

**Analysis of Policy-Innovation Linkage of End-of-Life Vehicles
(ELV): The Potential Environmental Implication and
Technologies Transfer to Developing Countries**

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ABSTRACT

Rapid economic growth and urbanization in developing countries has taken many people out of poverty. However, this economic growth has also brought environmental problems including air pollution, water pollution and improper management of solid waste. Solid waste has been particularly a challenge in developing countries because of rapid increase in waste generation which has caused many problems due to lack of adequate collection, treatment, and final disposal options.

Some types of waste like Waste Electrical and Electronic Equipment (WEEE) and End-of-Life Vehicles (ELV) have become a major concern in developing countries due to their containing of many hazardous materials like mercury, lead, cadmium, different fluids and chlorofluorocarbon etc. which are harmful for environment and human health. Japan, the EU and the U.S.A. were huge consumers and producers of automobiles until the 1990s. These nations have dealt with the ELV problems from the late 1990s by implementing effective ELV regulations. However, there has been a shift since the early 2000 in the production and consumption of automobiles by rapidly growing developing countries like China, India, Brazil and Mexico. China is currently the major market for the production and consumption of cars. The automobile production increased to 13.79 million units in 2009 compared to 2.07 million in 2000 which made China number one producer of automobile in world. The number of registered vehicles reached more than 150 million in 2015 compared to 16 million in 2000. This indicates that ELV production will increase in coming future. Currently, most of ELV in China are handled by informal recyclers where automobiles are mostly dismantled manually and their parts are sold or disposed illegally. Only few mechanized and

automated recycling and disposal facilities exist in China due to which the dismantling efficiency in China is low with high labor involvement. If these ELVs are not properly managed, they can damage the environment and health of people due to presence of hazardous substances.

This research analyzes the policy innovation linkage for ELV in Japan, the EU and the U.S.A., and investigates the dissemination of ELV technological innovation from these developed countries to rapidly developing country China. The research also evaluates the impacts of ELV recycling technologies on the environment using Life Cycle Assessment (LCA). The research outcomes and experience gained in developed countries is used to make hybrid ELV model in China to solve the upcoming ELV problems via an efficient ELV management system.

The statistical test results signify that ELV regulations in Japan are efficient compared to the EU and the U.S.A. The result also shows that the patent counts was very high for ELV patents during regulation period in Japan for four patents (JP3, JP6, JP8 and JP9). The Revealed Technological Advantage Index (RTA) for ELV technological patents in Japan signify that Japan has relative advantage in ELV technology in the world compared to the EU nations and the U.S.A. Especially, Japan has higher RTA value for ELV patents such as JP1, JP4, JP5 and JP6. The EU has higher RTA value for EU1, EU2 and EU10. The results of spillover show that the spillover of ELV technologies were higher from Japan to China compared to from the EU and the U.S.A. This signifies that there is huge potential of ELV recycling in China using advanced Japanese technologies. Further, Technological Gap Model indicates that China's technological gap is decreasing rapidly compared with developed countries. This shows that China has not only absorptive capacity to adopt with new technologies but also innovative capacity to convert new ideas into innovation. The negative value for indicators of Technological Gap Model like Technological output and International Trade indicate that not China has only decreased the

technological gap but already surpassed the developed countries. Finally, the research outcomes were used to construct the hybrid model for rapidly developing country like China to solve the upcoming ELV problems to have leap-frog effect which can lead into efficient ELV management system.

Key words:

environmental policy instrument; environmental innovation; end-of-life vehicles; revealed technological advantage index; technology gap model