An Inclusive and Effective End-of-Life Vehicle Recycling System in India: Balancing Economy and Ecology from Grave to Cradle

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ABSTRACT: *End-of-Life Vehicles (ELVs) in India are often recycled by car-breaking yards operating in the informal sector. In the absence of well-established, state-of-the-art ELV mechanisms, their work – ensures the crucial recycling of ELVs. Multiple qualitative analysis methods, such as desk study, literature review, and field visits, are utilized. Our study shows the following: car-breaking yards frequently work in an inefficient manner causing environmental hazards and health risks; the replacement policy adopted during vehicle servicing by Original Equipment Manufacturers and Authorized Dealers results in inefficient material use; Informal actors such as Private workshop owners and Reconditioning shops enable significant savings in material and costs, partly by substituting capital and energy with labor. We propose an inclusive 3R (reuse, recondition, and recycle) framework, which integrates various informal actors involved in ELV recycling. This sustainability-oriented framework ensures that the components and materials circulate in a closed loop.*

KEYWORDS: *Circular Economy; 3R - Reuse, Remanufacture, and Recycle; End-of-Life Vehicle; Inclusive supply chain; Sustainable development goals.*

INTRODUCTION

The extraction of raw materials such as fossil fuels, metal ores, and minerals requires enormous energy and water. Also, it generates a large amount of waste. We are losing freshwater ecosystems and marine water ecosystems at the rate of 6% and 4% a year, respectively [2]. A recent analysis by the World Wide Fund for Nature states that humans, with their current consumption pattern, are using 50% more resources than nature can replenish (Guardian, 2014). Since 1970 in 44 years, global emissions of CO_2 have increased by 90%.

In developing countries like India, more middle-class people possess higher purchasing power in the coming years. This will cause a drastic increase in resource consumption and industrial pollution (IGEP, 2013). Annual sales of passenger vehicles in India for the year 2017-18 were about 3.29 million units, and the number of registered cars by 2029 is estimated to be 100 million units (SIAM, 2019). This shows that the Indian vehicle industry is growing at a fast pace. In ten years, there has been a considerable increase in production plants. The absence of a proper end-of-life (ELV) recycling infrastructure to handle ELVs is a significant concern. The status quo of ELVs being processed by the informal sector in an unhealthy and inefficient manner pollutes the environment and generates more

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