Circular Cars Initiative

In collaboration with Systemiq

WORLD ECONOMIC FORUM

Enabling Automotive Circularity through Digital Vehicle Passports

BRIEFING PAPER

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Images: Getty Images

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Introduction

The European Union has proposed a circularity vehicle passport (CVP) as part of an EU circular vehicles regulation. This CVP is scoped to be primarily aimed at enabling end-of-life processes, which includes making information and disassembly instructions on vehicle components available to downstream actors. An additional requirement might come from the Euro 7 regulation with the proposed environmental vehicle passport (EVP) focusing on the environmental performance of a vehicle at the moment of registration.

This briefing paper argues that building on the CVP and EVP, a holisitc digital vehicle passport (DVP) could be created to become a powerful enabling tool for global automotive circularity, and would include:

- General vehicle information (e.g. registration numbers, ownership history).
- Upstream information (e.g. Scope 3 emissions of vehicle materials, supply chain due diligence).
- Vehicle use information (e.g. events tracking and accident history).
- Downstream information (e.g. component disassembly information).

Taking this approach to DVPs could enable automotive circularity globally by:

- Supporting informed purchasing decisions by increasing transparency on product characteristics such as the carbon footprint or energy consumption.
- Improving vehicle and component use by making vehicle use information such as vehicle malfunctions or age available to the aftermarket, fleet operators and used vehicle traders.
- Enhancing the safety and sustainability of vehicle end-of-life by enabling more effective and efficient vehicle collection, remanufacturing and recycling.

The introduction of such a holistic DVP could support recent policy efforts and initiatives in the key vehicle manufacturing regions – the European Union (EU) , China and the United States (US). To seize this opportunity, policy-makers should consider the following three recommendations:

- Introducing an ambitious DVP legislation in the EU by expanding the intended scope of the CVP and creating synergies with the EVP.
- Advancing DVPs in China, the US and other geographies, and working towards their harmonization to prevent fragmented DVPs.
- Advancing and supporting multistakeholder initiatives to advance DVPs that are ambitious yet feasible.

1 How the EU intends to introduce a circularity vehicle passport

Released in July 2023, the European Commission's circular vehicles regulation proposal aims to facilitate the automotive sector's transition to a circular economy, from design to end-of-life treatment. The proposed regulation would replace the end-of-life vehicle directive (ELV Directive) and the so-called 3R-type approval directive. The proposal introduces a range of measures to increase circularity across the vehicle lifecycle.

Article 13 introduces the concept of a CVP, essentially a DPP for vehicles. The CVP is due to enter into force seven years after the coming into force of the regulation, likely in 2031. The initiative to introduce a CVP is part of a wider EU push to introduce DPPs to improve the sustainability and circularity of value chains. The groundwork for the extensive use of DPPs across diverse product categories was laid out by the 2022 EU ecodesign for sustainable products regulation (ESPR) and the 2023 EU battery regulation, which introduces a digital battery passport for EV, light means of transport and industrial batteries with >2kWh capacity.

According to the circular vehicles regulation proposal, the CVP's proposed scope is primarily aimed at enhancing information accessibility for the safe removal and replacement of vehicle parts and components. Figure 1 provides an overview of the mandatory information that needs to be included according to the proposal.

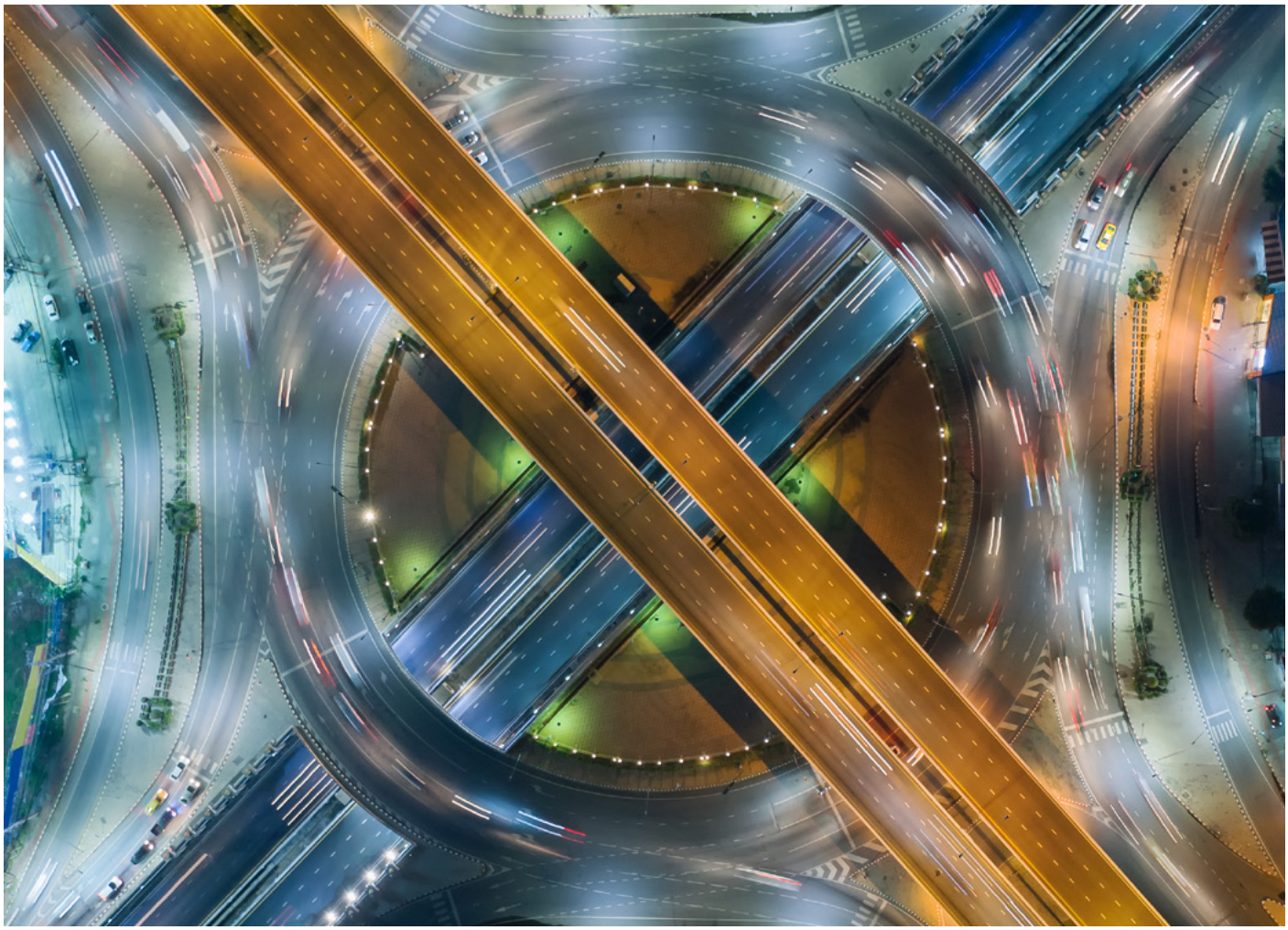
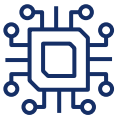


FIGURE 1 | **Mandatory information on the CVP introduced in the circular vehicles regulation proposal**

1	2	3	4	5	6
					
Electric vehicle batteries	E-drive motors	Components, parts and materials containing fluids and liquids	Parts and components for mandatory removal	Parts and components containing critical raw materials*	Digitally-coded components and parts
Number	Number	**For parts and materials, incl. airbags, tanks, air conditioning systems, and refrigerants:**	**For 19 parts and components, incl. Batteries, engines, wheels, headlights and dashboards:**	Information requirements for critical raw materials (34 materials listed in the CRM Act) not further specified	Number
Location	Location	Presence of lead mercury, cadmium,or hexavalent chromium	Number		Location
Weight	Weight	Number	Location		Technical instructions on access, removal and replacement
Battery chemistry type	Type of permanent magnets	Location	Technical intructions on removal and replacement		Description on functionality, interchangeability with specific parts and components of other makes and models
Instructions for safe discharging	Technical instructions on removal and replacement	Weight			Contact point of the manufacturer for technical assistance
Technical instructions on removal and replacement	Tools required for access, removal and replacement	Technical intructions on removal			
Tools required for access, removal and replacement		Availability of best treatment techniques			

* The circular vehicles regulation proposal introduces parts and components containing critical raw materials in Article 11. However, Annex V, outlining information requirements on removal and replacement, does not include such requirements.

In addition to the CVP, in the EU's ongoing revision of rules for type-approval and market surveillance of motor vehicles (Euro 7), an EVP is introduced. The EVP, outlined in the adopted proposal of the Environment Committee from October 2023, aims to capture detailed information on a vehicle's environmental performance at registration, including emission limits, CO_2, fuel and energy consumption, electric range, engine power and battery durability. This data is intended also for display in the vehicle's electronic systems. However, the synergy between the EVP and CVP requires further clarification, potentially paving the way for a unified vehicle passport.

2 The vision: a digital vehicle passport (DVP) entailing upstream, vehicle use and downstream information

Based on the circular vehicles regulation draft, this paper proposes to extend the CVP concept by including not only general vehicle information and downstream data, but also upstream and usage data. This could start by fusing the proposal with the one suggested in the Euro 7 agreement for an EVP.

Figure 2 provides a detailed breakdown of the proposed types of data points that could ultimately be included. This includes:

- General vehicle information, such as vehicle identification number, vehicle make and model, registration information, ownership history and warranty information.
- Upstream information, such as Scope 3 emissions of vehicle materials and supply chain due diligence.
- Vehicle use information, such as events tracking and accident history.
- Downstream information, such as component disassembly information.

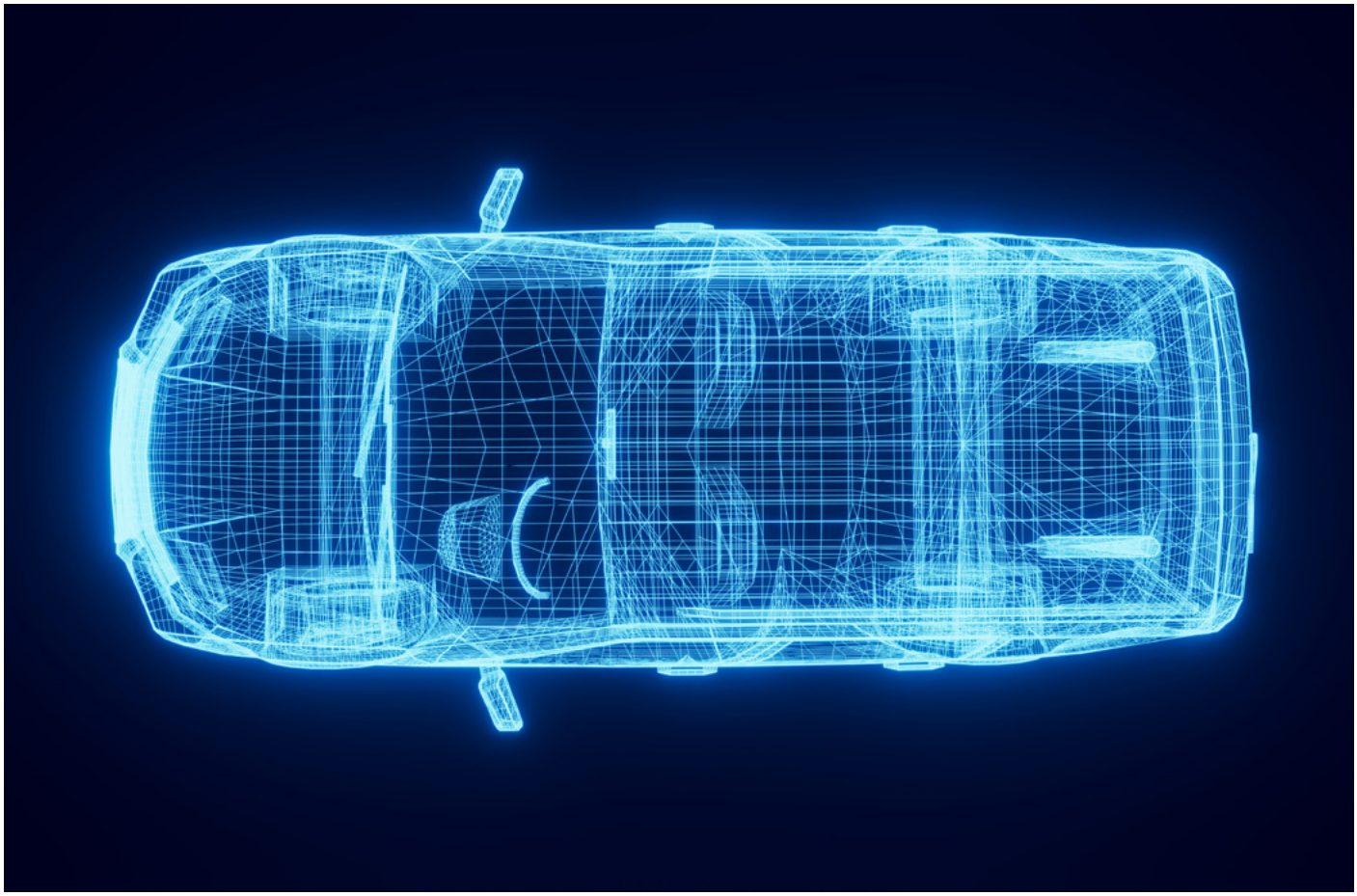
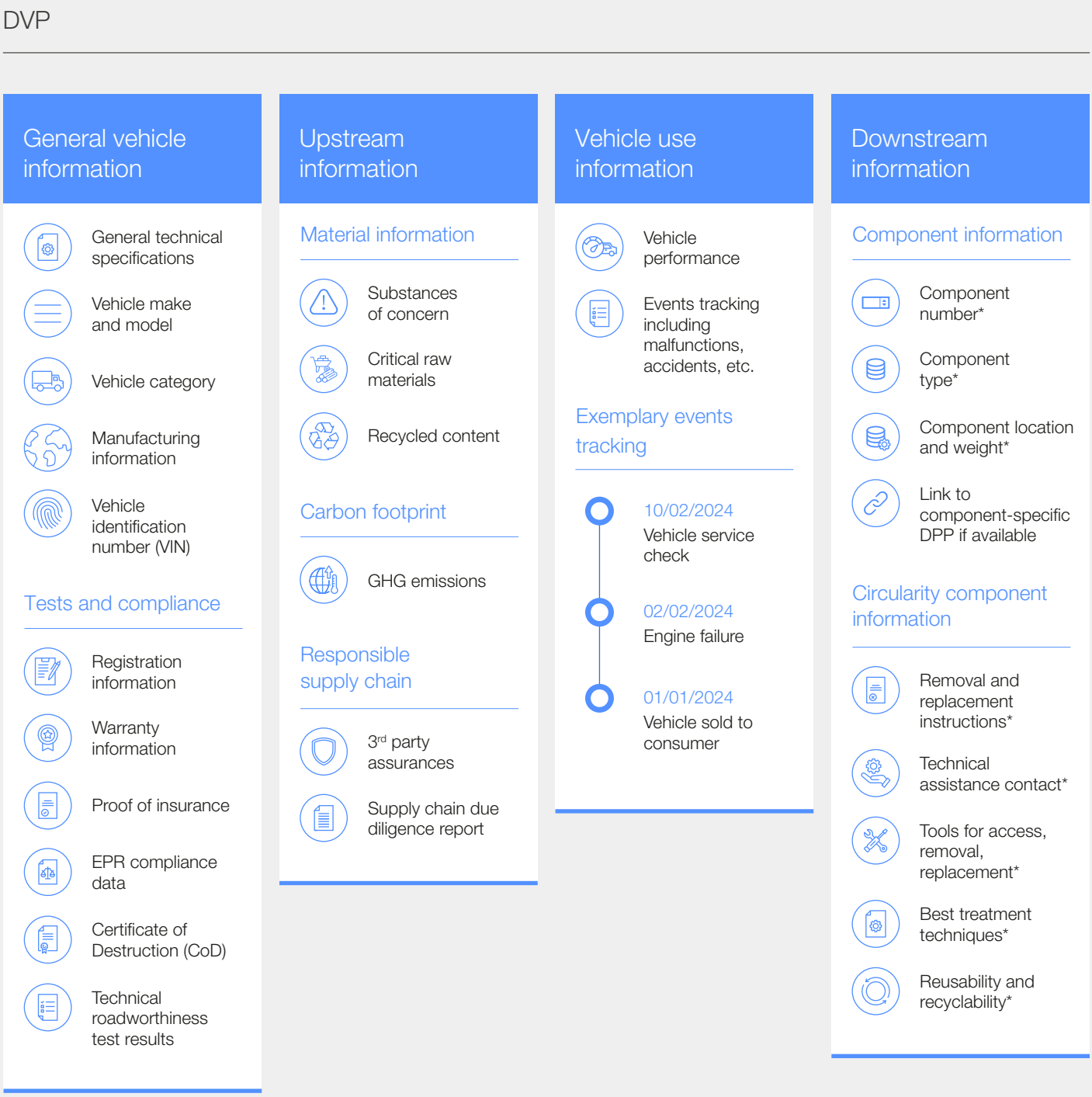


FIGURE 2 | **Vision of a holistic DVP**

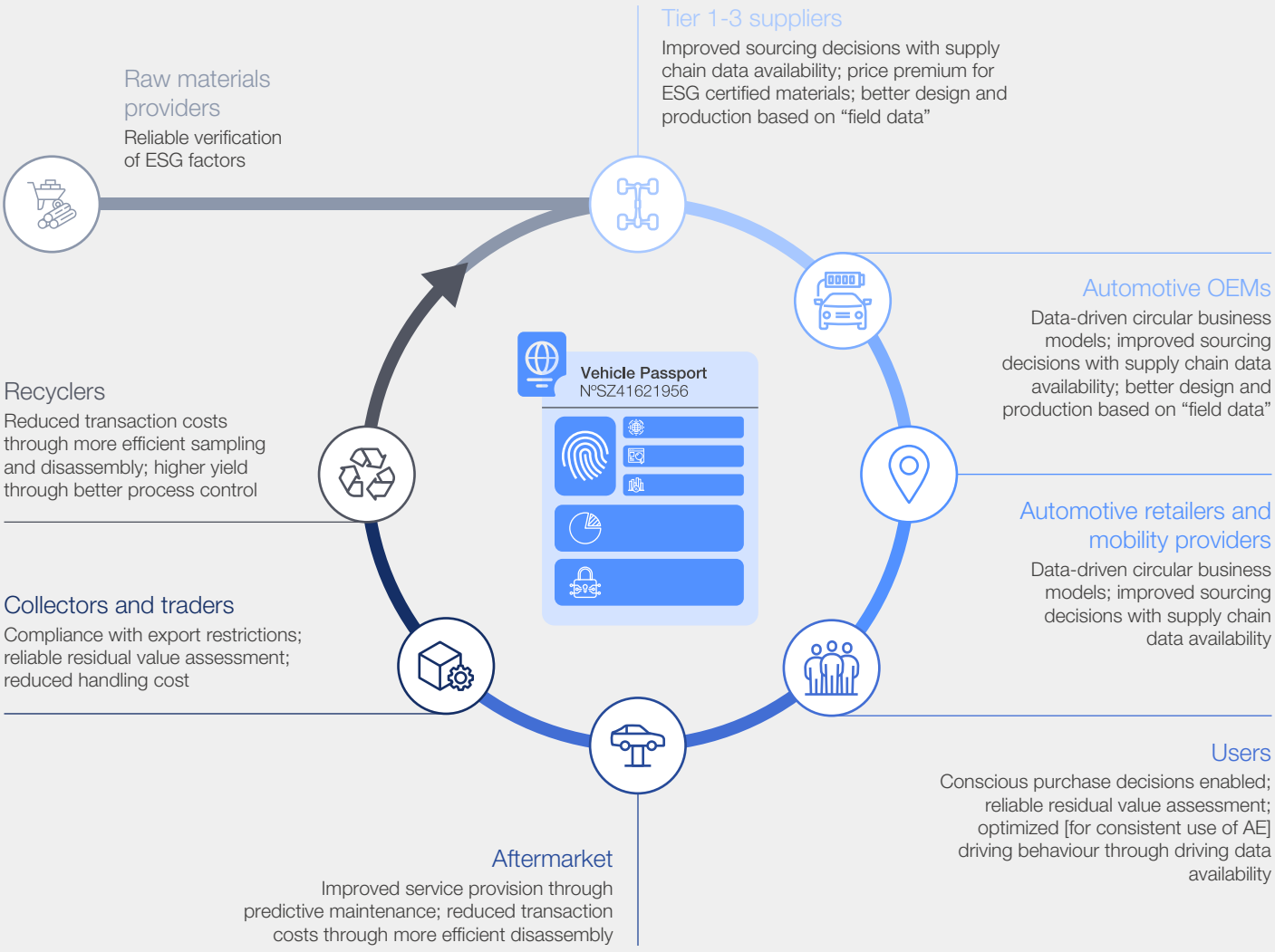


* Required per circular vehicles regulation proposal.

3 The DVP can enable global automotive circularity

A DVP that requires transparency over a vehicle's entire life cycle can unlock value along the entire value chain (see Figure 3). It can enable automotive circularity in three ways.

FIGURE 3 **Overview of potential use cases of a DVP**



3.1 Enabling actors along the automotive value chain to make informed purchasing decisions

- *Reducing the carbon footprint of vehicles, components and materials:* The DVP can empower upstream buyers and consumers to make purchasing decisions based on the carbon footprint of materials, components and vehicles by identifying emission hotspots and inefficiencies. This is especially important as a significant portion of a vehicle's lifecycle emissions (18-22% for internal combustion engine vehicles and over 60% for EVs) stems from materials production.

- *Increasing the usage of recycled content:* Providing transparent information on the recycled content of vehicles can encourage greater utilization of recycled materials. It allows OEMs to showcase their commitment in meeting recycled content targets and requirements while enabling upstream buyers and consumers to make more informed choices when purchasing vehicles or components.

- *Ensuring supply chain responsibility:* By simplifying the collection and provision of supply chain information, the DVP can play a pivotal role in managing sourcing risks and ensuring compliance with emerging due diligence requirements, such as the EU corporate supply chain due diligence directive. For OEMs, communicating on and demonstrating supply chain responsibility can also build trust with customers.

3.2 The DVP can improve vehicle and component utilization

- *Unlocking circular business models:* A DVP can unlock new business opportunities through circular value retention and optimization such as the creation of new used vehicle marketplaces with reduced transaction costs or making vehicle as-a-service models more attractive with enhanced repair and maintenance information.

- *Enhancing the usage of vehicles and reducing information asymmetries:* Providing general vehicle information, including proof of insurance, technical roadworthiness test results, or the vehicle identification number, can streamline administrative processes as registration, sales, shipping and accident management. Vehicle owners can improve the usage of their vehicle, for example, by optimizing their driving behaviour or itinerary planning based on personal driving data in order to minimize energy consumption.

- *Performing predictive maintenance and repair:* Access to detailed information about vehicle usage patterns, component condition and repair instructions can optimize vehicle utilization. Predictive maintenance not only reduces customs, but also extends the vehicle's lifespan, thereby benefiting vehicle owners and operators.

- *Increasing vehicle and component reuse:* Information on component conditions and removal instructions facilitates undamaged component removal and the identification of reusable components, prolonging their lifecycles and promoting resource efficiency.

3.3 The DVP can enhance a circular and sustainable end-of-life treatment

- *Facilitating refurbishment and remanufacturing:* Similar to repair and reuse, refurbishment and remanufacturing operations rely on information regarding component conditions, removal and repair. This process can elevate vehicles to the quality of new ones, improving carbon and material efficiency.
- *Informing recycling:* Vehicle components often comprise advanced and composite materials; the removal of these materials can be challenging. Detailed information on component specifics and removal procedures simplifies the recycling process, increasing recycling rates, ensuring compliance with mandatory recycling requirements and retaining material value. Enhanced transparency on recyclability further encourages circular vehicle design. In regions with a lack of stringent health and safety standards, information on potentially harmful substances and safe method for component removal and recycling is indispensable.
- *Preventing illegal exports:* Clear information on vehicle identification and technical roadworthiness, such as proof of suitability for export as second-life vehicles, can streamline and facilitate the used vehicle trade and help prevent illegal exports.

4 A DVP can support existing global policy measures

Introducing DVPs globally has the potential to support emerging policy action globally:

- **European Union:** The introduction of a DVP can support the EU in meeting several sustainability and circularity initiatives, especially under the EU Green Deal. For example, this could help track and report upstream Scope 3 under the EU's 2023 corporate sustainability reporting directive (CSRD) in line with the European sustainability reporting standards. In addition, a DVP could also help track and report material provenance and embedded carbon footprint under the carbon border adjustment mechanism, as well as supply chain due diligence information as specified in the EU corporate sustainability due diligence directive. Any DVP in the EU needs to be closely aligned with the requirements for digital battery passports under EU battery regulation.

- **China:** In China, the DVP can support ongoing measures to improve vehicle circularity. For example, the implementation of a DVP could be a key enabler to support the dismantling and remanufacturing of key components, as stipulated by the 2019 revision of the measures for the administration of the recycling of end-of-life motor vehicles.. In addition, it could support Chinese efforts to increase supply chain transparency and to develop DPPs. In 2018, for example, China passed the interim provisions on traceability management of power battery recycling in new energy vehicles., which introduced a traceability system that collects information on maintenance, battery retirement, recycling and reuse. Any efforts to develop a DVP should be aligned with ongoing efforts in China to develop a digital battery passport, following the passing of the EU battery legislation.

- **United States:** In the US, the inflation reduction act aims at achieving climate goals while strengthening the domestic market. Incentives such as the clean vehicle credit and other subsidies are actively promoting supply chain localization, EV adoption, or the usage of recycled content. However, the successful execution of this act may rely on regulatory mandates for DPPs or traceability systems. A DVP can facilitate the verification of the origin of vehicle components and materials.

5 Recommendations: turning holistic DVPs from vision to reality

DVPs hold the potential to enable circular and sustainable vehicle lifecycle management globally by increasing transparency on upstream, use phase and downstream information. Currently, holistic DVPs remain a theoretical concept. Policy-makers can advance the implementation of holistic DVPs by:

- **Expanding the intended scope of the DVP in the draft EU circular vehicles regulation and create synergies with the EVP:** At the upcoming trialogue negotiations of the EU circular vehicles regulation, the EU should consider expanding the current requirements to also mandate upstream and vehicle-use data for CVPs. During this effort, synergies with the EVP need to be clearly defined and a unified vehicle passport should be envisioned. This could be based on the requirements defined in the EU battery regulation. Most importantly, however, the EU needs to ensure that the current ambition level of the EU circular vehicles regulation and of the EVP proposed in the Euro 7 standard are maintained, especially given European Parliament elections in June 2024.

- **Advancing DVPs in China, the US and other geographies:** Policy-makers in China, the US and other countries could start policy initiatives to introduce holistic DVPs. This is vital in supporting a global roll-out of DVPs and thus unlocking their full potential. In addition, global policy-makers could work towards harmonizing their efforts to prevent fragmented DVPs from impeding global trade.

- **Advancing and supporting multistakeholder initiatives:** Drawing inspiration from multistakeholder initiatives such as the Global Battery Alliance (GBA), Battery Pass, or Catena-X, similar initiatives should be fostered to advance DVPs that are ambitious yet feasible. Policy-makers can advance this by establishing and supporting the formation of these platforms.

Acknowledgments

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