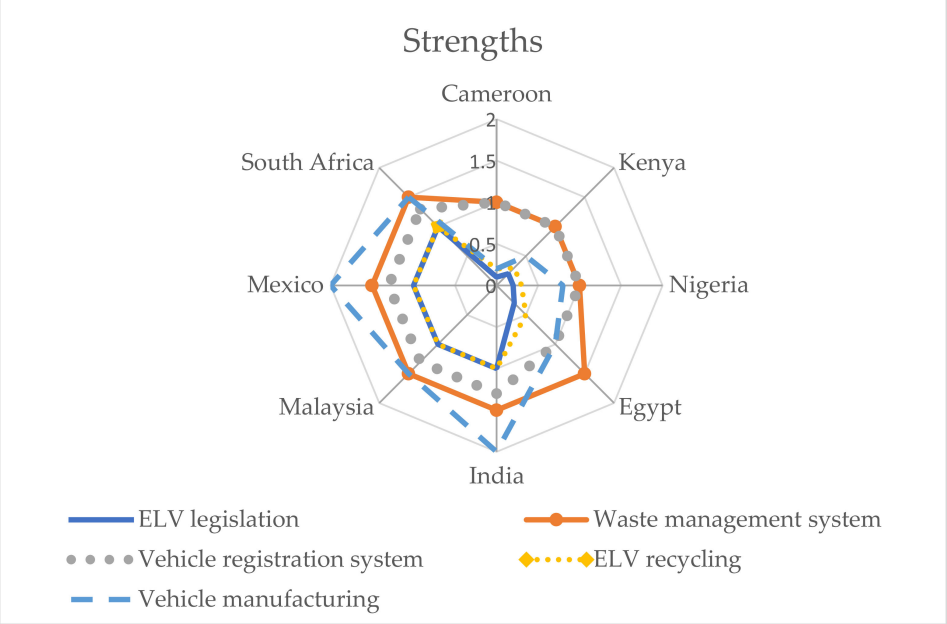

Figure 3. Strengths per country.

3.1.2. Weaknesses

The absence of a regulatory framework on ELV management and recycling was considered a serious weakness in this study. While this was found to be the case in Cameroon, a weak regulatory framework on municipal waste management ensures that a contractor, HYSACAM (a French acronym meaning hygiene and health in Cameroon), is responsible for waste collection and disposal in landfills, and other intermediate private company initiatives [14,69]. In an effort to be recognized as an emerging economy, Cameroon has indicated its intention to reduce greenhouse gases by 32% by the year 2035 (Vision 2035) [14,70]. Another weakness in Cameroon is that a large number of local garages and workshop dealers are involved in the improper dismantling of ELVs for the purpose of recovering reusable parts. Such improper dismantling often leads to leakages of oil and other hazardous substances into the soil and water bodies, resulting in more environmental pollution from ELVs. The abandoning of ELVs and illegal dismantling of these vehicles, with little recycling and unavailable information on ELVs, was also considered a weakness [14,69]. In the case of Kenya, the absence of vehicle deregistration, and regulations for ELV disposal and recycling are serious setbacks to the effective recycling of ELVs [11]. The technological capacity for recycling in Kenya is low, and the infrastructure for recycling is poor [82]. In reality, ELVs tend to be abandoned in police grounds, or left in garages or on empty lots [11]. Kenya is also threatened by environmental pollution and degradation due to the improper treatment of ELVs and hazardous substances [81]. As is the case in Cameroon, there is no recycling of ELVs, and information on ELVs is not available. There are no requirements for vehicle deregistration in Nigeria; as a result, the illegal scrapping and dismantling of ELVs are rife and vehicles are abandoned at construction sites and in urban areas [10]. Nigeria routinely outsources its industrial and technological needs to foreign countries [88]. As such it is reasonable to assume that the technological capacity for the recycling of EVs in Nigeria is also severely lacking. The high dependence on technology from other countries has contributed to the poor technological growth in Nigeria: this is considered a challenge for the recycling of ELVs along with the inadequate infrastructure for recycling ELVs [88]. As ELVs are abandoned and illegally dismantled largely by the informal sector, Nigeria also experiences environmental degradation and pollution from

ELVs [10]. Other weak points were noted among the emerging economies considered in this study. There is also no vehicle deregistration in Egypt, therefore, more than a quarter of the registered vehicles are over 30 years old [96]. Egypt also lacks the infrastructure required for ELV recycling. Owners of small sized workshops and scrap yards practice improper dismantling and recycling of ELV parts, resulting in environmental pollution due to leakages of oil and other harmful substances into the rivers and soil, and little information about ELVs available [96]. India does not have the regulatory framework required for the recycling of ELVs, and also has a poorly developed information management system [18]. Since the collection network is mostly informal, the dismantling is also informal, and there are insufficient shredder facilities to properly recycle the recovered metals [102]. In India, such environmental problems as water, land, and air pollution, are challenging, and there is no post shredder treatment available for recycling: information on ELVs is also unavailable [18,102]. In a study on Malaysia, it was revealed that the weak regulatory framework results in vehicles being used for extended periods of time, and in many cases being abandoned [106]. In Malaysia, the environmental pollution caused by recyclers not adhering to standard practices is considered a significant problem, along with environmental degradation from abandoned vehicles, overflowing landfill, and inadequate ELV recycling facilities [17]. In Mexico, regulations for the management of ELVs are sorely lacking. In addition, it has been reported that as a result of the preference for used vehicles, a considerable number of second-hand cars are imported from the United States, many with no registration number [19]. In another study, it was reported that the number of recycling businesses are unknown [107]. The challenges in Mexico are its lack of depollution measures and regulations for the management of hazardous waste [19,107]. Another problem is that the incidence of crime involving the usage of vehicles with no registration numbers imported from the United States is high [19]. This inhibits effective control of vehicles in use and even when these vehicles reach the end of their useful life. The availability of information regarding recyclers of ELV parts is also limited in Mexico [19,107]. Like Mexico, South Africa also has few regulations for the management of ELVs [20]. The number of recyclers of ELV parts are unknown, and the number of ELVs in the country is unknown. Likewise, there is limited information available on current ELV recyclers in South Africa. The improper de-pollution and hazardous waste released due to the illegal and improper dismantling by the informal sector has been identified as a problem in South Africa, and the drive towards extended producer responsibility reflects awareness of the need to address this problem urgently [20].

The results of the SWOT analysis with regard to weaknesses are shown in Figure 4. Here, a lower rating equates to a higher weakness except for environmental impact and pollution, and unavailability of information on ELVs, where a higher rating equates to a higher weakness. The technological capacity in Mexico, Malaysia, and India was the highest, at 1.5 considering their level of vehicle manufacturing and development. South Africa was rated 1, and Nigeria, Egypt, Kenya, and Cameroon were rated poorly. Among the developing countries, those acknowledged to be emerging economies had greater technological capacities for application to the recycling of ELVs. The recycling infrastructure in India, Malaysia, Mexico, and South Africa was 1, the ELV regulatory framework was rated at 0.8. This was followed by Egypt, Nigeria, Kenya, and Cameroon. In the case of the waste regulatory framework, South Africa, Mexico, and Malaysia were rated at 1.5, and India, Egypt, Nigeria, Kenya, and Cameroon were rated lower. The countries with emerging economies were rated at 0.9 for ELV collection, and Egypt was rating at 0.8, considering the cash reward incentive. The rating for Nigeria was 0.3, and Kenya and Cameroon were rated 0.2. The environmental impact and pollution due to ELVs were the worst in Cameroon, Kenya, and Nigeria due to the lack of ELV recycling. The environmental impact and pollution from ELVs were also shown to be a problem in Egypt, and the other emerging economies. Limited information on ELVs was a problem in all of the countries. South Africa and Egypt were rated well for their small efforts to extend producer responsibility and the cash incentives, respectively. All of the developing countries lacked a

requirement for the deregistration of ELVs. These results indicate that while the developing countries have many weaknesses, those with emerging economies were in a better position with regard to their potential to recycle ELVs.

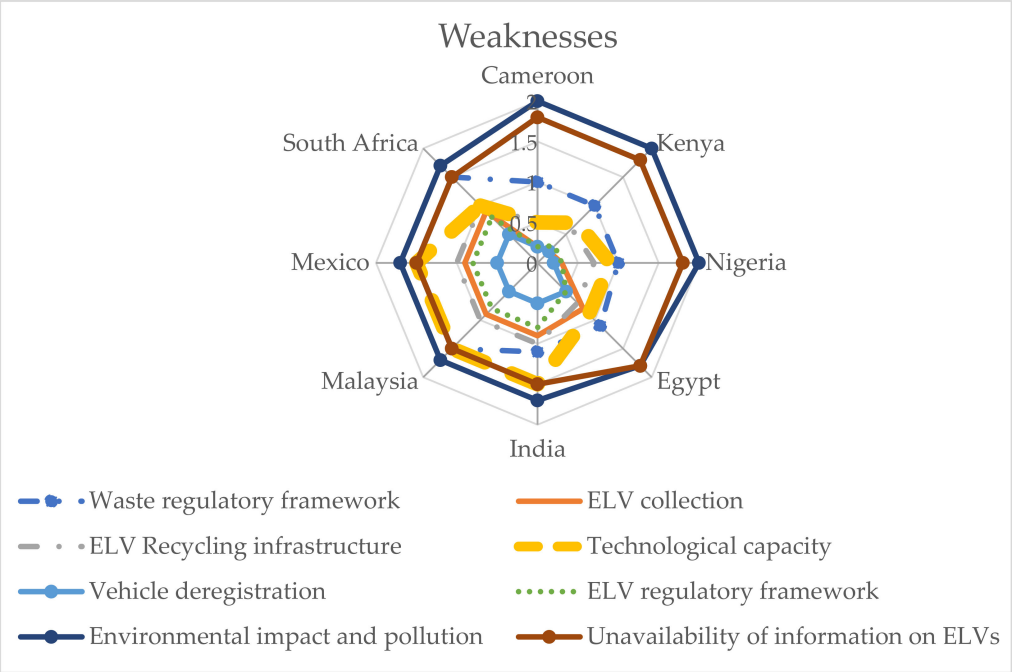

Figure 4. Weaknesses per country.

3.1.3. Opportunities

With regard to ELV management, the large population of Cameroon, at about 26 million inhabitants [47], is considered an opportunity given that larger populations are potentially larger markets [71,72]. There are also a number of companies engaging in the recycling of waste in Cameroon capable of recycling ELV parts and metal and plastic [73]. The low cost of labor in Cameroon is also considered an opportunity [79] as more people could be employed to facilitate ELV recycling in the country. The large population in Kenya is also a potentially large market, particularly because of the high demand for imported products [83]. It has also been reported that there are a number of ELV parts processing companies in Kenya in operation [87]. Due to the largely unskilled labor force in Kenya, there is a need to boost investment in human capital [83]. With about 206 million inhabitants, Nigeria has a large potential market [47]. A number of processing companies that deal in ELV parts can also be found in Nigeria [95]. Labour is cheap in Nigeria, as it is in other developing countries [6]. In Egypt, a number of companies engage in the processing of ELV parts [101]. The low cost of labor and market potential provided by its 102 million people are also considered opportunities [47,71,72]. India has legislation and guidelines for ELV recycling and has been reported to be making efforts to ensure extender producer responsibility [18]. In 2011, an ELV dismantling facility known as NATRIP was set up, indicating that India is taking action to address its ELV problem. The number of ELVs in India is projected to reach about 21 million by 2025 [115], and the size of the informal sector with basic technical know-how is also extremely large [18,102]. Another perceived opportunity for India is that an increase in demand for raw materials would likely result in an increase in the commodity prices of secondary raw materials, which would make future ELV recycling profitable [102]. The size of the potential market in India is reflected by its massive population of about 1.3 billion people [47,71]. In the emerging economies of Malaysia, Mexico, and South Africa, the opportunities for ELV recycling are as follows. The government of Malaysia has made steps towards implementing an ELV recycling policy, there are a number of companies already engaged in ELV recycling, and the used parts

market is well-established [106]. Like many other developing countries, the market size is potentially large, given its population of about 32 million people [47,72]. Like Malaysia, some companies in Mexico are engaged in the recycling of ELVs, and the market in Mexico is also larger, considering its population size of about 128 million inhabitants [47]. Like other developing countries, the cost of labor in Mexico is low [19]. A similar scenario was found for South Africa: some ELV recycling is underway, the potential market is large, [107], and labor is cheap [20].

The results of the SWOT analysis with regard to opportunities are shown in Figure 5. Here, the higher the rating, the greater the opportunity. Given its large population size, India was considered to have the highest opportunity rating, at 2 for its large market size and informal sector, and 1.5 for ELV parts recyclers. Egypt, Kenya, and Cameroon had low ratings of 0.8, and 0.7 for ELV parts recyclers, respectively. Since they have some companies engaging in the recycling of ELV parts, Nigeria, South Africa, Mexico, and Malaysia were considered to have greater opportunities. The potential market size was gauged by the population of the countries: India is seconded by Nigeria, and then Mexico, Egypt, South Africa, Kenya, Malaysia, and Cameroon. The scale of the informal sector was considered a valuable opportunity for all the countries, especially for India. Labor from the large informal sector could be used in a healthy and occupational safety approach, for deep dismantling of ELVs as a means to recover some high-quality materials such as glass, copper, batteries, aluminum, catalytic converters, and plastics [18]. The low cost of labor was considered a valuable opportunity for ELV investment in these countries. This is particularly true in Cameroon, where the cost of labor is the lowest. All countries were deemed to have considerable opportunities with regard to their potential for ELV recycling.

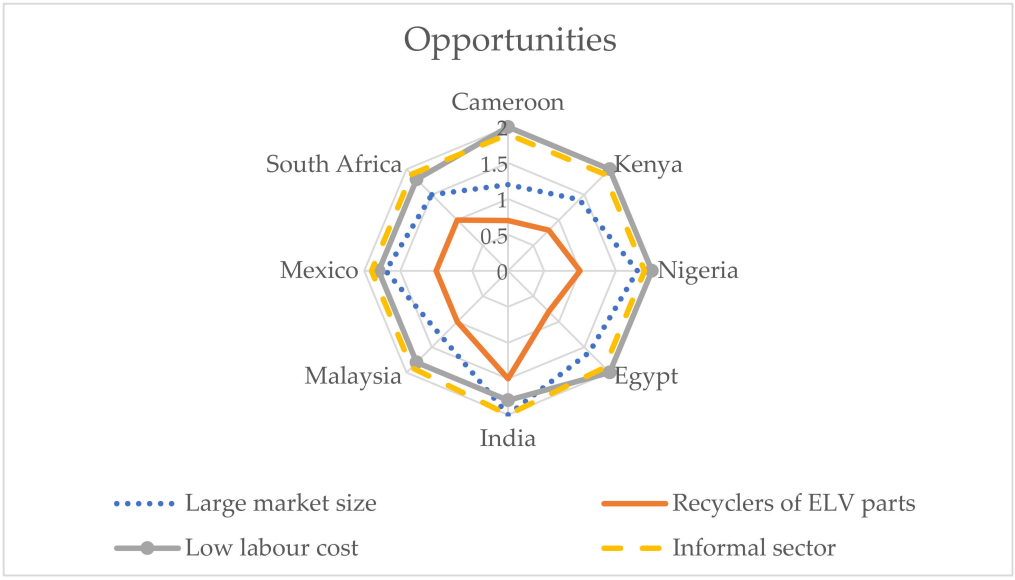

Figure 5. Opportunities per country.

3.1.4. Threats

The SWOT analysis revealed a number of threats that pose challenges to the recycling of ELVs in developing countries. One of the threats identified for Cameroon is the difficulty of doing business. The ease of doing business in Cameroon is lower than the average of CEMAC region, ranking 167 of 190 countries as per the 2020 report on the World Bank's Ease of Doing Business [74,75]. In this report, starting a business in Cameroon requires high capital cost (gross national income per capita) of about 24.6% for business permits coupled with lengthy procedures for registering a business. Also, propriety rights are unevenly ensured often leading to land disputes in some areas (rural areas) due to a corrupt judiciary and low registrations [75,76]. This shows a difficult business environment in Cameroon, unfavorable for ELV recycling businesses. In addition to the difficulty of

doing business, another threat for Cameroon is political and social instability. While the political atmosphere in Cameroon was relatively stable, the secessionist uprising and civil war "Ambazonia: The Anglophone Crisis" in Southern Cameroon since 2016, and violent attacks by Boko Haram in the Far North region of the country have led to the widespread instability [77,78]. An unstable political atmosphere with violent attacks is a threat to sustainable ELV recycling. The reported institutionally weak political parties with narrow social origins, coupled with the ranking of Cameroon as a lower middle-income country, has promoted inequality in socioeconomic development in the country [74,75].

According to a World Bank report on Kenya, the country has maintained a fairly stable political and social atmosphere, though the country still faces significant challenges such as overcoming poverty, vulnerability to shocks, climate change, inequality, and other key development indicators [84]. According to the World Bank, the ease of doing business in Kenya has improved from a rank of 61 in 2018 to 56 out of 190 countries in 2019 and 2020 [85,86]. This is evidence of progress in the business environment in Kenya, which is a favorable condition for ELV recycling businesses to thrive. Kenya is also a lower middle-income country [86].

Nigeria is also a lower middle-income country with an ease of doing business ranking of 131 out of 190 economies in 2020, which is the highest rank achieved by Nigeria in the past decade [89,90]. This shows a weakening business regulatory environment in Nigeria, inconducive for ELV recycling businesses. In a report by Tomola et al., the Nigerian economy has been experiencing political and social instability following the global financial crisis in 2008 [91], Boko Haram attacks in Central and Northern Nigeria, and security force abuses in the country [92]. This instability affects the Nigerian economy and is a threat to ELV recycling.

Egypt was ranked 114 out of 190 economies in 2019 and 2020, and it is classified as a lower middle-income country [97,98]. In 2018, the country was ranked 120, which implies the regulatory environment was more favorable for businesses in 2020 than it was a few years earlier [98]. Egypt has been experiencing political and social instability since its economic and political transition in 2011, when an Islamic insurgency and attacks on freedom of speech resulted in a return to authoritarianism, increased inequality, and youth unemployment [99,100].

In India, it is reported that social inequalities have been on a rise since 1990, impeding the social and economic development of the country [103]. It is also reported that the political system may well be the root cause of economic challenges in the country [104]. Also, the high investment cost in India is considered an impediment to the effective recycling of ELVs, and the lack of cooperation between local authorities and other stakeholders is also likely to impede progress [18]. Unlike Nigeria, with a low ranking but a noteworthy improvement in its ease of doing business in 2020, India was ranked 63, Mexico was ranked 60, South Africa was ranked 84, and Malaysia indicated friendlier business regulations with a rank of 12 out of 190 countries [93,94]. Malaysia, South Africa, and Mexico, which are upper middle-income countries, with Malaysia showing to have most conducive business regulation [94,108]. However, instability was reported in Malaysia following a fragile and unstable federal government [105]. In Mexico, there is social instability characterized by the illegal drug trade, high migration and crime waves, political instability stemming from corruption and illegitimacy of its political players, and declining global relevance [109]. The ranking for ease of doing business in South Africa was an overall 84 [111], and the increase in political and social instability is reflected in inequality, unemployment, and poverty [112]. The abandoning of ELVs and illegal dismantling of these vehicles in these countries, with little recycling and unavailable information on ELVs are considered the result of too little attention being paid to recycling by the governing authorities. ELV recycling requires cooperation with such state authorities as the transport and environmental authorities to ensure surrendering of ELVs, deregistration, data on available ELVs, and other information required for a successful implementation of ELV recycling. The reported political and social instability is a threat to ELV recycling.

The results of the SWOT analysis with regard to the threats are shown in Figure 6. In this case, a higher rating equates to a higher threat. The lack of attention to ELV recycling by the governing authorities was the most problematic in Cameroon, Kenya, and Nigeria, followed by Egypt. Political and social instability was also high for Cameroon and Nigeria, and the difficulty of doing business was very high in Cameroon, Nigeria, and Egypt. Kenya followed these countries. Meanwhile, Mexico, Malaysia, and India were rated fairly for their lack of attention to ELV recycling, political and social instability, and difficulty of doing business. Malaysia was shown to have the most favorable business regulation with its low rate of difficulty of doing business. In the category of "Threats", all countries were shown to be susceptible to specific threats identified.

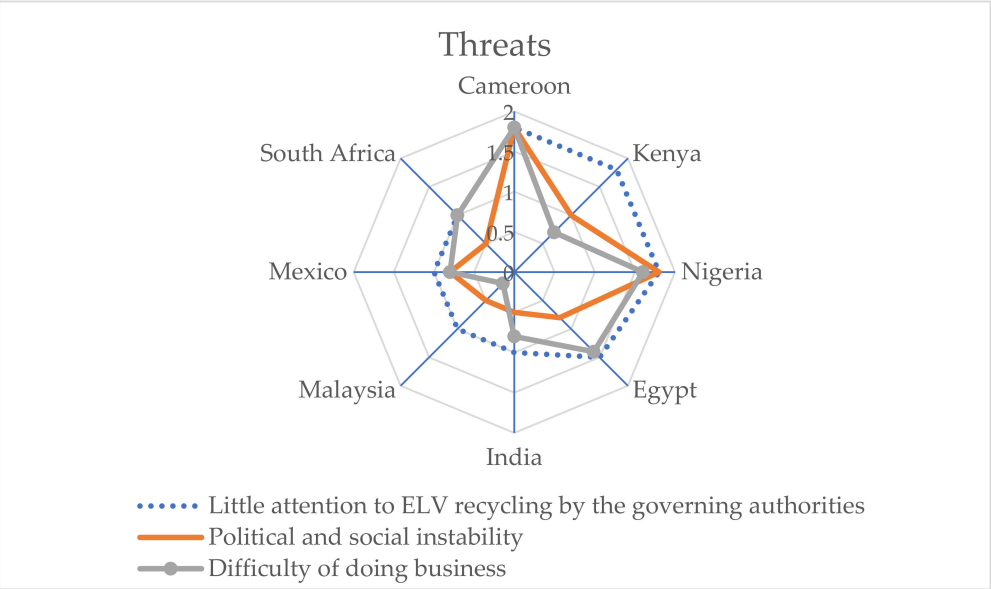

Figure 6. Threats per country.

4. Discussion

The results of the SWOT analysis show that the recycling of ELVs in developing countries involves certain weaknesses and threats, and also includes valuable opportunities and strengths. The poor policy in these countries is a problem hindering the recycling of ELVs [14], unlike in the EU where through the ELV Directive, member states have taken initiatives on implementing ELV recycling and to address other ELV related concerns [6,7]. In these developing countries, vehicle deregistration is not a requirement. This makes the collection of ELVs challenging, though these countries have some underdeveloped systems of municipal solid wastes collection [69,81]. Through the SWOT analysis, the strengths, opportunities, weaknesses, and threats of eight developing countries were identified with regard to the task of recycling ELVs. Five of these developing countries have been categorized as emerging economies. The ELV challenges were reflected in the analysis of weaknesses and threats, while opportunities were reflected in the strengths and opportunities. However, the weaknesses and threats could be avenues for greater ELV recycling opportunities in these countries if appropriate measures are taken to address them, such as implementing policies to regulate ELV recycling. These could include the introduction of an African ELV Directive to promote ELV recycling country initiatives following the implementation of this directive, as is the case with the EU Directive on ELV [4,6]. Strengths and opportunities indicate positive characteristics, while weaknesses and threats are negative characteristics regarding the recycling of ELVs in these countries.

The SWOT analysis of the developing countries indicated some similarities and differences in these countries. Cameroon, Kenya, and Nigeria were assigned lower ratings in all categories of strengths, weaknesses except for environmental impact and pollution, and unavailability of information on ELVs. This indicates that these countries have more

weaknesses and fewer strengths in ELV recycling. On the other hand, Egypt was rated more highly after considering its cash award incentive, which results in lower environmental impact and less pollution. Mexico and India are rated high for their vehicle manufacturing. This is an indication of their high technological capacities. The same goes for Malaysia and South Africa, though they are rated a little lower due to their vehicle assembling. With regard to weaknesses, the environmental impact and pollution, and unavailability of information on ELVs were rated high for all countries. With regard to opportunities, Nigeria was rated highly for its large population and potential market size, large informal sector, and recyclers of ELV parts. The large informal sector practice of improper dismantling of ELVs has a high environmental impact and pollution in Nigeria. Cameroon was also shown to have the lowest labor cost, which is a valuable opportunity for ELV recycling businesses. The opportunities were considerable for all countries, though their weaknesses were high and their strengths were low. With regard to the threats, these countries indicated high vulnerability to threats. Because of the high political and social instability in Cameroon and Nigeria, as well as the higher difficulty of doing business, the business environments are less friendly. This also makes it challenging for these countries to implement effective ELV collection and regulatory frameworks. Egypt and Kenya have fairly stable and favorable business regulatory environments. Mexico, Malaysia, India, and South Africa also have more friendly business environments, Malaysia showing the most favorable business environment. The political and social conditions are fairly stable in Mexico, Malaysia, India and South Africa compared to the other developing countries. However, they are all vulnerable to threats.

The results of the SWOT analysis indicate that the strengths of the emerging economies, including India, Mexico, Malaysia, and South Africa, tended to be greater, and the weaknesses were less pronounced than those in Nigeria and the other developing countries in this study. The opportunities were considerable and the threats were significant for all of the countries considered in this study. The two-by-two matrix provided by the SWOT analysis indicates that weaknesses must be overcome to take advantage of the opportunities and weaknesses should be prevented to avoid vulnerability to threats. Also, by utilizing the strengths it would be possible to reduce the susceptibility to threats. In this way, it should be possible to make the opportunities strengths. It should be acknowledged that allocating traits to categories in the SWOT analysis was not straightforward. Some features in threats, such as little attention to recycling, could also be classified as weaknesses. Likewise, some features in opportunities, such as the presence of recyclers of ELV parts, informal sector, could be classified under strengths or weaknesses. Labor from the large informal sector in these countries could be used in a healthy and occupational safety approach, for deep dismantling of ELVs as a means to recover some high-quality materials. On the other hand, a large informal sector with often lacking safety and environmental standards could result in more pollution of the environment through improper recycling/dismantling of ELVs for parts recovery. In addition, without advanced cleaner technologies, high-value materials, including platinum in catalytic converters, copper wires, could remain unrecovered [18].

Before embarking on programs to ensure the recycling of ELVs in these countries or other countries with similar features, these strengths, opportunities, weaknesses, and threats need to be considered. The results of the SWOT analysis on ELV recycling in these countries show the suitability of this method as a tool for identifying the environmental and organizational factors in a given scenario, where weaknesses and strengths are internal factors, and threats and opportunities are external factors. Developing and emerging countries face enormous challenges and opportunities in the future task of recycling ELVs. It is important for governments and ELV businesses to address these challenges and devise strategies to ensure the success and growth of their economies. The ease of doing business, political and social instability, are shown to be important in actualizing the implementation of ELV recycling. In the analysis of threats, these countries have political and social instability, rated highest for Cameroon and Nigeria. Likewise, Cameroon and Nigeria show to be more difficult with starting a business, whereas Malaysia has a more business friendly

environment [94]. This indicates that it would be easier for ELV recycling businesses to thrive in Malaysia than in Cameroon and Nigeria.

The absence of regulations and guidelines for the recycling of ELVs in developing countries is a major setback resulting in environmental pollution [81]. The lack of information available about ELVs in developing countries reflects the lack of attention paid to the importance of ELV recycling by the governing authorities. Governments need to be aware that the proper management and recycling of ELVs is vital to reduce environmental impact and pollution, and also to boost economic activities and growth in their respective countries, through the establishment of ELV recycling facilities and increased employment to facilitate ELV recycling This could solve some of the challenges such as ELV abandonment at police yards in Kenya, construction sites in Nigeria, and other illegal disposal and abandonment of ELVs [11]. When the governing authorities pay little attention to ELV recycling, it is reasonable to assume that the public also pays little attention to the proper treatment of ELVs, which makes it difficult for the population to understand the importance of stopping the improper disposal of ELVs, the improper dismantling ELVs for parts recovery, and abandoning ELVs [10].

An understanding of the challenges to the effective recycling of ELVs will serve as the basis for implementing the necessary laws and regulations and establishing the necessary infrastructure to overcome the ELV recycling barriers. Only then can a high rate of ELV collection be achieved and reprocessing efficiency be realized. Once such an infrastructure is in place, it is reasonable to expect to see a rapid decline in the improper management of ELVs by the informal sector and the promotion of the adoption of proper ELV recycling steps and procedures [25,26], as shown in the flow chart for ELV processing. The many benefits of ELV recycling include a much healthier environment, a market for the secondary materials recycled from ELVs, and employment opportunities. Resource recovery is also a benefit from the recycling of ELVs. Vigano et al. reported the recovery of energy and material, from recycling ASR [38], and ASR is generated during the recycling process of ELVs as shown in Figure 1. These resources could be used to promote ELV recycling and other manufacturing industries such as the thermal recycling of rubber crumbs from ELVs in such processes as cement calcination in the cement industry, metal refining, and electricity generation in Japan [29]. It is possible that first-hand information achieved through a survey would allow for a more detailed understanding of the issues in the countries subject to analysis in this study. However, the SWOT analysis allowed the scenarios in these countries to be compared through common themes. It should also be noted that the ratings were based on the information provided in the literature. Given the limited information available on the situation in these countries, it is possible that the SWOT analysis may not be completely up to date given that some references are dated [19,68,70,103,107]. In addition, the categories for analysis were based on the features considered in the literature. Other categories, such as the legal environment, funding may also be valid for considering the scenario for the recycling of ELVs. While the SWOT analysis has its limitations such as its inability to rank factors and fully assess the decision-making process, it was adopted for use in this study due to its many advantages and wide applicability in improving decision making for complex and important circumstances [42]. The understanding of ELV recycling challenges and opportunities can be improved by considering other methods and approaches and by including more countries [8,9,16].

5. Conclusions

We have performed a SWOT analysis on ELV recycling by reviewing the structure of eight developing countries and emerging economies to identify the challenges and opportunities for ELV recycling in these countries. We showed that ELV recycling opportunities were considerable and the threats were significant for both developing countries and emerging economies. The strengths tended to be greater for developing countries with emerging economies, while weaknesses were significant in the other developing countries, though Nigeria also showed significant weaknesses. The SWOT analysis showed

how developing countries are lagging in the recycling of ELVs, though there are valuable opportunities for recycling ELVs. The greatest challenge is poor policies and, in most cases, the absence of ELV management policy especially in countries like Cameroon. The challenges of recycling ELVs were captured in the analysis of weaknesses and threats, and the opportunities were captured in the analysis of strengths and opportunities. With these countries lacking in terms of ELV recycling, the SWOT analysis is an important tool to facilitating the analysis and knowledge on strengths, weaknesses, opportunities, and threats for effective implementation of ELV recycling in these countries and other countries with similar contexts. The establishment of proper ELV recycling systems will reduce environmental impact and pollution, and also provide a vital source of secondary raw materials for use in industry. In addition, there is a need for cooperation between the governments, ELV recycling businesses, the public, and other stakeholders, for effective recycling of ELVs. Like developed countries, which are making significant progress with the recycling of ELVs, it is necessary for developing countries to also engage in this activity to reduce environmental concerns and facilitate effective resource recovery and utilization. One of the promising trends identified is that the principle of extended producer responsibility is gaining ground in developing countries. To govern ELV recycling, laws and regulations which adhere to international standards need to be enacted in developing countries. By referring to the well-established systems in Japan and European Union, developing countries have great potential to provide valuable secondary materials through the recycling of ELV waste, develop their markets, and provide jobs by effectively recycling ELVs.

The main problem faced by the ELV recycling businesses in emerging and developing countries is how to collect and manage the ELVs through systematic reprocessing steps in order to maximize economic benefits from the recovery of materials and parts/components while fulfilling the environmental regulations. This study presented the findings based on automobile recycling in these countries, the management strategy adopted by each of those countries, an efficient ELV management system, and ELV management limitations. The findings suggest that more research on the financing of sustainable ELV management and the costs involved, as well as energy requirements, need to be carried out in order to accurately quantify the economic and environmental benefits of ELV recycling. Once ELV policies and regulatory frameworks have been introduced in these countries, a proper collection and recycling of ELVs should ensue. In addition, periodic monitoring by the regulatory or governing authorities is necessary to assess and regulate the environmental impacts of ELV recycling, and also to reevaluate ELV policies and the business regulatory environment. By addressing their environmental concerns, including those related to ELVs, developing countries will see advances in efforts to achieve a number of UN SDGs, including sustainable cities and communities.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/su13094918/s1, Table S1: SWOT-Strengths per country, Table S2: SWOT-Weaknesses per country, Table S3: SWOT-Opportunities per country, Table S4: SWOT-Threats per country.

Author Contributions: S.A.N.: She is the first and corresponding author of this research. She contributed to the conceptualization and investigation of this research, writing the original draft, review and editing, research methodology, and formal analysis of this research. G.B.O.: He is the second author of this research. He contributed to the conceptualization, methodology, and formal analysis, writing the original draft and investigation of this research. Z.Z.: She is the third author of this research. She contributed to the methodology, structuring, and revision of this research. K.M.: She is the fourth author and supervisor of this research. She contributed to funding acquisition, review and editing, validation, and overall administration of this research. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Japan Society for the Promotion of Science (KAKENHI 18H04147, 20H00648, 21K17918).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Acknowledgments: The authors acknowledge Kaiho Industry Co., Ltd for providing the collaborative platform to conduct this research. The authors also acknowledge valuable insights from UNIDO report on development of recycling industries within the UNIDO circular economy approach (Vienna 2019).

Conflicts of Interest: The authors declare no conflict of interest. The sponsors had no role in the design, execution, interpretation, or writing of the study.

References

1. Kosacka-Olejnik, M. How manage waste from End-of-Life Vehicles?—Method proposal. *IFAC* **2019**, *52*, 1733–1737. [CrossRef]
2. Despeisse, M.; Kishita, Y.; Nakano, M.; Barwood, M. Towards a circular economy for end-of-life vehicles: A comparative study UK–Japan. *Procedia CIRP* **2015**, *29*, 668–673. [CrossRef]
3. European Commission Environment. End of Life Vehicles. Available online: https://ec.europa.eu/environment/waste/elv/index.htm#:~{}:text=Directive%202000%2F53%2FEC%20(,the%20ELVs%20and%20their%20components (accessed on 7 April 2021).
4. European Parliament and Council. Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles. *Off. J. Eur. Communities* **2000**, *5*, 34–43.
5. Rovinaru, F.I.; Rovinaru, M.D.; Rus, A.V. The Economic and Ecological Impacts of Dismantling End-of-Life Vehicles in Romania. *Sustainability* **2019**, *11*, 6446. [CrossRef]
6. United States Environmental Protection Agency. Recycling and Resuse: End-of-Life Vehicles and Producer Responsibility. Available online: https://archive.epa.gov/oswer/international/web/html/200811_elv_directive.html (accessed on 7 April 2021).
7. Agence de l'Environnement et de la Maitrise de l'Energie. Annual Report the End-of-Life Vehicle Observatory Report. 2017. Available online: https://www.ademe.fr/sites/default/files/assets/documents/automotive-end-life-vehicles-data-2017-report.pdf (accessed on 7 April 2021).
8. United Nations Conference on Trade and Development. Country Classification. Available online: https://unctadstat.unctad.org/en/classifications.html (accessed on 7 April 2021).
9. United Nations. World Economic Situation Prospects. Country Classification. New York. 2020. Available online: https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/WESP2020_Annex.pdf (accessed on 7 April 2021).
10. Agbo, C.O.A. Recycle materials potential of imported used vehicles in Nigeria. *Niger. J. Technol.* **2011**, *30*, 118–128.
11. Muiruri, J.K. The magnitude of unclaimed end of life vehicles and environmental implications in police stations' yards: A case study of Nairobi, Kenya. *Am. J. Environ. Prot.* **2014**, *3*, 51–58. [CrossRef]
12. The World Bank. Scrapping and Recycling Old Vehicles in Egypt. 2015. Available online: https://www.worldbank.org/en/results/2015/08/12/scrapping-recycling-old-vehicles-egypt#:~{}:text=The%20Egypt%20Vehicle%20Scrapping%20and,toward%20the%20purchase%20of%20new (accessed on 7 April 2021).
13. Springborg, R. Egypt's economic transition: Challenges and prospects. In *Combining Economic and Political Development*; Graduate Institute Publications: Geneva, Switzerland; Brill Nijhoff: Boston, MA, USA, 2017; pp. 184–210.
14. Global Recycling. The Magazine for Business Opportunities and International Markets. Available online: https://global-recycling.info/archives/2304 (accessed on 7 April 2021).
15. International Financial Corporation. World Bank Group. Emerging Markets: Assessment of Hard-Currency Bond Market. An Analysis of Emerging market Hard-Currency Bonds Issued by Financial Institutions. Available online: https://www.ifc.org/wps/wcm/connect/5a9d3ade-1c10-4e19-8250-ef9c2e41311f/Assessment+of+EM+Hard-Currency+Bond+Market+June+2020+Final+June+10%2C+2020.pdf?MOD=AJPERES&CVID=nawl7r0 (accessed on 7 April 2021).
16. International Monetary Fund. World Economic Outlook Update. January 2021. Available online: https://www.imf.org/en/Publications/WEO/Issues/2021/01/26/2021-world-economic-outlook-update (accessed on 7 April 2021).
17. Azmi, M.; Mat Saman, M.Z.; Sharif, S.; Zakuan, N.; Mahmood, S. Proposed framework for end-of-life vehicle recycling system implementation in Malaysia. In Proceedings of the 11th Global Conference on Sustainable Manufacturing, Berlin, Germany, 23–25 September 2013. [CrossRef]
18. Arora, N.; Bakshi, S.K.; Bhattacharjya, S. Framework for sustainable management of end-of-life vehicles management in India. *J. Mater. Cycles Waste Manag.* **2019**, *21*, 79–97. [CrossRef]
19. Cruz-Rivera, R. Implementation of end-of-life vehicle's recycling for developing countries: Case study, Mexico. Ph.D. Thesis, Brandenburg Technical University, Brandenburg, Germany, 2007.
20. Annexure, H. National Waste Management Strategy Implementation South Africa. 2005. Available online: https://www.gov.za/sites/default/files/gcis_document/201409/wastestrategyinceptionrephase0.pdf (accessed on 26 April 2021).
21. Nwachukwu, M.A.; Feng, H.; Achilike, K. Integrated studies for automobile wastes management in developing countries; in the concept of environmentally friendly mechanic village. *Environ. Monit. Assess.* **2011**, *178*, 581–593. [CrossRef]
22. Development of Recycling Industries within the UNIDO Circular Economy Approach. UNIDO. Vienna. 2019. Available online: https://www.unido.org/sites/default/files/files/201907/Development%20of%20recycling%20industries%20within%20the%20UNIDO%20circular%20economy%20approach.pdf (accessed on 7 April 2021).
23. Urama, K.; Muchie, M.; Twingiyimana, R. East and Central Africa; UNESCO Science Report. Available online: https://en.unesco.org/sites/default/files/usr15_east_and_central_africa.pdf (accessed on 7 April 2021).

24. World Trade Organization. Trade Policy Review: Southern African Customs Union, Namibia, Botswana, Eswatini, South Africa and Lesotho. WTO. 2015. Available online: https://www.wto.org/english/tratop_e/tpr_e/tp424_crc_e.htm#:~{}:text=The%20recent%20global%20economic%20crisis,highly%20vulnerable%20to%20external%20shocks (accessed on 7 April 2021).
25. Egypt Today News Magazine. Egypt is Turning into Africa's Top Tech Hub, Report. 2020. Available online: https://www.egypttoday.com/Article/1/81297/Egypt-is-turning-into-Africa%E2%80%99s-top-tech-hub-report (accessed on 7 April 2021).
26. Market Classification. MSCI. Available online: https://www.msci.com/market-classification (accessed on 7 April 2021).
27. Chen, K.; Huang, S.; Lian, I. The development and prospects of the end-of-life vehicle recycling system in Taiwan. *Waste Manag.* **2010**, *30*, 1661–1669. [CrossRef]
28. Hedayati, M.; Subic, A. A framework for extended end-of-life vehicle (ELV) recovery rate based on a sustainable treatment option. *Int. J. Sustain. Des.* **2011**, *1*, 381–401. [CrossRef]
29. Japan for Sustainability. The Recycling of End-of-Life Vehicles in Japan. Available online: https://www.japanfs.org/sp/en/news/archives/news_id027816.html (accessed on 7 April 2021).
30. Ministry of Economy, Trade and Industry. End-of-Life vehicle Recycling Law. Japan. Available online: https://www.meti.go.jp/policy/recycle/main/english/law/end.html (accessed on 7 April 2021).
31. AIS Committee 2015: Automotive Industry Standard. End-of-Life Vehicles. Available online: https://araiindia.com/hmr/Control/AIS/35201550654PMAIS-129_F.pdf (accessed on 7 April 2021).
32. Kenya Gazette Supplement. Acts 2015. Available online: https://www.industrialization.go.ke/images/downloads/Policies/Scrap_Metal_Act_2015_No1_of_2015.pdf (accessed on 7 April 2021).
33. Santini, A.; Passarini, F.; Vassura, I.; Serrano, D.; Dufour, J.; Morselli, L. Auto shredder residue recycling: Mechanical separation and pyrolysis. *Waste Manag.* **2012**, *32*, 852–858. [CrossRef]
34. Tian, J.; Ming, C. Sustainable design for automotive products. Dismantling and recycling of end-of-life vehicles. *Waste Manag.* **2014**, *34*, 458–467. [CrossRef]
35. Sakai, S.I.; Yoshida, H.; Hiratsuka, J.; Vandecasteele, C.; Kohlmeyer, R.; Rotter, V.S.; Passarini, F.; Santini, A.; Peeler, M.; Li, J.; et al. An international comparative study of end-of-life vehicle (ELV) recycling systems. *J. Mater. Cycles Waste Manag.* **2014**, *16*, 1–20. [CrossRef]
36. CALRECYCLE. Thermochemical Conversion Procesess. California's Department of Resources Recycling and Recovery (CalRecycle) 2011. Available online: http://www.calrecycle.ca.gov/organics/conversion/Pathways/ThermoChem.htm (accessed on 7 April 2021).
37. Jenseit, W.; Stahl, H.; Wolny, V.; Wittlinger, R. Recovery Options for Plastics Parts from End-of-Life Vehicles: An Eco-Efficiency Assessment. Institute for Applied Ecology. 2003. Available online: Social-lca.net/oekodoc/151/2003-039-en.pdf (accessed on 7 April 2021).
38. Viganò, F.; Consonni, S.; Grosso, M.; Rigamonti, L. Material and energy recovery from Automotive Shredded Residues (ASR) via sequential gasification and combustion. *Waste Manag.* **2010**, *30*, 145–153. [CrossRef]
39. Vermeulen, I.; Jo, V.C.; Chantal, B.; Jan, B.; Carlo, V. Automotive shredder residue (ASR): Reviewing its production from end-of-life vehicles (ELVs) and its recycling, energy or chemicals' valorisation. *J. Hazard. Mater.* **2011**, *190*, 8–27. [CrossRef]
40. Serrona, K.R.; Yu, J.S.; Che, J. Managing wastes in Asia: Looking at the perspectives of China, Mongolia and the Philippines. *Waste Manag.* **2010**, 155–172. [CrossRef]
41. Gürel, E.; Tat, M. SWOT analysis: A theoretical review. *J. Int. Soc. Res.* **2017**, *10*, 994–1006. [CrossRef]
42. Teimoori, D.; Alinezhad, A. Organizational Sustainable Competitive Advantage using ORESTE, TRIZ, SWOT Approaches in Gray Conditions. *Iran. J. Optim.* **2019**, *11*, 85–96.
43. Nyarku, K.; Agyapong, G. Rediscovering SWOT analysis: The extended version. *Acad. Leadersh. Online J.* **2011**, *9*, 28.
44. Santander Trade Markets. Cameroonian Economic Outline. Available online: https://santandertrade.com/en/portal/analyse-markets/cameroon/economic-outline (accessed on 7 April 2021).
45. International Monetary Fund. World Economic Outlook Database October 2020. Available online: https://www.imf.org/en/Countries/CMR (accessed on 7 April 2021).
46. Global Finance. Countries with Highest GDP Growth 2020. Available online: https://www.gfmag.com/global-data/economic-data/countries-highest-gdp-growth (accessed on 7 April 2021).
47. Countries in the World by Population. Worldometer. 2020. Available online: https://www.worldometers.info/world-population/population-by-country/ (accessed on 7 April 2021).
48. List of Countries by Vehicles per Capita. Available online: https://en.wikipedia.org/wiki/List_of_countries_by_vehicles_per_capita (accessed on 7 April 2021).
49. Landsprofiler Kenya: Economic and Political Overview. Available online: https://www.nordeatrade.com/no/explore-new-market/kenya/economical-context (accessed on 7 April 2021).
50. CEIC. Kenya Road Transport: No of Motor Vehicles: Registered from 2004 to 2018. Available online: https://www.ceicdata.com/en/kenya/road-transport-number-of-motor-vehicles-registered/road-transport-no-of-motor-vehicles-registered (accessed on 7 April 2021).
51. Landsprofiler Nigeria: Economic and Political Overview. The Economic Context of Nigeria. Available online: https://www.nordeatrade.com/se/explore-new-market/nigeria/economical-context (accessed on 7 April 2021).

52. International Monetary Fund. World Economic Outlook Database January 2021. Available online: https://www.imf.org/en/Countries/NGA (accessed on 7 April 2021).
53. Country Profile Egypt: Economic and Political Overview. Available online: https://www.nordeatrade.com/en/explore-new-market/egypt/economical-context?#:~{}:text=According%20to%20IMF%20estimates%2C%20GDP,2019%20to%203.5%25%20in%202020.&text=In%20its%20most%20recent%20January,%2B0.5%25%20in%202022) (accessed on 7 April 2021).
54. International Monetary Fund. World Economic Outlook Database January 2021. Available online: https://www.imf.org/en/Countries/EGY (accessed on 7 April 2021).
55. The World Bank. GDP (Current USD)-India. Available online: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=IN (accessed on 7 April 2021).
56. Santander Trade Markets. India: Economic and Political Outline. Available online: https://santandertrade.com/en/portal/analyse-markets/india/economic-political-outline (accessed on 7 April 2021).
57. International Monetary Fund. World Economic Outlook Database January 2021. India. Available online: https://www.imf.org/en/Countries/IND (accessed on 7 April 2021).
58. Statistica. India: Inflation Rate from 1985 to 2025. Available online: https://www.statista.com/statistics/271322/inflation-rate-in-india/ (accessed on 7 April 2021).
59. Statistica. Number of Vehicles in Operation Across India from Fiscal Year 1951 to 2017. Available online: https://www.statista.com/statistics/664729/total-number-of-vehicles-india/ (accessed on 7 April 2021).
60. International Monetary Fund. World Economic Outlook Database January 2021. *Malaysia.* Available online: https://www.imf.org/en/Countries/MYS#countrydata (accessed on 7 April 2021).
61. Santander Trade Markets. Malaysia: Economic and Political Outline. Available online: https://santandertrade.com/en/portal/analyse-markets/malaysia/economic-political-outline (accessed on 7 April 2021).
62. Santander Trade Markets. Mexico: Economic and Political Outline. Available online: https://santandertrade.com/en/portal/analyse-markets/mexico/economic-political-outline (accessed on 7 April 2021).
63. The World Bank. GDP (Current USD)-Mexico. Available online: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=MX (accessed on 7 April 2021).
64. International Monetary Fund. World Economic Outlook Database January 2021. Mexico. Available online: https://www.imf.org/en/Countries/MEX (accessed on 7 April 2021).
65. Statistica. Number of Motor Vehicles in Circulation in Mexico between 1980 and 2019. Available online: https://www.statista.com/statistics/698065/vehicles-in-operation-in-mexico/ (accessed on 7 April 2021).
66. Statistica. South Africa: Gross Domestic Product (GDP) in Current Prices from 1985 to 2025. Available online: https://www.statista.com/statistics/370513/gross-domestic-product-gdp-in-south-africa/ (accessed on 7 April 2021).
67. Santander Trade Markets. South Africa: Economic and Political Outline. Available online: https://santandertrade.com/en/portal/analyse-markets/south-africa/economic-political-outline (accessed on 7 April 2021).
68. Achankeng, E. Sustainability in Municipal Solid Waste Management in Bamenda and Yaounde, Cameroon. Ph.D. Thesis, University of Adelaide, Adelaide, Australia, 2004.
69. Manga, V.E.; Forton, O.T.; Read, A.D. Waste management in Cameroon: A new policy perspective? *Resour. Conserv. Recycl.* **2008**, *52*, 592–600. [CrossRef]
70. Ministry of the Economy, Planning and Regional Development. Cameroon Vision 2035. 2009. Available online: https://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/laws/1816.pdf (accessed on 7 April 2021).
71. Chia, Y.M. Population, More People Bigger Market and More Options. The Straits Times, Business Economy. 2015. Available online: https://www.straitstimes.com/business/economy/population-more-people-bigger-market-more-options#:~{}:text=%22A%20larger%20population%20will%20provide,bigger%20market%20and%20more%20talent.&text=To%20make%20a%20larger%20population,transport%2C%20can%20handle%20larger%20volumes (accessed on 7 April 2021).
72. Desmet, K.; Parente, S.L. Bigger is better: Market size, demand elasticity, and innovation. *Int. Econ. Rev.* **2010**, *51*, 319–333. [CrossRef]
73. Scrap Dealers Wanted. Scrap Monster. Available online: https://www.scrapmonster.com/companies/scrap-metal-recycling/country/cameroon/397 (accessed on 7 April 2021).
74. The World Bank. Doing Business, Measuring Business Regulations. Ease of Doing Business in Cameroon. 2020. Available online: https://www.doingbusiness.org/en/data/exploreeconomies/cameroon (accessed on 7 April 2021).
75. BTI 2020 Cameroon Country Report 2020. Available online: https://www.bti-project.org/en/reports/country-report-CMR-2020.html#pos10 (accessed on 7 April 2021).
76. Trading Economics. Cameroon Corruption Index. Available online: https://tradingeconomics.com/cameroon/corruption-index (accessed on 7 April 2021).
77. The World Bank in Cameroon. Overview. 2019. Available online: https://www.worldbank.org/en/country/cameroon/overview (accessed on 7 April 2021).
78. Africa Center for Strategic Studies. Growing Instability in Cameroon Raises Fundamental Questions about the State. 2018. Available online: https://africacenter.org/spotlight/growing-instability-cameroon-raises-fundamental-questions-about-state/ (accessed on 7 April 2021).

79. Index of Economic Freedom. Cameroon. 2020. Available online: https://www.heritage.org/index/country/cameroon (accessed on 7 April 2021).
80. Ministry of Environment and Forestry. Draft National e-Waste Management Strategy: Nairobi, Kenya. 2019. Available online: http://www.environment.go.ke/wp-content/uploads/2019/01/E-WASTE-MANAGEMENT-STRATEGY-final-draft-Jan-2019-1.pdf (accessed on 26 April 2021).
81. Ministry of Environment and Forestry. National Sustainable Waste Management Policy, Revised Draft 2019: Nairobi, Kenya. 2019. Available online: http://www.environment.go.ke/wp-content/uploads/2019/04/Revised_National_Waste_Policy_2019.pdf (accessed on 26 April 2021).
82. State Department of Industrialization—Ministry of Industrialization, Trade and Enterprise Development. Draft National Automotive Policy: Nairobi, Kenya. 2019. Available online: https://www.industrialization.go.ke/index.php/downloads/538-draft-national-automotive-policy-february-2019 (accessed on 26 April 2021).
83. Tabitha, W.K.N. Kenya-Economic Diversification, Challenges and Opportunities. *SSRG Int. J. Econ. Manag. Stud.* **2020**, *7*, 173–181.
84. The World Bank in Kenya. Available online: https://www.worldbank.org/en/country/kenya/overview (accessed on 7 April 2021).
85. Trading Economics. Ease of Doing Business in Kenya. Available online: https://tradingeconomics.com/kenya/ease-of-doing-business#:~{}:text=Ease%20of%20Doing%20Business%20in%20Kenya%20averaged%2098%20from%202008,low%20of%2056%20in%202019 (accessed on 7 April 2021).
86. The World Bank. Doing Business, Measuring Business Regulations. Ease of Doing Business in Kenya. 2020. Available online: https://www.doingbusiness.org/en/data/exploreeconomies/kenya (accessed on 7 April 2021).
87. Waste Management Companies in Kenya. Expert Environmental. Available online: https://www.environmental-expert.com/waste-recycling/waste-management/companies/location-kenya (accessed on 7 April 2021).
88. Nathaniel, I.N.; Rachael, D. Factors Affecting Technological Growth in Nigeria and the Way Forward. *Int. J. Mech. Eng. Appl.* **2017**, *5*, 269. [CrossRef]
89. The World Bank. Doing Business, Measuring Business Regulations. Ease of Doing Business in Nigeria. 2020. Available online: https://www.doingbusiness.org/en/data/exploreeconomies/nigeria (accessed on 7 April 2021).
90. Center for the Study of the Economies of Africa. Nigeria's Ease of Doing Business Ranking: Behind the Number. 2019. Available online: http://cseaafrica.org/nigerias-ease-of-doing-business-ranking-behind-the-numbers/ (accessed on 7 April 2021).
91. Tomola, M.O.; Oladapo, F. The Nigerian Economy in the Face of Socio-Political Challenges: A Retrospective View and Ways Forward. *Int. J. Financ. Bank. Stud.* **2016**, *5*, 32–41.
92. Human Rights Watch. 2012. Available online: https://www.hrw.org/report/2012/10/11/spiraling-violence/boko-haram-attacks-and-security-force-abuses-nigeria (accessed on 7 April 2021).
93. Bomes Resource Consulting. Ease of Doing Business in Nigeria 2020 report. Available online: https://www.bomesresourcesconsulting.com/ease-doing-business-nigeria-2020.html (accessed on 7 April 2021).
94. The World Bank. Doing Business, Measuring Business Regulations. Available online: https://www.doingbusiness.org/en/doingbusiness (accessed on 7 April 2021).
95. Waste and Recycling Companies in Nigeria. Expert Environmental. Available online: https://www.environmental-expert.com/waste-recycling/companies/location-nigeria (accessed on 7 April 2021).
96. Harraz, N.A.; Galal, N.M. Design of Sustainable End-of-Life Vehicle Recovery Network in Egypt. *Ain Shams Eng. J.* **2011**, *2*, 211–219. [CrossRef]
97. Trading Economics. Ease of Doing Business in Egypt. Available online: https://tradingeconomics.com/egypt/ease-of-doing-business (accessed on 7 April 2021).
98. The World Bank. Doing Business, Measuring Business Regulations. Ease of Doing Business in Egypt. 2020. Available online: https://www.doingbusiness.org/en/data/exploreeconomies/egypt (accessed on 7 April 2021).
99. Directorate-General for External Policies. Policy Department. European Parliament. 2018. Available online: https://www.europarl.europa.eu/RegData/etudes/STUD/2018/603858/EXPO_STU603858_EN.pdf (accessed on 7 April 2021).
100. Michele, D. Egypt: Trends in Politics, Economics and Human Rights. Carnegie Endowment for International Peace. 2020. Available online: https://carnegieendowment.org/2020/09/09/egypt-trends-in-politics-economics-and-human-rights-pub-82677 (accessed on 7 April 2021).
101. Waste and Recycling Companies in Egypt. Expert Environmental. Available online: https://www.environmental-expert.com/waste-recycling/companies/location-egypt (accessed on 7 April 2021).
102. Naik, T.S. End of Life Vehicles Management at Indian Automotive System. Production Development and Management; Final Report. Master's Thesis, Jönköping University, Jönköping, Sweden, 2018.
103. The Political Economy of Development in India since Independence. Available online: https://eprints.lse.ac.uk/20381/1/The_political_economy_of_development_in_India_since_independence_(author_final).pdf (accessed on 7 April 2021).
104. Kaushik, B. India's Economic Troubles are Rooted in Politics. FP News. 2020. Available online: https://foreignpolicy.com/2020/02/21/india-economic-problems-politics-citizenship-law/ (accessed on 7 April 2021).
105. Yen, N.L. Malasia's Political Crisis Could Worsen Coronavirus and Economic Challenges. 2020. Available online: https://www.cnbc.com/2020/05/18/malaysia-has-triple-crisis-of-coronavirus-economy-and-politics-analyst.html (accessed on 7 April 2021).

106. Shameem, A.; Shamsuddin, A.; Md Rezaul, H.S.; Quader, M.A. End-of-Life Vehicles (ELVs) Management and Future Transformation in Malaysia. *J. Appl. Sci. Agric.* **2017**, *9*, 227–237.
107. Cruz-Rivera, R.; Ertel, J. Reverse logistics network design for the collection of end-of-life vehicles in Mexico. *Eur. J. Oper. Res.* **2009**, *196*, 930–939. [CrossRef]
108. The World Bank. Doing Business, Measuring Business Regulations. Ease of Doing Business in Malaysia. 2020. Available online: https://www.doingbusiness.org/en/data/exploreeconomies/malaysia (accessed on 7 April 2021).
109. Vargas-Hernàndez, J.G.; Noruzi, M.R. An analytic study of Mexico in economics, social, political, environmental and sustainable development trends by the year 2030. *Probl. Perspect. Manag.* **2010**, *8*, 197–212.
110. Nishino, K. *Challenges and Prospects for Mexico's Automotive Industry*; Monthly report; Mitsui Global Strategic Studies Institute: Tokyo, Japan, 2016.
111. The World Bank. Doing Business, Measuring Business Regulations. Ease of Doing Business in South Africa. 2020. Available online: https://www.doingbusiness.org/en/data/exploreeconomies/south-africa (accessed on 7 April 2021).
112. Cilliers, J.; Aucoin, C. *Economics, Governance and Instability in South Africa*; Studies Papers; Institute for Security: Pretoria, South Afrcia, 2016; pp. 1–24.
113. Baskin, A. Africa Used Vehicle Report. In Proceedings of the Africa Clean Mobility Week, Nairobi, Kenya, 10–16 March 2018.
114. Brand South Africa. South Africa's Automotive Industry. Available online: https://www.brandsouthafrica.com/investments-immigration/business/economy/sectors/south-africas-automotive-industry?gclid=CjwKCAiA_KzBRAJEiwAhJNY7_EbV3C152ySX1pFnNO1zCOL1pa1OX38Oi6jenfhhvPbUa4qa32ApBoCVokQAvD_BwE (accessed on 7 April 2021).
115. Autocar Professional. Essential Reading for the Automotive Industry. 2020. Available online: https://www.autocarpro.in/news-national/india-will-have-over-2-crore-endoflife-vehicles-by-2025-cse-report-67303 (accessed on 7 April 2021).