



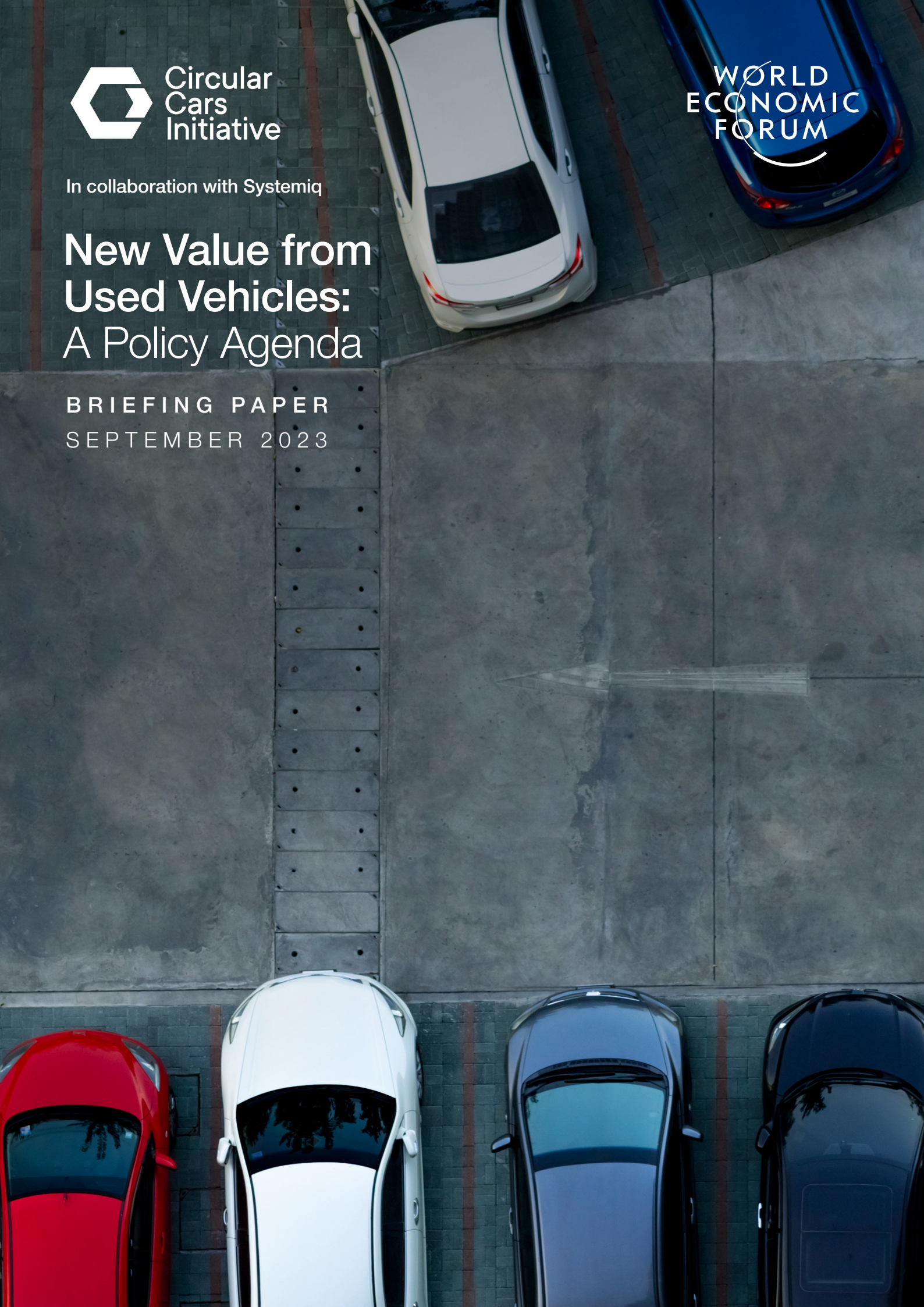
Circular
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In collaboration with Systemiq

New Value from Used Vehicles: A Policy Agenda

BRIEFING PAPER
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Executive summary

Close to [five million used light-duty vehicles are exported](#) annually from high-income to low- and medium-income countries. While access to affordable motorized transport is essential for enabling individual access to work, education and healthcare in importing countries, [used vehicles come at a significant societal cost](#). Most of these vehicles have poor safety and emissions standards, resulting in respiratory health conditions, accidents and greenhouse gas emissions.

Circular economy principles provide a promising lens through which the used vehicle trade can be turned from a burden into an opportunity. While circular business models such as recycling or repair are already widely established, especially in many importing countries, there is an opportunity to further scale and professionalize these business models to increase the quality and affordability of used vehicles. Opportunities for circular business models include:

- Industrializing high-value vehicle recycling in exporting countries
- Industrializing vehicle repair, refurbishment and remanufacturing both in exporting and importing countries

- Developing high-quality end-of-life vehicle (ELV) management and recycling ecosystems in importing countries

To enable their wide-spread adoption, the right regulatory frameworks need to be established, especially in exporting countries. A review of current policy frameworks shows that the EU, China and the US – as the three key automotive markets of the world – have different approaches and ambition levels to managing used vehicle exports. There are five aspects that policy-makers in these countries should prioritize:

- Passing comprehensive ELV legislation
- Incentivizing delivery to authorized treatment facilities
- Enforcing import standards at the point of export
- Aligning ELV policies with the waste management hierarchy
- Supporting capacity development in importing countries



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The global used vehicle trade is a growing concern for the global transition to a sustainable road transport system



Some [five million used light-duty vehicles are exported](#) annually from high-income to low- and medium-income countries. Currently, Europe (ca. 54%), Japan (ca. 27%) and the United States (ca. 18%) lead used vehicle exports, although China is also [playing an increasingly important role](#). African countries are the [largest importers of used vehicles](#), accounting for close to 40% of global imports. By 2050, the African vehicle fleet is set to grow four to five times, with around [90% of this growth expected to come from used vehicles](#). Since 2015, exports of used vehicles have been steadily growing, driven by a voracious demand for mobility in importing countries.

Even though used vehicles provide access to affordable motorized transport, [they come at a significant societal cost](#). Most of these used vehicles have poor safety and emissions standards, resulting in respiratory health conditions, greenhouse gas emissions and accidents. For example, Africa has the highest road traffic fatalities in the world with [246,000 deaths per year](#). In addition, many vehicles that reach their end-of-life in importing countries are not properly disposed of, resulting in environmental pollution and health hazards.

To enable the transition to a sustainable road transport system globally, the adverse impacts of the used vehicle trade need to be addressed.

This becomes especially important against the backdrop of the battery electric vehicles (BEV) transition. Specifically, there are two issues that need to be solved.

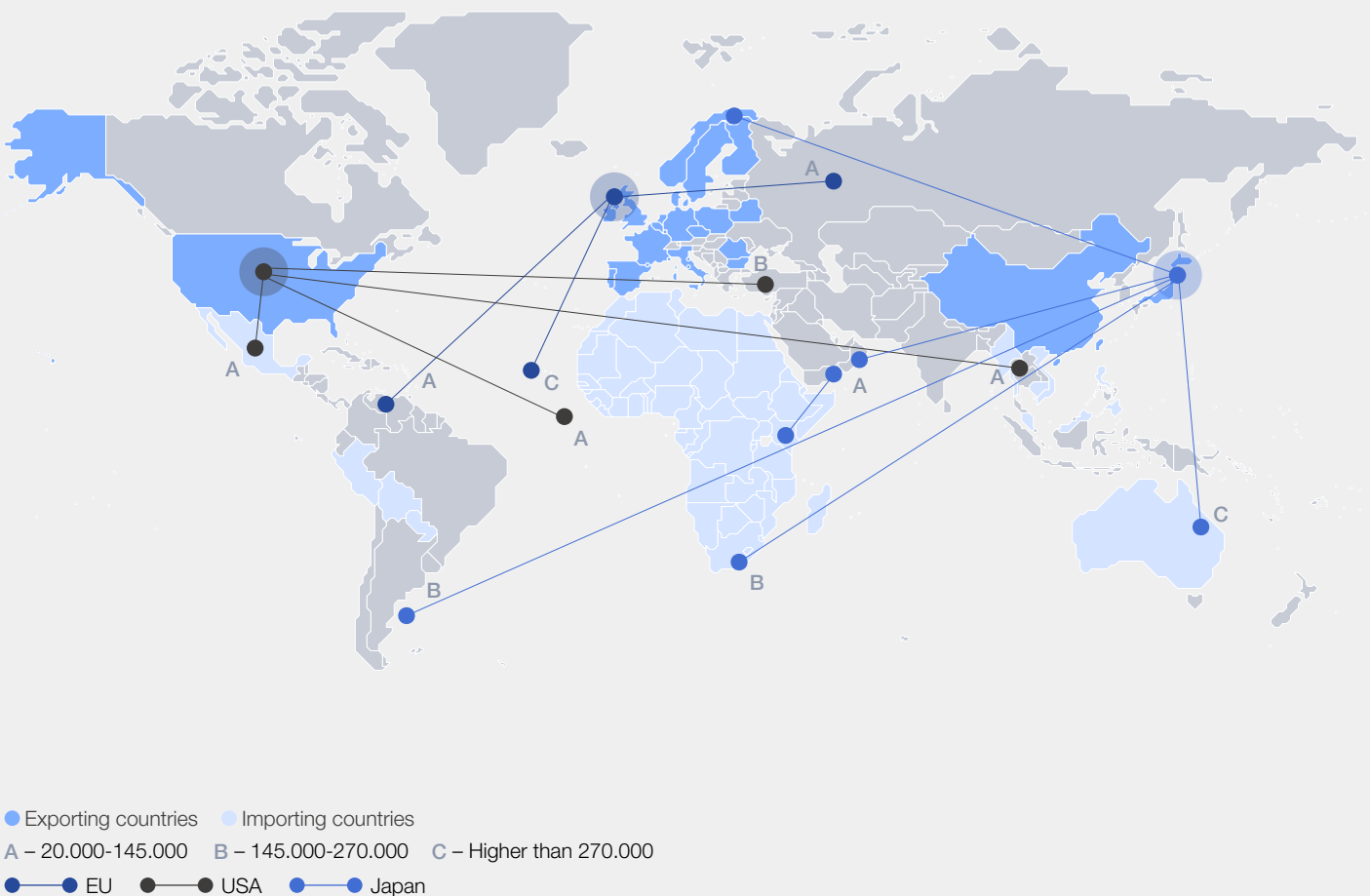
1. There is a risk that exports of the most polluting vehicles could, at least partially, offset emissions reductions from the BEV transition. Until 2050, the global fleet of light-duty vehicles is [set to at least double](#), with over 90% of growth coming from non-OECD countries. Used vehicles will play a significant role in this growth. Ensuring their quality will be critical in minimizing carbon leakage. Transitioning that fleet to zero-carbon vehicles also will be indispensable to reach a net-zero target.

2. As the number of BEVs increases in low- and medium-income countries (LMICs), these countries will also need to be [equipped with the necessary circular governance and infrastructure](#). This pertains not only to reliable and safe charging infrastructure, but also to the circular and sustainable life cycle management of EV batteries and ELVs. While the lack thereof is already an issue with combustion engine cars, mishandling high-voltage systems is quickly life-threatening and thus will need a new generation of capacity development.

Addressing the existing issues of the used vehicle trade is an important element to achieve a truly global transition to a circular and sustainable road transport system.

FIGURE 1 Overview of the current light-duty vehicle trade

Main used light duty vehicles quantity and flows (2017)



Source: [UNEP \(2020\)](#)

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Further scaling circular business models can enhance the quality and profitability of the used vehicle trade

Circular economy principles provide a promising lens through which the used vehicle trade can be turned from a burden into an opportunity.

While circular business models such as recycling or repair are already widely established, especially in many importing countries, there is an opportunity to further scale and professionalize these business models to increase the quality and affordability of used vehicles. There are three types of business models that will be examined in more detail:

- Industrializing high-value vehicle recycling in exporting countries

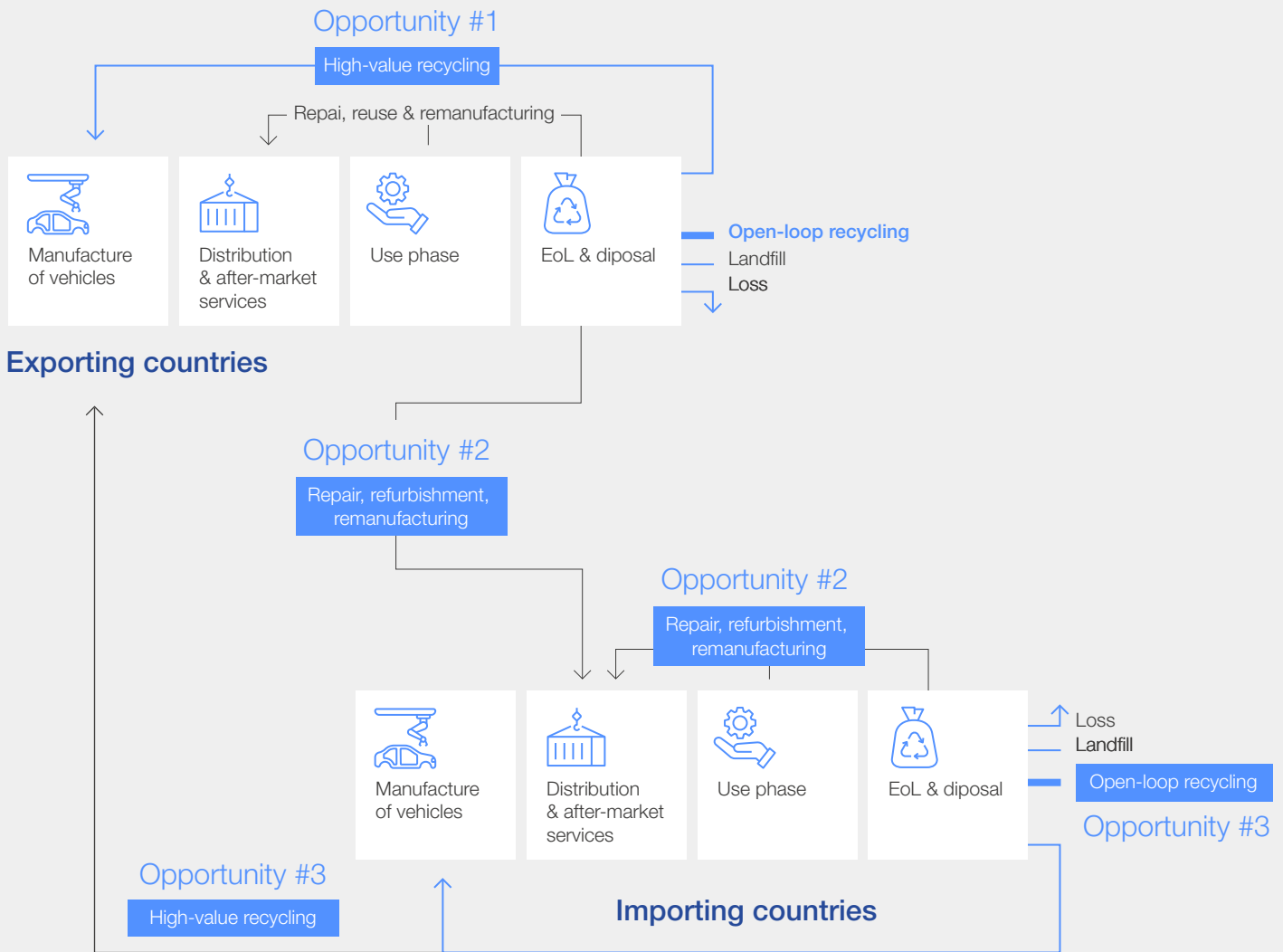
- Industrializing vehicle repair, refurbishment and remanufacturing in exporting and importing countries

- Developing high-quality ELV vehicle management and recycling ecosystems in importing countries

Scaling these business models requires public-private collaborations to create the enabling conditions for a circular and sustainable vehicle life cycle management that optimizes the lifetime of vehicles and closes material loops – regardless of geographic location.



FIGURE 2 | Vision of the potential circular business model opportunities along the used vehicle trade



Circular business model opportunities

 <p>Opportunity #1 Industrializing high-value end-of-life vehicle (ELV) recycling in exporting countries</p>	 <p>Opportunity #2 Industrializing vehicle repair, refurbishment, and remanufacturing in exporting and importing countries</p>	 <p>Opportunity #3 Developing high-quality ELV vehicle management and recycling ecosystems in importing countries</p>
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Source: [Systemiq](#)

Opportunity 1: Industrializing high-value ELV recycling in exporting countries

The first opportunity lies in industrializing high-value ELV recycling in exporting countries. In the EU, [about a third of all ELVs](#) – between 3 to 4.5 million vehicles – are lost to illegal dismantling or exports annually. This is [driven by the low value of recycled materials](#) compared to the high costs of dismantling and recycling. Even though the EU has ambitious recycling targets in place, current

quantity-focused recycling practices typically yield lower-value materials, due to the contamination of most high-value materials.

Advances in the circular economy could improve scrap purity levels, thereby preventing the loss of economic value added. [Potential measures](#) could include: improved design for disassembly, as well as investments into industrialized dismantling processes and advanced shredding technologies. This could improve scrap purity levels, thereby preventing the loss of economic value added. Ultimately, higher-value ELV

recycling could not only prevent the export of the most polluting vehicles, but also increase the supply of less carbon-intensive secondary materials, such as steel, copper, or plastics.

High-value recycling could enable OEMs, automotive component and materials suppliers to meet recycled content and decarbonization targets. BMW, for example, wants to increase share of secondary materials in vehicles [from 30% to 50% by 2040](#). The latest [draft of the EU Circular Vehicle Regulation](#) introduces a 25% recycled plastic target (by mass), of which 25% must be recycled from ELVs, creating an incentive to improve plastics recycling both from vehicles and other sources. Could use the scraps to decarbonize their steel production. Increasing both the collection of ELVs as well as the quality of recycling processes could not only improve automotive circularity in exporting countries, but also reduce adverse impacts in importing countries.

Opportunity 2: Industrializing vehicle repair, refurbishment and remanufacturing in exporting and importing countries

The second opportunity centres around lifetime optimization through repair, refurbishment and remanufacturing. Across the vehicle life cycle and could occur in both exporting and importing countries. At vehicle export, these models could address minor deficiencies to ensure vehicle roadworthiness and to meet minimum import requirements. However, the majority of vehicles exported today are economically irreparable, since their market value is lower than the cost of the necessary repairs needed to restore roadworthiness.

Economic feasibility is a significant but not insurmountable barrier for scaling business models around repair, refurbishment and remanufacturing. Potential solutions could include:

- Professionalizing and industrializing refurbishment and remanufacturing processes, thereby increasing the pool of lower cost components for repair
- Digitalizing the reverse value chain from testing to demand matching, thereby cutting transactions costs, increasing quality and improving business cases
- Scaling reverse value chain networks in countries with lower cost bases, thereby reducing handling and processing costs

These types of business models could be attractive to certain OEMs and/or aftermarket players, since it provides the opportunity to extend into the used vehicle market. For example, French car manufacturer Renault expects to [generate annual sales up to €1 billion by 2030](#) from circular economy-related activities, including repair and remanufacturing. For some OEMs, selling used vehicles could be a way to complement their new vehicle portfolio. This is especially the case for smaller vehicle segments, which are made less economically attractive due to relatively high costs associated with meeting heightened emissions standards, such as Euro 7/VII or China's VI-b, make new small vehicles less economically attractive due to relatively high costs for additional emissions control measures. However, it needs to be ensured that smaller aftermarket players also have access to the components and information required to conduct these value retention processes.

Opportunity 3: Developing high-quality ELV management and recycling ecosystems in importing countries

Inevitably, all vehicles will reach their end of life, resulting in the need to develop a more formalized recycling infrastructure that can economically recover materials and minimize adverse environmental and social effects. Today, many ELVs are not disposed of properly in importing countries, resulting in environmental pollution and health hazards. This could be exacerbated by the export of EVs, which would [shift the burden of EV battery recycling](#) to importing countries that may lack the infrastructure, training and governance to manage and recycle them safely.

Developing recycling infrastructure and networks in importing countries could be a potential business model for regional aftermarket players.

Apart from selling recycled materials locally, a potential opportunity could be to export recycled materials to countries where vehicle production is localized. For example, end-of-life EV batteries could be recycled into black mass and then exported again to countries with an EV battery production. Over time, the development of higher value-added manufacturing (e.g. refining black mass into precursor materials; turning those into active battery materials, etc.) could provide a path to economic development for the participating countries.

3 **Current policy frameworks in exporting countries do not sufficiently enable circular business models across the used vehicle trade**



To enable the wide-spread adoption of these circular business models, the right policy frameworks need to be developed. There are several efforts underway to coordinate actions between exporting and importing countries, for example by [UNEP](#) or the Zero Emission Vehicles Transition Council ([ZEVTC](#)). Nevertheless, [policy-makers in exporting countries](#) are particularly responsible for curbing pollution exports to the Global South and to ensure access to clean and sustainable road transport.

This section will review the policy environment in the EU, China and the US to assess its effect on the three aforementioned circular business model opportunities. Since some measures will affect several opportunities simultaneously, these are addressed separately. The findings are synthesized in Table 1.

TABLE 1 **Synthesis of current used vehicle policies**

	European Union <i>(based on Circular Vehicles Regulation draft)</i>	China	United States
Cross-cutting market enablers	<ul style="list-style-type: none"> Introduces a digital circularity vehicle passport Requires manufacturers to implement a circularity strategy 		
Option 1 – Industrializing high-value ELV recycling in exporting countries	<ul style="list-style-type: none"> Ensures design for recyclability/disassembly Mandates the use of recycled plastics Increases authorized treatment of ELVs Facilitates vehicle dismantling Enhances recycling quality 	<ul style="list-style-type: none"> Requires the recycling of ELVs Incentivizes ELV returns to authorized treatment facilities Increases the recyclability of vehicles 	<ul style="list-style-type: none"> Requires the safe handling and recycling of hazardous and non-hazardous wastes
Option 2 - Industrializing vehicle repair, refurbishment, and remanufacturing in both exporting and importing countries	<ul style="list-style-type: none"> Makes disassembly information available across the value chain Clarifies the definition of used vehicles Incentivizes the use of secondary spare parts Links exports to roadworthiness 	<ul style="list-style-type: none"> Encourages the remanufacturing of vehicle parts 	<ul style="list-style-type: none"> Encourages the public procurement of remanufactured components
Option 3 – Developing high-quality ELV management and recycling ecosystems in importing countries	<ul style="list-style-type: none"> Makes disassembly information available across the value chain 		

3.1 European Union

The European Commission introduced a [Circular Vehicles Regulation draft](#) in July 2023 to replace the current directives on [end-of-life vehicles](#) and on vehicle [reusability, recyclability and recoverability](#). The regulation draft covers the core aspects of the aforementioned business models and will be the focus of the EU policy assessment. Following its publication, the draft will now be considered by the European Parliament and the European Council in the regular legislative process and is expected to be passed into law before the end of the current election period in June 2024.

Cross-cutting market enablers

The regulation draft suggests a few cross-cutting measures that can help overcome barriers related to information asymmetry, which include:

- **Introducing a digital circularity vehicle passport:** Following the introduction of a [digital battery passport](#), the EU Commission proposes a digital vehicle passport. This tool would provide on the safe removal and replacement of vehicle parts and components and could thereby enable informed decision-making for the optimal vehicle processing at end-of-life (Articles 11 & 13; Annex V).
- **Requiring manufacturers to implement a circularity strategy:** These strategies can help improve data availability and information on the sector's circularity transition. Among others, manufacturers need to report on their efforts to collect supply chain information, improve vehicle circularity, and to invest in end-of-life treatment (see Article 9, [Annex IV](#)).

Opportunity 1 – Industrializing high-value ELV recycling in exporting countries

The regulation draft includes a number of measures to enable the high-value recycling of ELVs in Europe, which include:

- **Ensuring design for recyclability and for disassembly:** Regarding recyclability, the draft suggests the same requirement of 85% recyclability (by mass) as the previous ELV Directive (Article 4). In regard to disassembly, the draft adds that vehicles shall be designed that certain components, such as electronic and electrical equipment or wire harnesses, can be easily disassembled (Article 7, [Annex VII part C](#)).

- **Mandating the use of recycled plastics:** The regulation introduces a 25% recycled plastic target, of which 25% must be recycled from ELVs (Article 6). Manufacturers are obliged to declare the share of recycled content of indicated materials present in vehicles (Article 10).
- **Increasing the collection and treatment of ELVs by authorized treatment facilities:** First, the regulation extends the requirements to include vehicles, lorries, busses and trailers (Article 1). Second, it obligates owners to deliver vehicles to authorized treatment facilities and to present the certificate of destruction for vehicle de-registration (Articles 24 & 26). While these measures address important gaps, they do not [financially incentivize delivery](#) to authorized treatment facilities.
- **Facilitating the dismantling of vehicles:** The draft regulation helps reduce scrap contamination by mandating the removal of certain components in the disassembly process, such as wire harnesses (see Article 30, [Annex VII part C](#)).
- **Enhancing the recycling quality:** The regulation draft maintains the current ELV Directive's recycling target of 85% (by mass) and introduces a material-specific target of at least 30% for plastics (Article 34). Nevertheless, it falls short in introducing further material-specific or quality of recovery-related targets for other materials, thereby inhibiting the transition to more high-value recycling.

Opportunity 2 – Industrializing vehicle repair, refurbishment and remanufacturing both in exporting and importing countries

The draft regulation also includes several measures to enable lifetime repair, refurbishment and remanufacturing including:

- **Making design for disassembly information available across the value chain:** As mentioned above, the regulation draft requires vehicles to be designed for disassembly (Article 7; [Annex VII, part C](#)). In addition, manufacturers are obliged to make disassembly information available free of charge to repair and maintenance operators (Articles 11 & 13).
- **Clarifying the definition of used vehicles:** The draft provides more certainty on the types of vehicles that can qualify for repairs, by clarifying the definition of ELVs and the terms of technical and economic irreparability (Article 3).

- **Incentivizing the use of used parts:** Member States are required to adopt incentives that promote component reuse or remanufacturing, for example through value added tax reductions for secondary components (Article 33).
- **Linking exports to roadworthiness:** The draft also links vehicle exports to a roadworthiness certificate (Article 38). This not only prevents the export of low-quality vehicles, but can also encourage additional vehicle repairs before export, as long as they are technically and economically feasible.

Opportunity 3 – Developing high-quality ELV management and recycling ecosystems in importing countries

The draft regulation does not explicitly account for ELV recycling in importing countries. Nevertheless, it can facilitate this by ensuring that that operators in importing countries have a similar access to the dismantling information on digital circularity vehicle passports and that the capacity and capability development for the safe and sustainable life-cycle management of vehicles is supported.

3.2 China

Since the late 2000s, China has adopted the circular economy as a national priority and identified vehicle remanufacturing and recycling as a key strategic priority. In particular, Chinese [policy efforts have focused on five priorities](#): strengthening producer responsibility; increasing the recyclability of vehicles; standardizing the ELV dismantling and recycling industry; subsidizing the replacement of used vehicles; and scaling the remanufacturing of automotive parts. Current policies in China have significant implications for the scaling of the aforementioned circular business models, which will be reviewed below:

Opportunity 1 – Industrializing high-value ELV recycling in exporting countries

Chinese policies include a range of measures to enable this circular business model, which include:

- **Requiring the recycling of ELVs:** Originally passed in 2001, the [Measures for the Administration of the Recycling of End-of-Life Motor Vehicles](#) (2019) established an ELV collection system to prevent accidents caused by old vehicles. The law also established basic requirements for the establishment of dismantling and recycling facilities.
- **Incentivizing ELV returns to authorized treatment facilities:** Since the 2019 update of the [Measures for the Administration of the Recycling of End-of-Life Motor Vehicles](#), ELVs do not have to be picked up anymore by

authorized dealers at the price of scrap metals. [Before this adjustment](#), the price of ELVs which capped, which reduced owners' incentives to deliver ELVs to authorized facilities and instead resulted in outflows to illegal markets.

- **Increasing the recyclability of vehicles:** With the 2015 policy on [Requirements for the Management of Hazardous Substances and Recyclable Utilization Rate of Automobiles](#), China introduced comprehensive eco-design requirements for vehicles (e.g. use of non-toxic materials and recyclability), requirements for vehicle recycling at end-of-life, and increased transparency over materials used in vehicle components.

Opportunity 2 – Industrializing vehicle repair, refurbishment and remanufacturing both in exporting and importing countries

As mentioned above, one of the key pillars of Chinese policy-making has been to encourage the remanufacturing of vehicle parts. This has been enabled primarily by two policies. The 2013 [Swap the Old for Remanufacturing](#) policy incentivizes swaps of old with remanufactured parts through subsidies. In addition, the [2019 revision of the Measures for the Administration of the Recycling of End-of-Life Motor Vehicles](#) stipulates that the key “five assemblies” of dismantled end-of-life vehicles (i.e. engine, steering machine, transmission, front and rear axle, and frame) should be remanufactured and not recycled if possible.

3.3 United States

Contrary to the European Union and China, the United States does not have a national policy framework regarding ELVs. As a result, the management of used vehicles and [ELVs is mainly driven by market forces](#) instead of regulatory requirements. Moreover, the US remains the only OECD-country that has yet to ratify the Basel Convention. This multilateral environmental agreement aims to manage the cross-border transport of hazardous waste, including ELVs. As a result, there is no policy framework in place that limits the exports of used vehicles.

Opportunity 1 – Industrializing high-value ELV recycling in exporting countries

In the US, the recycling of [ELVs is only managed through cross-sector regulations on environmental protection](#), such as the [Resource Conservation and Recovery Act](#), [Clean Air Act](#) and [Clean Water Act](#). The Resource Conservation and Recovery Act, for

example, sets standards to ensure that hazardous and non-hazardous wastes (e.g. vehicle fluids and batteries) are stored, handled, recycled and disposed of safely.

Opportunity 2 – Industrializing vehicle repair, refurbishment and remanufacturing both in exporting and importing countries

The United States is the [world's leading producer](#), consumer and exporter of remanufactured goods. Similar to the recycling industry, the development of the remanufacturing industry has been primarily driven by market forces. However, the US government has also been supporting the development of this industry through demand-side public procurement policies. Under the Resource Conservation and Recovery Act, the US government also [encourages the public procurement](#) of vehicles with remanufactured parts.

Recommendations: Policy action to turn the global used vehicle trade from burden to opportunity

Even though there are promising policy developments underway, particularly in the European Union, all three actors – China, the US and the EU – can further strengthen their policy frameworks to enable circular business models for used vehicles. There are five aspects that can be done:

- **Passing comprehensive ELV legislation:** With its new Circular Vehicle Regulation draft, the EU proposes a set of comprehensive measures to enable circular business models for used vehicles. China and the US can take this as an example for comprehensive policy design and to further develop their own policy frameworks, especially around transparency and circular vehicle design. For the EU, it will be important ensure that draft's current ambitions are maintained through the legislative process – especially considering the next elections in June 2024.
- **Incentivizing delivery to authorized treatment facilities:** The EU and China could incentivize delivery to authorized treatment facilities through [well-designed financial incentives](#). This could help to discourage illegal dismantling and exports. Potential best practice examples already exist in Denmark, the Netherlands and Portugal.
- **Enforcing import standards at the point of export:** While banning exports of non-roadworthy vehicles is an important first step, exporting countries could support governance and monitoring efforts of importing countries (e.g. [Euro 4/IV emissions standards set by the East Africa sub region](#)), by monitoring compliance with import requirements at the point of export.
- **Aligning ELV policies with the waste management hierarchy:** Across all three geographies, there is insufficient support for repair, refurbishment and remanufacturing. This [could be further strengthened](#) through separate mandatory targets or economic incentives, such as subsidies or tax credits, for these processes.
- **Supporting capacity development in importing countries:** Exporting countries could support the infrastructure and capacity building for repair, refurbishment, remanufacturing and recycling in importing countries (e.g. through technology or knowledge transfer as well as investment support). Given the increasing prevalence of BEVs, special attention should be given to developing the necessary skills and facilities for their safe and environmentally sound service and recycling, for example through training programmes, knowledge sharing platforms, or collaborative initiatives.

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