CHAPTER 4

Approach for proper processing of end-of-life vehicles and development of relevant legislation in the ASEAN region

1. Overall situation and issues in ASEAN and other Asian countries

In the Association of Southeast Asian Nations (ASEAN) and other Asian countries, there are still countries where the gross national income (GNI) per capita is not sufficiently high. As a result, the diffusion rate of automobiles is not very high. However, in view of the current rapid pace of economic growth in those countries, it is expected that their GNI per capita will go up sharply in the future and that the diffusion of automobiles will advance rapidly. Yet, such rapid diffusion of automobiles is expected to bring about not only such problems as air pollution but also those associated with the treatment and recycling of waste materials.

Europe and Japan in the past had problems regarding illegal dumping of used automobiles and the treatment of residues from recycling used automobiles. While the mechanisation of the process of automobile recycling was promoted when higher efficiency in the automobile recycling was being sought, the treatment and disposal of matters such as shredder dust residues became a new problem[1]. Furthermore, due to the increased number of automobiles equipped with airbags and the like, the degree of difficulty in waste treatment has increased.

These problems derived from economic development and the associated increase in the number of used automobiles are also expected to occur in ASEAN and other Asian countries in future. Thus, this report will discuss the various problems that are expected to occur from the upstream to the downstream of automobile recycling, together with the possible measures/countermeasures that have been suggested to cope with such problems.

[1] Due to the large-scale illegal dumping of shredder dust residues, the shredder dust residues from used automobiles was categorised as one of the 'hazardous waste materials'. Such materials are obligated by law to be disposed in 'controlled' disposal sites built under strict conditions, instead of the conventional dumping in so-called 'stable' disposal sites. However, since the number of such controlled disposal sites is limited nationwide, there is a constraint in their accepting capacity. In addition, because the installation of new disposal sites has become more and more difficult, it became necessary to establish a system where the recycling rate is increased to reduce the volume of shredder dust residues. This is one of the major reasons that led to the enactment of the 'Automobile Recycling Law' in Japan.

2. Design for Recycling

(1) Situation and issues expected in ASEAN and other Asian countries

1) Expansion of need for activities in the upstream end-of-life vehicle (ELV) recycling flow (from the period of matured automobile society)

Design for Recycling (DfR) is a necessary approach towards the increasing sophistication of the downstream recycling process associated with (i) separability of parts and (ii) material identifiability. ASEAN countries are divided roughly into two categories: one, where automobile industry has already been developed; and two, where the automobile industry is in the process of development. DfR needs to be promoted in the car design process, depending on the development of the automobile industry itself. For the purpose of promoting DfR, the important point is identifying how to link the DfR to the recycling efforts on the downstream side, and how to offer incentives to automotive manufacturers.

(2) Expected measures

1) Development of regulatory systems to provide support for technological development of DfR and to promote DfR (from the period of matured automobile society)

As mentioned above, the promotion of DfR in the car design process is done in line with development of the automotive industry. The national government and public bodies are expected to provide support to private companies for the technological development of DfR. With respect to (i) and (ii) above, more sophisticated technologies need to be developed and implemented to reduce costs. Furthermore, regulatory systems to promote DfR such as incentives related to operators need to be developed.

For implementing the measure, the following points should be considered.

(i) Division of roles among stakeholders

Division of roles among the national government, municipalities, manufacturers, and dismantling and recycling operators is necessary. For the improvement of recyclability in particular, the provision of information from dismantling and recycling operators who are actually involved in the recycling business to manufacturers is important.

(ii) Degree of the involvement by the national government

Parallel with the voluntary efforts of private companies on the promotion of DfR, the introduction of legislative measures to promote DfR should be considered in the automobile recycling process.

3. Occurrence of ELV and its flow

(1) Situation and issues expected in ASEAN and other Asian countries

1) Illegal import and export of ELVs (from the early stage of automobile diffusion)

In countries where the GNI per capita is still low, cars are expensive and people prefer to buy imported used cars. In addition, there is a huge demand for imported half-cuts and used parts because car owners want to continue to use their cars for as long as possible. Sometimes, they are illegally imported. Illegal importation of half-cuts and used parts poses problems not only in terms of violation of legislation but also in terms of creating environmental pollution and safety concerns. On the other hand, there are companies that have appropriate licences for importing half-cuts and used parts, and trading the used parts. These companies are contributing to sustainable resource utilisation. Hence, just prohibiting import of such parts may have a negative impact on resource utilisation. Therefore, ASEAN countries are required to prohibit illegal importation but allow it in case it can obviously contribute resource utilisation.

2) Unclear situation of ELV generation (from the early stage of automobile diffusion)

Due to the fact that automobile registration and deregistration systems are not well developed in developing countries, it is difficult to obtain accurate statistical data on the occurrence of ELVs (e.g. number of generation, generating area, ages, among others). For developing policies on ELV recycling, the acquisition of reliable data is important. Incentives to deregistration are also required.

3) Safety and environmental issues caused by continuous use of too old vehicles (from the early stage of automobile diffusion)

A low GNI per capita means that main road transportation measures, motorcycles, and four-wheel vehicles are fairly expensive for ordinary people. This leads people to refrain from replacing their ‘expensive’ cars with new ones and to try to use their own cars for as long as possible when there is no restriction on their service life. There are also cases where no legal automobile inspection systems exist or where no strict application of the law is imposed, even if a certain inspection system is in place. Thus, cars continue to be used for a long time without sufficient maintenance. This situation certainly causes safety concerns.

4) Illegal dumping of ELVs (from the period of matured automobile society)

In countries where the value of ELV is high, scrap trading companies collect even abandoned ELVs. However, as labour cost increases and environmental and safety costs increase (due to the increased awareness of people), the cost for the treatment of shredder dust because of automation increases. Thus, the possibility of ELV becoming worthless is increased. As a

result, illegal dumping of ELVs may happen.

(2) Expected measures

1) Stricter control of import (from the early stage of automobile diffusion)

(a) Stricter control by the Customs

The strengthening of Customs should be prioritised to prevent the illegal importation of ELVs. Stricter control by the Customs needs to become necessary not only to prevent the flow of ELVs to improper routes but also to prevent imports that could bring about environmental problems such as leakage of engine and transmission oil during the transfer.

(b) Review of import conditions and review of licensing conditions

Further measures are desired to prevent ELV parts from flowing to improper routes through reviews of required environmental standards for traders such as preventing leakage of engine and transmission oils and licensing conditions of importers (whether importers have the required licence or not).

For implementing stricter control of import, the following points should be considered.

(i) Division of roles among stakeholders

The division of roles among stakeholders will be a critical factor in ensuring stricter control of importation. Whether Customs, the local central responsible ministry, or the local municipality should inspect appropriate practices of importers and exporters will become a big issue.

(ii) Constraints of human resources and funds

A Customs officer pointed out the human resources and funds as constraints in Customs inspections. Under these restrictions, how to make strict inspection of used parts imports becomes a huge issue.

(iii) Appropriateness of content of import conditions

At the time when the environmental standards (e.g. prevention of oil leakage and licensing conditions) were reviewed, the contents corresponding to the actual situation of each country needed to be examined. For instance, the import permit is related to monitoring of

importers' activities after import. The import permit should therefore be set in consideration of the monitoring process.

2) Establishment and strict management of the registration system (from the early stage of automobile diffusion)

(a) Strengthening of the registration system

In the recycling of ELVs, automobile registration and deregistration systems play important roles such as collecting information required for policy making and preventing used cars and ELVs from being sent to the inappropriate informal sector. As the registration system itself is a basic system for national traffic safety, there are many countries that have already introduced this system. However, in countries where the system has just been introduced and the system is not sufficiently mature, there are problems such as data mismatch and there is a need for improvement. Enabling accurate registration information will not only be useful for the promotion of ELV recycling but will also greatly contribute to the protection of automobile users in various aspects, including automobile safety, prevention of environmental pollution, smooth implementation of automobile safety measures, and proof of proprietary rights. Furthermore, the compilation and publication of statistical data will make it possible to refine analytical results of market surveys, which is expected to contribute to the sound development of automobile-related industries.

(b) Strict management of the registration system

In the early stage of automobile diffusion, cars were not popular and the number of registrations was small. Hence, even though the capacity for accepting registration applications and managing them was small, it was acceptable. However, as the registration system itself is the basic system for national traffic safety, the problem in registration should be solved as soon as possible for the consideration of future diffusion of vehicles. Also, during the early stage of automobile diffusion, the government's administrative ability was not so high because of limitations on human and financial resources and sometimes delays in registration. Therefore, strengthening of capacity is indispensable.

(c) Effective operation of the registration system

If the collection of data is recorded manually, there are instances when data is recorded inaccurately such that the actual car type, age and similar information are inconsistent. Registration information is also not maintained accurately. It is thus necessary to check the integrity of the data through sample surveys in order that no contradiction occurs at the time of deregistration.

To establish and strictly manage the registration system, the following point should be considered.

(i) Securing of funds and human resources

To achieve the objectives of the above proposal, it is necessary to secure funds and human resources. Improvement of the functions to check data integrity and create a registration database, among others, cannot be realised without a budget. Securing such budget is a huge challenge for policymakers. In addition, the fostering of human resources who are to be involved in operations also becomes an important issue.

3) Establishment and strict management of the deregistration system (from the early stage of automobile diffusion)

(a) Establishment of a deregistration system

The establishment of deregistration system has been steadily progressing in the ASEAN and the other countries in Asia. In some cases, deregistration is directly requested of car owners but there are little incentives for following procedures. To improve effectiveness, some countries introduced a scheme where cars are automatically deregistered when car owners do not pay taxes or registration fees for more than specific terms. Deregistration is the pivotal system for the recycling of ELVs and its establishment/improvement is important. Therefore, countries are expected to introduce a robust deregistration system at the earliest possible time. The system needs to be linked with the registration system, and information such as the model and age of the used automobile and the region where the relevant automobile was disposed need to be recorded.

(b) Strict management of the deregistration system

If deregistration is not obligatory, there is no incentive for automobile users to deregister. In such cases, even though the system exists, it may not function well. Therefore, it is necessary to obligate automobile users to deregister. In case it is impossible to make it obligatory, there is the option to automatically deregister cars when car owners do not pay their tax and registration fees during the terms in their countries,

(c) Improvement of the function to check the integrity of data

As with any registration system, if the collection of data is paper based, there are cases when the integrity of the data is not maintained. As a result, registration information such as car type, age, owner, and the like are not very accurate. It is thus necessary to check the integrity of the data so that no contradiction occurs at the time of deregistration.

In the case of paper-based aggregation, we often encounter problems such as input errors and/or longer calculation times for aggregation. If a database based on computerised registration information were available, paper-based aggregation would no longer be necessary and the time lag between registration and completion of aggregation can be shortened. It will also be possible to capture the number of automobiles more accurately. Furthermore, as the aggregation by region becomes feasible, it will become easy to capture the flow of ELV and it will become possible to establish proper strategies such as determining where to establish recycling centres.

To establish and strictly manage the deregistration system, the following points should be considered.

(i) Legal obligation or provision of incentives

In cases where no legal obligation is stipulated or where there is no incentive for automobile users, the deregistration system will not function well, even if the system is well created. There will also be cases where quasi-scrap automobiles continue to be counted among the number of retained automobiles semi-permanently. This situation will make it difficult to capture the number of retained automobiles accurately. Accordingly, it is important to not only develop a system but also to examine the way to stipulate the obligation or to give incentives.

(ii) Creation of a system based on the premise of ELV recycling

In addition to the recording of simple information about the disposal of a certain vehicle, information on whether a vehicle is exported or disposed domestically is also important when examining the contents of the ELV recycling system. Thus, there is a need to improve the deregistration system based on the premise of ELV recycling.

(iii) Securing of funds and human resources

As in the case of the automobile registration system, it is necessary to secure funds and human resources to achieve the objectives of the above proposal. Just like the registration system, securing funds to create a hardware system and fostering human resources to be involved in operations are important issues.

4) Development and improvement of the automobile inspection system (from the early stage of automobile diffusion)

(a) Development of the automobile inspection system

From the viewpoint of ELV recycling and safety, the automobile inspection system, which promotes the scrapping of old automobiles with no proper maintenance, is a very important system. It is indispensable to introduce and develop the inspection system. A proper system can be created by carefully examining the contents of the automobile inspection system operating in the country in question. There may be cases where, even if an automobile inspection system is in place, the system is not properly operated, such as low accuracy of inspection and passing without achieving appropriate level. Then, measures need to be taken so as to make a stricter operation of the system.

In other countries, the automobile inspection system is applied to commercial vehicles only. For the promotion of ELV recycling and improvement of safety, it is important to expand the inspection system to private vehicles as well.

(b) Development of infrastructure

To operate the automobile inspection system, suitable devices for inspection and location is required. Thus, in parallel with the development of an automobile inspection system, the development of infrastructure also needs to be pursued.

(c) Fostering human resources

To operate the automobile inspection system, the fostering of human resources to manage the system is required.

To develop and improve the automobile inspection system, the following points should be considered.

(i) Securing of funds

It is difficult for developing countries to secure enough funds for the infrastructure required for the automobile inspection system. Government may put less priority on automobile inspection systems because of lack of budget. Securing funds is an important issue for improving the inspection system.

(ii) Division of roles among stakeholders

In the development of infrastructure, the division of roles between the government and the

private sector is also important. In certain countries, expansion of the diffusion of the automobile inspection system is promoted in such a way that the government asks the private sector to assume the operation of automobile inspection within their jurisdiction. In any event, a proper division of roles among stakeholders is important.

5) Restriction on expiration period

In order to eliminate the use of old automobiles with no sufficient maintenance, it is also effective to impose restrictions by law on the length of usable years of vehicles. In fact, restrictions on the length of usable years are imposed on passenger and commercial vehicles in Viet Nam, and on taxis in Thailand. Along with effective policies, these regulations actually contribute to the improvement of road safety.

To restrict the expiration period, the following points should be considered.

(i) Measures to close loopholes

Even if a system of usable years of vehicles is introduced, there may be a variety of loopholes, including falsification of records and alteration of the sequence numbers of parts such as engines, in the actual implementation of the system. It is thus necessary to consider countermeasures against such acts.

(ii) Coordination/collaboration among stakeholders

Good coordination/collaboration is required among stakeholders, including police officers involved in the control of vehicles on roads and traffic-related public agencies such as District Land Transport Bureaus in charge of the automobile inspection system.

6) Establishment of a legislative scheme specific for ELV recycling (in the period of matured automobile society)

Labour, environmental, and safety costs, and treatment and disposal fees of shredder dusts will increase depending on the economic status of the country. Thus, it is possible that ELVs may not be sold as a valuable material but treated with fee.. In such cases, the establishment of a legislative scheme is required to address the problem. For example, the following legislative measures can be imposed.

(a) Division of roles between final users and related companies

Establishing a legislative scheme that demarcates the roles among final users and related companies, among others, can refrain ELVs from flowing to improper sectors. Arranging the sharing of the disposal fee of difficult items to dispose such as waste shredder dusts; setting

the obligation of passing ELVs to proper companies; and establishing appropriate ELV flows can also be developed.

(b) Introduction of a licence scheme

Among the various legislative measures related to ELV recycling, the licence scheme is an effective measure. Providing licences only to companies that implement safety and environmental measures can ensure that a certain level of safety and environmental standards will be secured. In addition, by clarifying the responsibilities of dismantling companies and requesting them to fulfil these will ensure that proper ELV recycling can also be secured.

To establish a legislative scheme specific for ELV recycling, the following points should be considered.

(i) Arrangement of division of roles among stakeholders

When a licensing system is introduced, the major question to ask should be: 'Who will administer the system?' There are various types of operations such those performed by local agencies of the central government or by municipalities.

(ii) Vigorousness of the licensing system

If a licence scheme is operated without the effective control of municipalities, ELVs might flow to the informal sectors who do not implement the environmental measures and so on. Another option is to introduce a less strict and more flexible licence system. In the former case, however, there is a question of whether it is possible to vigorously confirm that conditions of the authentication are all satisfied.

4. Dismantling facilities for ELVs

(1) General situation and issues expected in ASEAN and other Asian countries

1) Insufficient labour safety and environmental protection measures (from the early stage of automobile diffusion)

The actual situation concerning the dismantling of ELVs depends on the level of economic development of a country. In countries whose level of economic development is low, ELV dismantling is conducted mainly by hand and dealt through underground market mechanisms. This may be due to the low GNI per capita which causes low wages, and also because ELVs are not generated in a large quantity domestically. However, since these countries have generally no reserve of human resources and funds to deal with the administration of laws and regulation on industrial safety and environmental protection,

safety measures for workers and environmental measures are not sufficiently implemented. Consequently, there are health and environmental problems in these countries.

2) Introduction of advanced technologies (in the progressive stage of automobile diffusion)

When the level of economic development advances, incentives for mechanisation arise in line with the increasing level of wages. First, new tools are introduced. Then, when the economy further advances, large machines such as shredders and guillotine shears are introduced. However, as a result of automation, automobile shredder residues (ASRs) start to be generated and, by necessity, the establishment of landfill sites for ASRs becomes necessary.

3) Promotion of recycling or adequate disposal of ASRs for preventing illegal dumping of ASRs (in the period of matured automobile society)

Proportionate with the steady growth in the economy, there is an increasing social attention to industrial safety and environmental protection, and industrial safety and preventive measures on waste oils, among others, are being taken. Thus, associated costs are also increasing. It is therefore imperative that countermeasures dealing with ELV problems and the improper treatment and illegal dumping of ASRs should be considered. In particular, it is desirable to launch cost measures for recycling or adequate disposal of ASRs and other materials that are not easily treated or disposed.

(1) Expected measures

1) Promotion of labour safety measures (from the early stage of automobile diffusion)

(a) Rigorous application of labour safety regulation

Labour safety measures are enhanced through the establishment/improvement of implementation of laws/regulations and through actual operations. Labour safety measures deal not only with ELV dismantling but also with overall labour safety measures. In the rigorous application of labour safety regulations, municipalities, local agencies, or the responsible agency of the central government (that serves as the watchdog of the application of the regulation) play an important role. Therefore, capacity building of these agencies is important.

(b) Guidance by municipalities and workshops organised by industrial organisations

When the economy advances and people's interests in matters related to labour safety get stronger from the social standpoint, the awareness of ELV dismantling operators about labour safety is also expected to increase. Meanwhile, the municipalities will be expected to teach technical know-how and to expand human resources in relation to labour safety. Thus, it is

necessary to create a situation where ELV dismantling operators can deal with improvements in labour safety more voluntarily and/or mandatorily, through the guidance of municipalities and workshops organised by industrial organisations, besides the vigorous application of labour safety regulations.

To promote labour safety measures, the following points should be considered.

(i) Capacity building at municipalities

As mentioned above, building the capacity of personnel at municipalities or local agencies of the central government is important for the vigorous application of labour safety regulations. The question is how this may be accomplished as the question of who performs the capacity building and in what manner depends partly on the labour safety regulations in each country. Therefore, it is necessary to examine the specific method of capacity building in each country.

(ii) Measures when industrial organisations do not exist

If no appropriate industrial organisation exists in a country, the question of who will organise the workshops is important. Because the quickest way to address this issue is to establish a new industrial organisation that focuses on ELV dismantling domestically, each country is expected to first consider establishing such an organisation. If doing so is difficult for whatever reason, the government has to find an organisation elsewhere that can organise and hold the workshops instead.

(iii) Materialisation of a licensing system

Even if a licensing system is introduced, questions such as what conditions to attach to licences, which agency should take responsibility for the licensing system, and what legal system should be developed need to be considered and resolved. It is expected that each country would discuss these issues internally with a view to introducing its own licensing system.

2) Promotion of environmental measures (from the early stage of automobile diffusion)

(a) Rigorous application of the environmental regulation

At present, many ASEAN countries place more importance on the economic efficiency of ELV dismantling than on environmental protection measures. However, since various types of environmental pollution are expected to occur in the process of ELV dismantling, the appropriate countermeasures against them need to be considered. Among others, environmental problems caused by waste oil, and recovery of CFC, need to deal with. In view

of this, capacity building at municipalities is needed. It is necessary to contrive a concrete and workable operation scheme to control violations of the environmental regulations.

(b) Guidance by municipalities and workshops organised by industrial organisations

When the economic development of a country advances and people's environmental awareness rises, their criticism is expected to become quite severe if and when any of the ELV dismantling facilities has brought about environmental pollution. ELV dismantling operators, too, will become more aware about environmental measures. In the meantime, municipalities are expected to accumulate technical know-how and to expand human resources for environmental protection. Thus, it is important to encourage ELV dismantling operators to take voluntary measures, through the guidance of municipalities and workshops organised by industrial organisations.

(c) **Introduction of recycling technologies**

The introduction of recycling technologies and the development of infrastructure are necessary to ensure that Chlorofluorocarbons (CFCs) and waste oils are retrieved in an environmentally proper manner.

The same issues and points as those for labour safety must be considered. In addition, the following issues specific to the environment may be considered.

(i) Preparation of devices required for monitoring

For vigorous monitoring of environmental measures like evaluation of soil contamination levels caused by waste liquids and waste oils, various kinds of measuring instruments are needed. Therefore, the acquisition of such instruments and the fostering of personnel to handle them need to be considered.

(ii) Incentives for the introduction of technologies

There is a problem of incentives when proceeding with the introduction of technologies. For example, in the introduction of treatment technology for CFCs, the regulations or incentives are important so that the private sector will bear the burden of the introduction of the CFC recovery unit. It is also important to treat and recycle collected CFCs in a proper manner besides the introduction of the technology. Assuming that the introduction of the technology is initiated with the aid of international donors such as the World Bank, the Asian Development Bank or the Japan International Cooperation Agency and so on, it is necessary to discuss how the introduction will be done as the method of introduction of technology varies depending on the current regulations and respective systems of each country. Furthermore, assuming that technologies are to be introduced, it is also necessary to

determine the division of roles among stakeholders.

(iii) Coordination between the recovery/treatment system for household electrical appliances and CFC recovery

There are cases where certain CFC recovery/treatment systems for household electrical appliances are in place. There needs to be a linkage between those systems.

3) Development of infrastructure (final disposal sites (landfill) and recycling technologies) (in the progressive stage of automobile diffusion)

In addition to the introduction of shredders and guillotine shears, proportionate with the mechanisation of the dismantling operations, the technical know-how for assorting operations in advance and the treatment technology and infrastructure for residues generated from the disposal process are also important.

To develop the appropriate infrastructure, the following points should be considered.

(i) Linkage to waste management policy and energy policy

The development of infrastructure should not be considered from the standpoint of ELV recycling policy alone. For example, ASRs from shredders and guillotine shears should be properly treated in appropriate recycling facilities or disposed at appropriate disposal sites. Developing recycling facilities and appropriate disposal sites is not only for ELV recycling but for other industrial wastes as well. Therefore, it is linked with not only ELV policy but also with total industrial waste management policy. In addition, assuming the introduction of a large treatment facility, the installation of enough power infrastructures needs to be considered. Therefore, the energy policy is also related to the development of ELV recycling and disposal infrastructures.

4) Legislation for automotive recycling (in the period of matured automobile society)

Once the automobile society has become matured and social challenges relating to automobile recycling have become apparent, the legislation for automotive recycling for the purpose of further sophistication of ELV recycling should be considered. When the division of roles among the stakeholders in the automobile recycling system is considered, it becomes possible for the ELV recycling system to function appropriately since the responsibilities of dismantling operators are clear and they can implement it. The licensing system is considered to be an effective way of regulation because a certain known level of measures for labour safety and for the environment can be guaranteed since the approval is given only to companies that have already implemented measures for labour safety as well as for the environment.

To legislate for automotive recycling, the following points should be considered.

(i) Division of roles among stakeholders

When a licensing system is introduced, the division of roles among stakeholders should be determined. The next major question then is who will administer the system. We can think of various types of operations—whether it is by local agencies of the central government or by municipalities.

(ii) Vigorousness of the licensing system

A licensing system, unless implemented effectively by municipalities, will encourage the circulation of ELVs in the informal sector, which does not take environmental measures into account. It may also be possible to introduce a flexible authentication system rather than a vigorous licensing system. In the former case, however, there is a question of whether it is possible to vigorously confirm that all conditions for the authentication are satisfied.

5) Establishment of recycling technologies for ASR treatment (in the period of matured automobile society)

If ASRs are treated not in the least-controlled final landfill site but in the controlled type final disposal site, the treatment cost becomes higher. The difference in treatment cost may lead to the illegal dumping of ASRs. Therefore, reducing the volume of the treatment by recycling the shredder dust should be considered. Concretely, it should promote further the sophistication of recycling by way of thermal recycling and/or feedstock recycling of shredder dusts, and recycling of welding slag.

To establish recycling technologies for treatment of ASRs, the following point should be considered.

(i) Development of recycling technologies and incentives for their introduction

The development and introduction of recycling technologies such as thermal recycling and feedstock recycling of shredder dusts, and recycling of welding slag require high costs. Then, supposing that the development and introduction do not proceed, unless the incentives for development and introduction are given to the recycling industry, the structuring of the scheme in the form of subsidies and incentives is necessary.

5. Reuse of parts

(1) Situation and issues expected in ASEAN and other Asian countries

1) Illegal import and export of used parts (from the early stage of automobile diffusion)

At the stage, when automobiles are not yet widely diffused and a sufficient number of ELV is not generated domestically, the need for imports of used parts will become strong. This is because automobiles running in town are mainly imported, used and old, and a gap occurs between the demand for and supply of imported used parts. Although some of the countries prohibit the importation of used parts to foster the domestic industry, it is generally difficult to cover the demand by domestic production alone because the domestic parts-producing industry has not yet grown sufficiently. As a result, used parts are imported in an informal way. The illegal importation of used automobile parts needs countermeasures because environmental pollution could occur in both importing and exporting countries as the parts are being exported/imported without proper environmental measures such as prevention of engine and transmission oil leakage.

2) Insufficient safety and environmental measures (from the early stage of automobile diffusion)

Used parts are sometimes imported in the form of parts per se and sometimes in the half-cut form. In cases where they are imported in the half-cut form, a dismantling process to get out the parts is required. Then, as in the case of ELV dismantling facilities, safety measures need to be considered for workers as well as the environment. If the monitoring and guidance of responsible departments of local municipalities is not sufficient, safety and environmental problems may happen. As with ELV dismantling facilities, the violation of safety and environmental regulations is a serious problem. Therefore, the scheme to prevent this should be prioritised.

3) Safety problem from continuous use of very old used parts (from the early stage of automobile diffusion)

Continuous use of very old used parts may cause safety issues. For example, if used tires and used brake pads do not work effectively, serious accidents may occur. It is therefore important to keep the safety quality of used parts.

4) Immature network of distribution and promotion of utilisation (from the progressive stage of automobile diffusion)

To promote the utilisation of used parts, it is imperative that a proper network of distribution is established. To promote a certain standard of used parts and ensure that used parts do not have safety problems, traders' associations are also expected to establish a proper network.

Currently in ASEAN countries, traders' associations are launched but their networks are immature. In addition, remanufacturing parts are not utilised and the promotion of utilisation is expected.

(2) Expected measures

1) Enhancement of import control systems (from the early stage of automobile diffusion)

(i) Stricter control by Customs

First of all, used parts should be prevented from reaching informal traders who do not implement environmental pollution prevention measures and safety measures. Stricter control by Customs authorities is necessary to prevent the flow of used parts to improper routes and to prevent imports that could bring about environmental problems such as leakage of engine and transmission oils during the transfer. In the importation of half-cuts, importers should be careful because it can be subject to the Basel Convention. On the other hand, during the early stage of automobile diffusion, it is necessary to allow the import of a certain amount of used parts to promote the diffusion of automobiles, although this goes against the fostering of domestic industries. Even if the importation of used parts were officially prohibited, they would still be imported by underground organisations anyway. Therefore, it will be beneficial to officially permit the import of a certain amount of used parts in the early stage of automobile diffusion.

(ii) Review of import conditions and review of licensing conditions

Further measures are desired to prevent used parts from flowing to improper routes through reviews of required environmental standards for traders such as preventing leakage of engine and transmission oils and licensing conditions of importers.

To enhance the import control system, the following points should be considered.

(iii) Division of roles among stakeholders

The division of roles among stakeholders will be a major issue when the license system for dealing with used parts is introduced. In particular, the question of who should inspect importers will become big issue. Will it be the Customs, the local agency of the responsible central ministry, or the local municipality?

(iv) Constraints of human resources and funds

A Customs officer pointed out the human resources and funds constraints of Customs when inspecting used parts imports. Developing a guidance manual for Customs officers when checking used parts imports is a possible option.

(v) Appropriateness of content of import conditions

When environmental standards such as prevention of oil leakage and licensing conditions are reviewed, the contents corresponding to the actual situation of each country should be reviewed and considered. For instance, the import permit is related to the monitoring of importers' activities after import. The import permit should therefore be set in the consideration of the monitoring process.

2) Promotion of labour safety measures (from the early stage of automobile diffusion)

Just like the case of ELV dismantling facilities, operators who handle used parts are also required to take labour safety measures such as health measures to prevent exposure to hazardous materials and safety measures for dangerous operations and the like. The process for improving the measures is quite similar to the ELV dismantling facilities.

3) Promotion of environmental measures (from the early stage of automobile diffusion)

Environmental measures such as prevention measures for waste oil and waste liquid, and collection of CFCs are also required of the plants and storage facilities of operators. In particular, when used parts importers take parts from containers, engine oil and transmission oil tend to leak. Therefore, importers should take necessary measures such as opening containers on the concrete floor and separating oil from water with oily water separator. The same measures are required to be taken for ELV dismantling facilities.

4) Safety standards for used parts (from the early stage of automobile diffusion)

It is important to set safety standards for used parts and remanufacturing parts, and to develop checklists to prevent used parts from causing environmental problems. This way, repair shops can check whether used parts and remanufacturing parts achieve safety standards.

To promote labour safety measures, the following point should be considered.

(i) Setting appropriate standards

Setting strict standards prevents diffusion of used parts and remanufacturing parts. It is also desirable to set up appropriate standards such as the obligation to install oily water separators, which does not prevent the diffusion of used parts and remanufacturing parts.

5) Developing a network of distribution of used parts (from the progressive stage of automobile diffusion)

Establishing a network of industrial associations will promote the distribution of used parts. First, establishing an industrial association of companies dealing with used parts that keep a certain quality should be considered. Such organisation should take the initiative to develop the distribution network of used parts. There may be cases when used parts cannot be used because of the difference in car types, ages, and so on. Therefore, collaboration between companies is very important. In future, it is recommended that an industrial organisation should establish a common database, strengthen collaboration, and accumulate technical know-how in checking whether used parts or half-cuts have safety problems or not. Distribution networks of used parts are also useful in terms of data collection. At present, there are still many countries that do not have good statistics of used parts. Accordingly, the circulation of used parts has not been well grasped. Therefore, it is important to establish a structure that takes charge of the collection of such data so that meaningful measures on used parts can be examined properly, and networking will contribute to it.

To develop a distribution network of used parts, the following points should be considered.

(i) Contribution of government

Mainly, industrial organisations are in charge of developing networking. In case there are many industrial associations, it is very difficult for government to contribute without being considered giving advantage only to a specific association. Therefore, the government can leave the issue of establishing networking to industrial associations.

(ii) Collaboration among stakeholders

To establish a database, there should be a division of roles and good collaboration among stakeholders. The most important point is who will create the database. The other point is who will input the information and at what point, should the importer of used parts input the information? Alternatively, should it be the dismantling companies, or the used parts shops?

(iii) Incentives for inputting data

A used parts database would only work when correct data is inputted. The merit of collaboration among companies is huge but as this is not expected during the early stage, we need to consider incentives for inputting proper data.

6) Quality standards on used parts (from the progressive stage of automobile diffusion)

In early stage of automobile diffusion, prices are prioritised over quality. However, proportionate with economic growth, car owners tend to want used parts with high quality. Hence, safety standards as well as quality standards on used parts should be established.

7) Standards on rebuilt parts (from the progressive stage of automobile diffusion)

During the early stage of automobile diffusion, car owners tend to use cheap used parts and demand for remanufacturing parts is small. The demand for rebuilt parts occurs only when the rebuild parts industry has already been developed to a certain level. Proportionate with the growth of the industry, demand will shift from used parts to remanufacturing parts with high quality. In many countries, rebuilt parts are recognised as being more or less the same as used parts. In Japan, however, rebuilt parts that have the same confirmed operability as that of new ones are also circulating in the market. This contributes to the efficient use and safety improvement of used parts. Therefore, it may be necessary to differentiate high-level rebuilt parts from other rebuilt parts by slightly improving the so-called used parts, and to take measures to make people recognise the existence of such high-level rebuilt parts. Developing quality standards and guidelines are expected.

To introduce standards on rebuilt parts, the following point should be considered.

(i) Creator of the guidelines

First, there is the question of who will create the guidelines. The second question is, to what extent should public institutions be involved since the contents of the guidelines are related to the interests of stockholders. The operators should be asked to establish their own voluntary guidelines.

8) Raising awareness of users (from the progressive stage of automobile diffusion)

Raising car owners' awareness for used parts is necessary. At the early stage of automobile

diffusion, because of the low income of people, there is an incentive to use used parts due to the price. However, as the income increases, the demand for used parts decreases. On the other hand, even though rebuilt parts have high quality at the progressive stage of the automobile diffusion, the use of rebuilt parts with high quality does not advance since it is thought to have the same quality as the used parts. Thus, for the sake of advancing the utilisation of used parts, especially the rebuilt ones, automobile users' awareness of used parts should be raised.

To raise the awareness of users, the following point should be considered.

(i) Coordination with brand-new parts industry

The utilisation of used parts and rebuilt ones generates a negative impact on the parts industry even though it brings about environment protection. In advancing the awareness of users of used parts and rebuilt ones, we have to carefully reflect on what level to proceed while considering how to promote the brand-new parts industry.

6. Downstream recycling and treatment

(1) Situation and issues expected in ASEAN and other Asian countries

1) Insufficient labour safety and environmental protection measures (from the early stage of automobile diffusion)

Downstream recycling plays an important role by making waste products resources in the ELV recycling system. Recycling facilities on the downstream side are not specialised in ELV recycling and this tendency gets stronger when we go further down the stream. Metals, non-ferrous metals, and plastics, among others, usually flow through the ordinary trading route of resources. When labour costs are low, recycling is mainly conducted by small household companies. Work is mainly done by hand, and there are concerns over the safety of workers. For instance, in the treatment of batteries, workers handle hazardous materials such as lead and sulfuric acid. This raises concerns about their health. There are also concerns about the health damage to local residents due to soil contamination of these harmful substances. Moreover, as downstream recycling operation is small scale, done informally, and with insufficient supervision and guidance from municipalities, the compliance with regulations on environmental protection and labour safety is not guaranteed.

2) Low quality of recycled resources (from the progressive stage of automobile diffusion)

Recycled resources such as metals, aluminium, and plastics reduce their quality when they are mixed with impurities. Appropriate segregation is expected to prevent the degradation of their quality. In addition, appropriate component analysis is required. In some cases, their usage is limited because the components of the materials are not properly segregated or not properly analysed.

3) Disposal of ASRs (landfilling) (in the progressive stage of automobile diffusion)

When the level of the economy and industrialisation advances, and manual labour costs increase mainly due to higher wage levels, the conventional household system will become no more competitive. Then, mechanisation and industrialisation of ELV recycling will take place as a matter of necessity. With the promotion of such industrialisation, measures to deal with new problems associated therewith such as treatment and disposal of ASRs and the like will become necessary.

(2) Expected measures

1) Promotion of labour safety measures (from the early stage of automobile diffusion)

(a) Vigorous application of the labour safety regulations

Measures for labour safety will certainly become necessary for downstream recycling. As there is a high possibility that the workers suffer directly from hazardous materials such as lead and sulfuric acid, prompt measures concerning the health problems of workers are required, regardless of the level of economic development, as the problems could be related to human life. Protective items such as masks and gloves need to be provided without fail so that workers are not exposed to hazardous materials directly.

(b) Guidance by municipalities and workshops organised by industrial organisations

Same as the case of ELV dismantling, the guidance by municipalities and workshops organised by industrial organisations are needed.

2) Promotion of environmental measures (from the early stage of automobile diffusion)

(a) Vigorous application of environmental regulations

At the early stage of automobile diffusion, compliance with basic regulations on environmental protection will become the starting point as there is a limit on administrative capacity due to lack of human resources and funds. It is primordial to eradicate environmental degradation by complying with relevant regulations, as downstream recycling is prone to cause environmental pollution by hazardous substances. As mentioned earlier, downstream recycling is related to the trading flow of resource materials as well as ELV recycling. Therefore, we need to proceed with the capacity building of municipalities, based not only on ELV recycling but also on the optimisation of waste treatment and recycling as a whole. We also need to develop a concrete operation system for the sake of strictly controlling violations of environmental regulations.

(b) Guidance by municipalities and workshops organised by industrial organisations

Just like the case of ELV dismantling, the guidance by municipalities and workshops organised by industrial organisations are needed.

To promote environmental measures, the following points should be considered.

(i) Coordination of existing waste treatment and recycling systems

For downstream recycling, it is important to coordinate the existing waste treatment and recycling systems. It is necessary to create a system by carefully examining whether we should create a specialised system for ELV recycling or proceed with it as a general matter for waste disposal and recycling as a whole. We should also cautiously consider the matter so as not to contradict existing regulations.

3) Sophistication of recycling technologies (from the progressive stage of automobile diffusion)

During low economic development, the quality requirements for recycled resources are also low. However, when the economy advances and there is an increasing demand for quality products, the demand for recycled resources, whose quality are not guaranteed due to the insufficient control of the household system, is supposed to decrease. In countries that are at the stage of matured automobile society, it becomes necessary to sophisticate recycling technologies that enable operators to produce recycled resources with high quality.

To promote environmental measures, the following point should be considered.

(i) Barriers to technology transfer

High-level expertise is required to produce recycled resources with high quality. One example of expertise is quality management of the recycled resources. It is difficult to introduce this kind of know-how in the short run. Therefore, together with the introduction of equipment, it is necessary to promote the introduction of technology and to develop personnel who can operate it in the long run.

4) Development of infrastructure, especially landfill sites (in the progressive stage of automobile diffusion)

As the mechanisation and automation of recycling advances, the treatment and disposal of newly generated residues such as ASRs become a problem. The proper treatment and disposal of these materials is necessary. ASRs should not be treated through a least-controlled final landfill site but through a controlled final disposal site with liner sheet and leachate treatment facility as ASRs have hazardous materials. The installation of this controlled final disposal site should be considered.

To develop infrastructure, the following point should be considered.

(i) Rising cost of treatment

The disposal cost of a controlled final disposal site is higher than that of a least-controlled final landfill site. The difference of treatment cost leads to the illegal dumping of ASRs due to the reluctance of bearing the burden of treatment cost. The development of a monitoring system on industrial wastes should be considered so as to prevent illegal dumping while the installation of controlled final disposal sites is promoted.

5) Legislation for downstream recycling (in the stage of matured automobile society)

(a) Division of roles among stakeholders

The system in which users and/or manufacturers are required to bear part of the treatment costs in order to prevent illegal dumping associated with the sharp increase in treatment and disposal costs is considered effective. For this kind of system to be realised, the premise is that citizens who are the final payers of the costs agree to cooperate regarding the collection of fees. This kind of examination will be made only after we enter into the stage of matured automobile society.

(b) Related licensing system

We need to create a separate licensing system for ELV recycling areas that cannot be covered by the existing treatment and recycling of hazardous materials. In Japan, a licensing system to cover hard-to-manage materials such as ASRs, airbags, and batteries was introduced to avoid any improper treatment. It is important to ensure the proper treatment of such materials by either modifying the existing system or establishing a new system for those that cannot be covered by the existing system, depending on the existing systems in each country. There are many countries that have licensing systems in place for the treatment and recycling of hazardous wastes such as lead and sulfuric acid. Therefore, it will be effective and efficient to include the treatment and recycling of hazardous materials wastes in the existing licensing system.

To legislate for downstream recycling, the following points should be considered.

(i) Securing of necessary funds and human resources

While the operation of the licensing system is performed by municipalities or by central governments (including local agencies of the central government), there are many developing countries that are unable to secure sufficient funds and human resources. Therefore, with limited funds and human resources, we need to find out the most efficient way to operate the system in a proper manner.

(ii) Consistency between the existing systems and the new system

In case a system specialising in ELV recycling is created, it is necessary to make it consistent with the existing waste treatment and recycling systems.

(iii) Vigorousness of the licensing system

It may also be possible to introduce a flexible authentication system rather than a vigorous licensing system. However, the question whether it is possible to rigorously confirm that conditions of the authentication are all satisfied arises.

(iv) Examination of a fee collection scheme

When examining the cost allocation system, we need to consider the manner in which the system will be established, including the fee level, who will collect fees from whom and in what manner, who is to administer the system, and how to make payments from the fund. When Japan enacted the Automobile Recycling Law, they had an intensive discussion about structuring the cost scheme, encompassing the collection, administration, and payment of fees. Because the most appropriate system may differ from country to country, it is necessary

to examine the contents of proper schemes on the basis of individual countries to secure a fee collection scheme.

6) Establishment of recycling technologies for the treatment of ASRs (matured automobile society stage)

If ASRs are treated through the controlled final disposal site, the treatment cost is higher. As mentioned earlier, the difference in treatment cost will lead to the illegal dumping of ASRs. Therefore, reducing the volume of the treatment by recycling the shredder dust should be considered. Concretely, it should promote further the sophistication of recycling through thermal recycling and/or feedstock recycling of shredder dusts, and recycling of welding slag.

To establish recycling technologies for the treatment of ASRs, the following point should be considered.

(i) Development of recycling technologies and incentives to the introduction

Recycling technologies such as thermal recycling, feedstock recycling of shredder dusts, and recycling of welding slag require high development and introduction costs. Then, it is assumed that the development and introduction does not proceed unless the incentives for development and introduction are given to the recycling industry. In this regard, structuring the scheme such as providing subsidies and incentives is necessary.

7. Others

(1) Situation and issues expected in ASEAN and other Asian countries

While each country is aware of the importance of ELV recycling, sufficient measures have not been actually undertaken due to the funds and human resources constraints. In such circumstances, support to ASEAN and other Asian countries from donor countries is strongly sought.

(2) Expected measures

1) Request for and promotion of international support

EVL recycling is not necessarily high in the priority in terms of international development cooperation. However, it is an issue related to human life from the viewpoint of safety and health. Accordingly, the importance of this issue is quite high. It is therefore important to draw more international support for ELV recycling in ASEAN and other Asian countries by

improving the awareness of international society and international assistance institutions such as the World Bank, the Asian Development Bank, Japan International Cooperation Agency and so on.

2) Dispatch of experts from advanced countries

In order to operate various systems related to ELV recycling, it is necessary to gather a variety of knowledge and experience. Therefore, it is necessary to request developed countries to dispatch experts with such knowledge to promote ELV recycling. It is also important for developed countries collaborate with relevant industries so that they agree to dispatch personnel with relevant experience and know-how to developing countries proactively.

8. Recommendations for upgrading the ELV recycling system in ASEAN

Motorisation is rapidly progressing in the ASEAN region. A huge amount of ELVs is expected to be generated in the ASEAN region as a result of the rapid rise of the number of vehicles, and the establishment of a scheme for their proper collection, reuse, treatment, and disposal will be required in the near future. The recommendations of the Economic Research Institute for ASEAN and East Asia Working Group on ELV recycling are summarised below. As the condition of motorisation is different among countries, the following recommendations have been made according to the stage of motorisation.

General

Recommendation 1. There is a need to raise the awareness of policymakers, car owners, and the general public on ELV, including safety standards.

Collaboration among stakeholders such as car owners, automobile dismantlers, used cars/parts dealers, recyclers of materials, waste treatment/disposal facilities, government, local municipalities and so on is indispensable for upgrading the ELV recycling system. The government is expected to collaborate on various policy measures.

Preliminary Stage

Recommendation 2. Illegal importation of ELVs and used parts should be prohibited. Stricter Customs control is indispensable.

Recommendation 3. Appropriate data collection is fundamental for further policy development. Currently, ELV generation and flow are not captured clearly. The establishment of a database system that is user friendly to prevent used parts entering the market needs to be considered. The introduction, upgrade, and proper management of the registration and deregistration systems are indispensable and will contribute to capture the ELV flow.

Recommendation 4. All stakeholders related to the ELV recycling system are responsible for the prevention of environmental pollution from ELVs. First, all stakeholders should make an effort to mitigate the environmental burden from ELV recycling. The government and local municipalities should strengthen the monitoring of environmental pollution from the ELV recycling process.

Recommendation 5. Currently, many workers in ELV recycling facilities are working under unhealthy conditions. The introduction and promotion of safety measures and the avoidance of health risks to workers are required for the sustainability of the ELV recycling system.

Recommendation 6. The control of ELV generation and flow is highly expected at this stage. Governments should introduce some policy measures like the strict implementation of car inspection or the introduction of maximum use of old cars.

Expanding Stage

Recommendation 7. Networking of used parts distribution is indispensable for the promotion of the utilisation of used parts and remanufacturing parts. Developing quality standards for used parts and remanufacturing parts contribute to this. Raising the awareness of car owners is also important.

Recommendation 8. Stakeholders should collaborate for the further development of the ELV recycling system. In particular, efforts in the following activities are highly expected:

1) Introduction, development, and transfer of ELV recycling technologies.

- Setting up of demonstration centres for dismantling facilities with appropriate environmental and occupational health measures in ASEAN and other countries in the Asian region.

2) Establishment of controlled final disposal sites (landfill sites with liner sheet and leachate treatment facility) and the like.

Maturing Stage

Recommendation 9. Stakeholders should advance the ELV recycling system. Governments should consider policy measures such as:

1) Development of ELV-specific regulations or laws (division of role and responsibility among relevant business entities and licence systems by legislation.

2) Adoption of recycling technology for ASR treatment, among others.

3) Promotion of the 3Rs.

References

Department of Environment and Natural Resources, Laws and Policies, http://www.denr.gov.ph/laws-and-policies.html

Environmental Protection Administration, Executive Yuan, R.O.C., Recycling Fund Management Board, http://recycle.epa.gov.tw/Recycle/en/index.html (accessed, 30 September 2015.

EX Research Institute Ltd. (2015), 'Survey on recycling law and business in Asia 2014', this study is commissioned by Ministry of Economy, Trade and Industry, Japan.

Feedback business consulting services (2015), 'Report on understanding Automobile Recycling Practices in India'.

Japan Automobile Recycling Promotion Center Statistics (2014), http://www.jarc.or.jp/.

Le Hoang Viet, Nguyen Vo Chau Ngan, Nguyen Xuan Hoang, Do Ngoc Quynh, Warinthorn Songkasiri, Catalin Stefan, and Terry Commins (2009), 'Legal and institutional framework for solid waste management in Vietnam', Asian Journal on Energy and Environment, 10(04), 261–272, http://www.asian-energy-journal.info/Abstract/Legal%20and%20institutional%20framework%20for%20solid%20waste%20management%20in%20vietnam..pdf

MOT (2013), 'Vietnam Vehicle Harmonization and Certification System. Presentation at the 37th APEC Transportation Technical Working Group (APEC-TTWG) Meeting, Ho Chi Minh City, Viet Nam, 8–12 April 2013.

Research and Markets (2015), 'China End-of-Life Vehicle (ELV) and Dismantling Industry Report 2014-2017', http://www.researchinchina.com/htmls/report/2015/9044.html.

The Ministry of Economy, Trade and Industry Japan (2011), Feasibility Study on Automotive Recycling business in China, http://www.meti.go.jp/policy/recycle/main/data/research/h23fy/23fy2403-1_kokusai01chinacar/23fy2403-1_kokusai01chinacar.pdf.

Recycling Foundation Management Board (2015), 'The Recycling, Disposal and Reuse Recycling Volume and Collection rate of Different Materials,', http://recycle.epa.gov.tw/Recycle/en/index.html (accessed 30 September 2015).

Japan External Trade Organization (JETRO) (2015), 'Trend of automobile production and sales in major countries in 2014', https://www.jetro.go.jp/ext_images/_Reports/01/20150032.pdf.

Sakai, Shin-ichi et al. (2014), An international comparative study of end-of-life vehicle (ELV) recycling systems, Journal of Material Cycles and Waste Management, Vol. 16, Issue 1, pp. 1–20, http://link.springer.com/article/10.1007%2Fs10163-013-0173-2 (accessed 30 September 2015).

UNEP,http://www.unep.org/ietc/Portals/136/Events/ISWM%20GPWM%20Asia%20Pacific%20Workshop/Vietnam_Presentation.pdf (accessed 30 September 2015).

Vietnam, Socialist Republic of (2006), 'Law on Environmental Protection', *Official Gazette*, Issues no. 11–12, February, http://faolex.fao.org/docs/pdf/vie64190.pdf (accessed 30 September 2015).

Viriyarattanasak, P., P. Wattanawongsakun, N. Pitaksapsin, and S. Lerspalungsanti (2015), 'Development of Integrated Flywheel-Clutch Case Using CAE Technique', SAE Technical Paper, 2015-01-0105, doi:10.4271/2015-01-0105.

Yano Research Institute Ltd. (2014), 'ASEAN Automobile Recycling 2014'.

Jawi, Zulhaidi Mohd, A. Rahmat, A. Manap, K.A. Abu Kasim, S.V. Wong, F. Lamin, F. Abas, P. Eng (2012), 'Review of the National Automotive Policy, Automotive on Car Maintenance Issues: Malaysia's Automotive Ecosystem Explained', *MIROS Review Report*.