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## Eco-Design & Circular Economy of Heavy-Duty & Off-Road (HDOR) Vehicles

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## Contextual Framework

### HDOR Features & Issues

- **Mass of EoL HDOR = Mass of ELV** in France [ADEME 06]
- **Poor traceability** after sales & **Recycling channels** are **marginal**
- **Shipment of HDOR** by **illegal operators** is still a flourishing business [EC & Bio by Deloitte 14]

### Emerging Technologies

- **Intelligent** Transportation System
- More & more **devices connected** to the OBD (On Board Diagnosis)
- **GPS + RFID + IoT + Telematics + Big Data Analytics** applied to transportation and construction industries

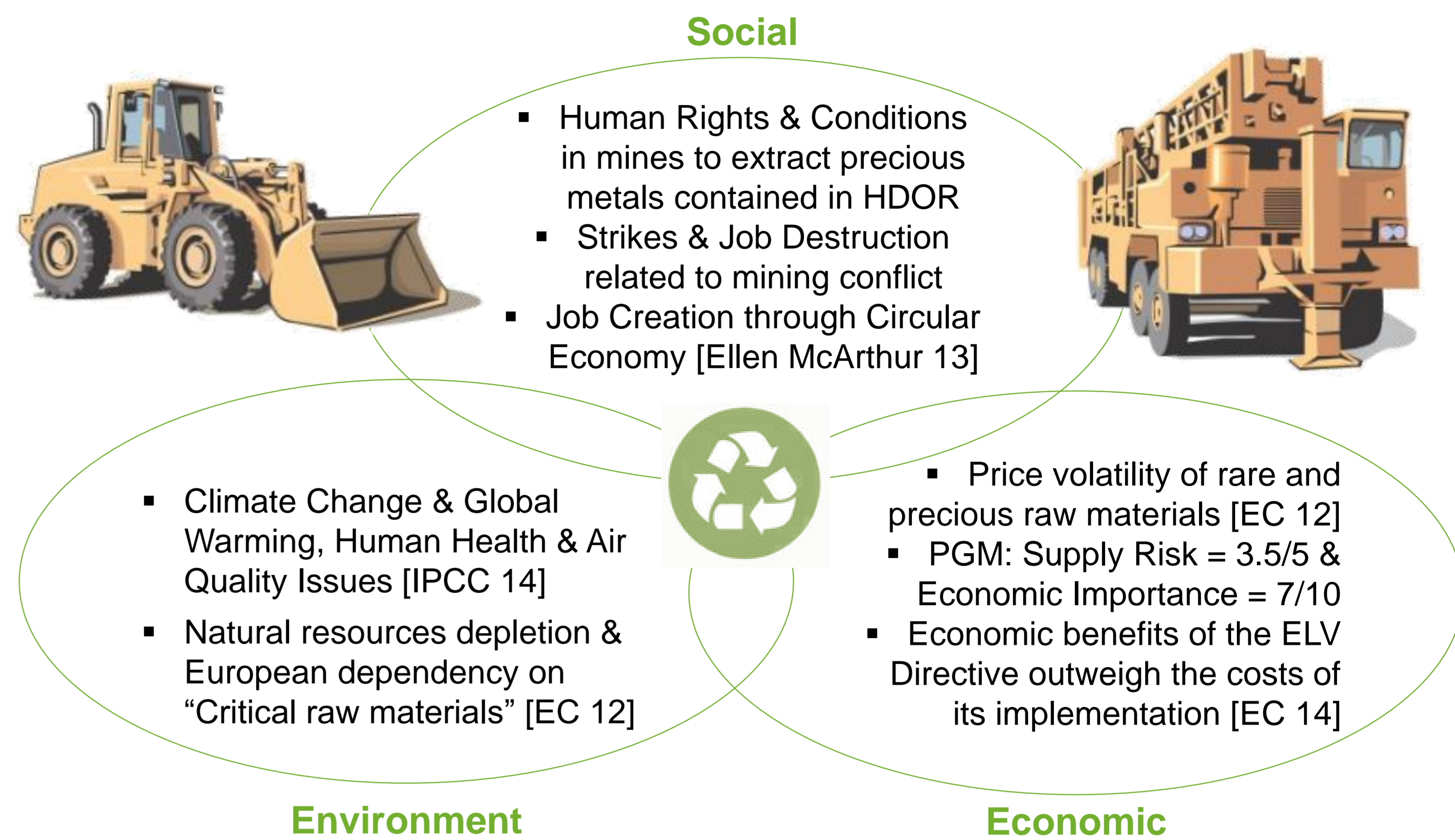
### Regulations

- **Absence** of a regulatory framework for EoL & CO<sub>2</sub> emissions of HDOR, contrary to ELV (2000/53/EC)
- Extended Producer Responsibility for some spare parts
- Beware: **Geographical disparity** of EoL & Emissions Regulations
- REACH; WEEE; RoHS

### Industrial Needs

- **Anticipate upcoming regulations**
- Develop **new Business Model** (e.g. PSS, Telematics Offers)
- **Eco-management in real-time** (e.g. eco-drive, preventive maintenance)
- **Reduce dependency** on oils & precious raw materials
- **Waste Management & Treatment**

## HDOR Vehicles & Sustainability Issues

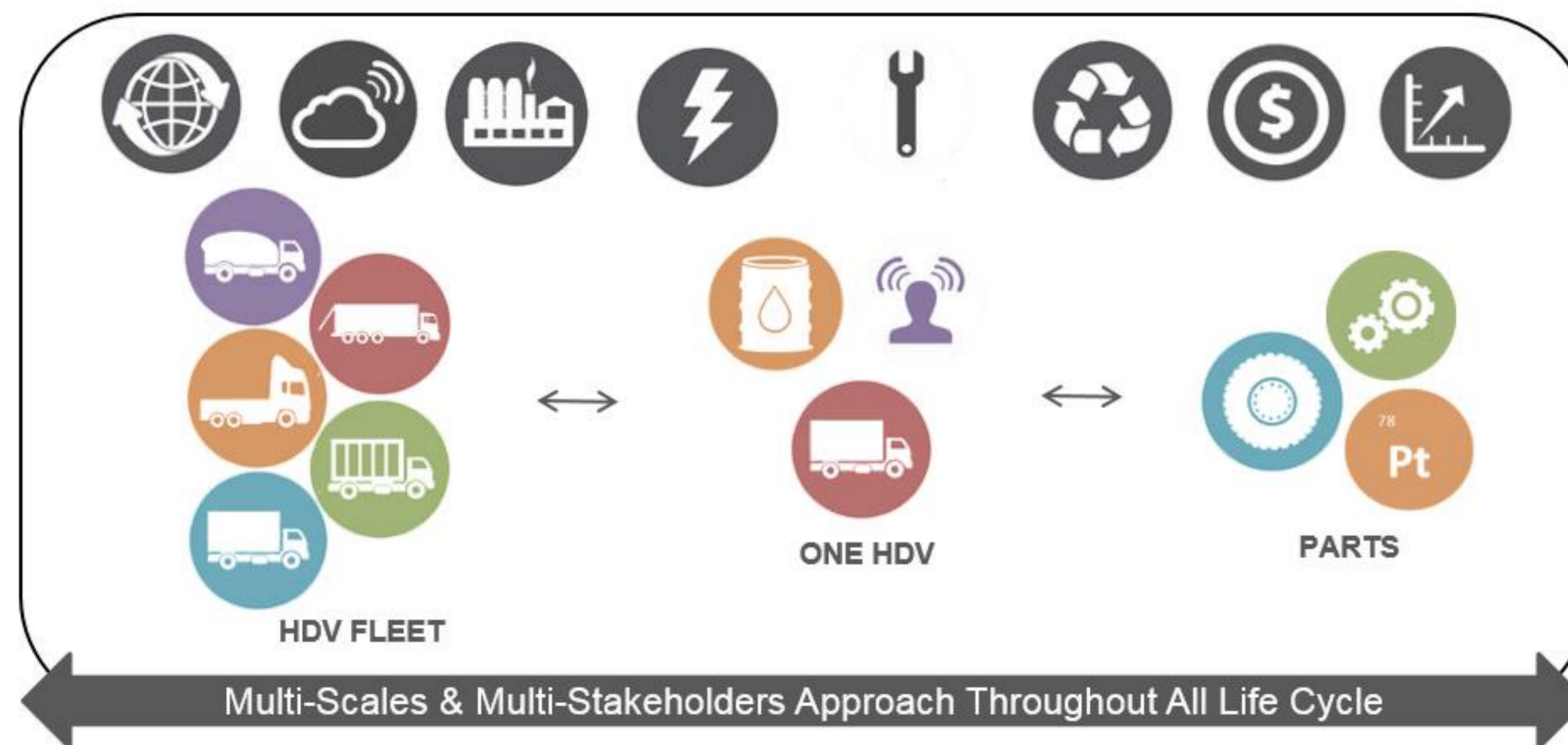


## Research Question & Objectives

### Research Question

- How to **optimize** the **sustainable management** of a **fleet of HDOR** throughout **all life cycle**, at **different scales** and for **all stakeholders** thanks to the help of the **new and emerging technologies, IoT & Telematic Systems?**

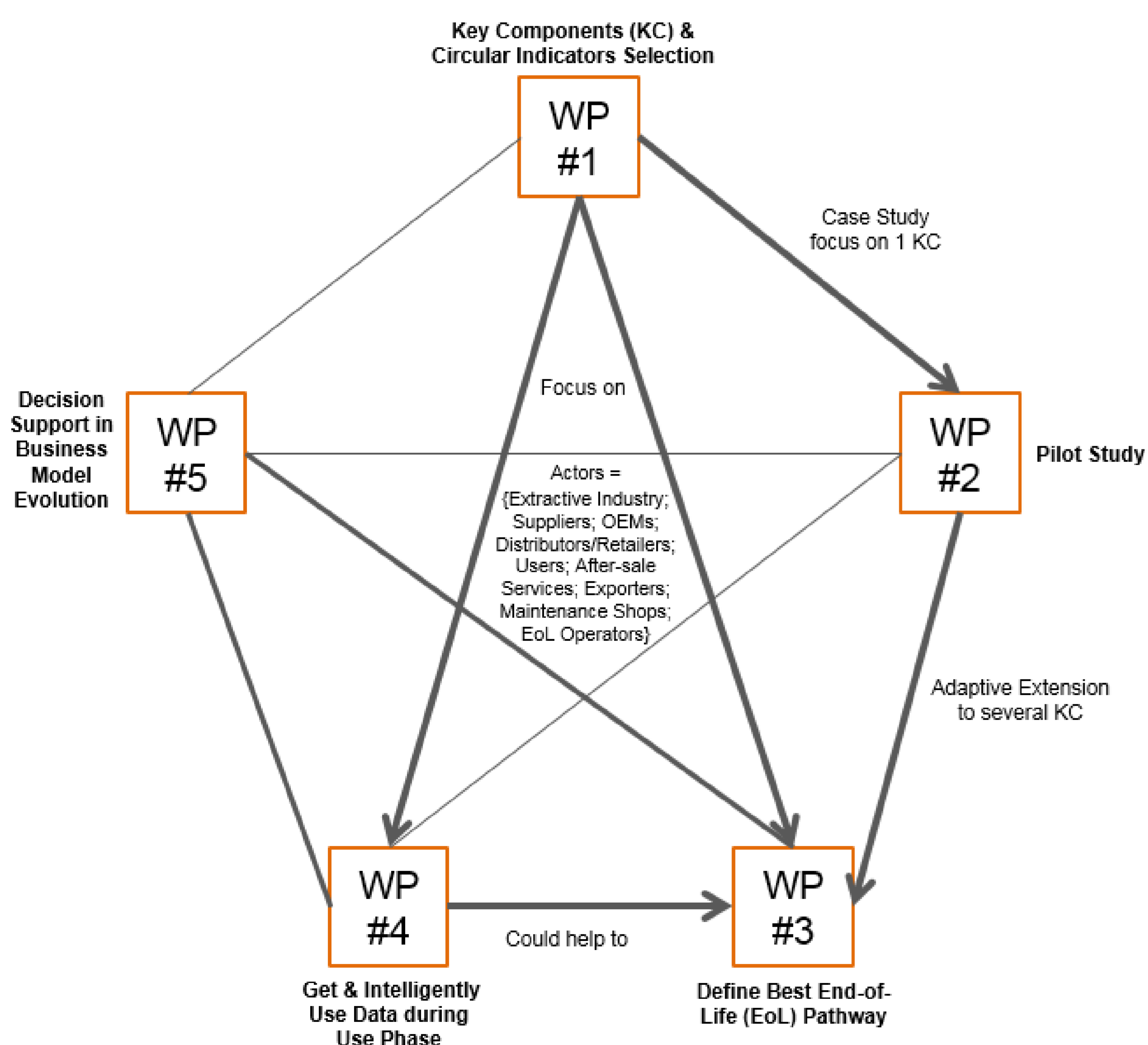
→ **Significant issue** divided into five **linked & complementary WorkPackages (WP)**



### Objectives

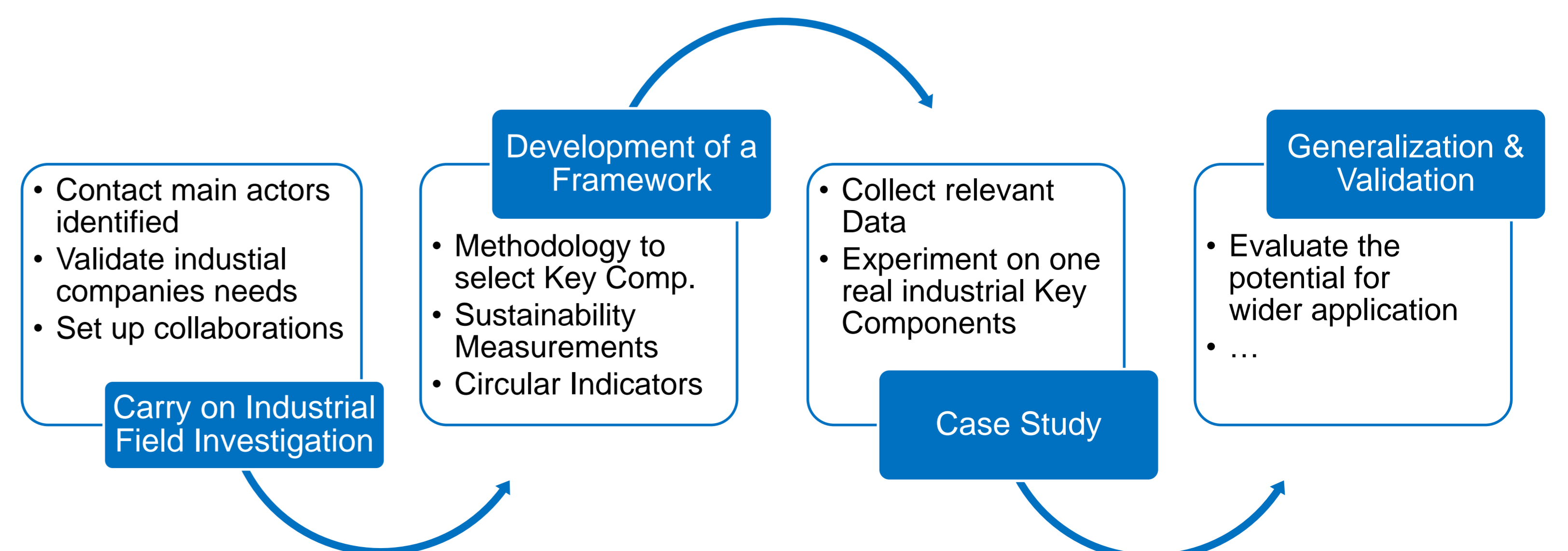
- For **Academics** = To develop relevant frameworks to handle the 3 sustainability pillars within socio-technical complex systems
- For **Industrials** = To foster and help companies to a sustainable management of their HDOR fleet all along the life cycle
- For **Policy-Makers** = To support strategic policy decisions concerning the EoL of HDOR

## Problem-Solving Method



## Progress, Perspectives & Next Steps

- ✓ **Extensive Literature Review**
- ✓ **Key words** = {Circular Economy; Design for 3R; End-of-Life Options; End-of-Life Vehicles; Modular Product Design; Sustainable Business Model; Sustainable System Design; Telematics & IoT Applications for HDOR; Upgradability; Usage Modeling in Design; Usage Predictive Model; Value Chain Design}
- ✓ **Main References** = [Farel & Yannou 13] [Kim et al. 16] [Ma & Kremer 15, 16]
- ✓ **Gaps Identified:**
  - Lack of tools to monitor overall performance of the circular economy;
  - A need to aggregate as many sustainability themes as possible into a framework, and from a dynamic point of view;
  - How to include user-generated contents, and organize consumption and maintenance feedbacks, in real-time and also during design process.
- ✓ **Meetings with experts from ADEME**, french environmental agency
- ✓ Establishment of a **Contact List**, with potential industrial companies to collaborate
- ✓ **WP#1 Progress** = Great range of criteria to select Key Components
- ✓ **WP#3 Progress** = Identification & Definition of 10 End-of-Life Options
- ✓ **WP#4 Progress** = Mapping of Information that could be captured in Heavy Vehicles



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