Quantification of the Non-Registered Electrical and Electronic Equipment for Domestic Consumption and Enhancing E-Waste Estimation: A Case Study on TVs in Vietnam

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Abstract : The fast increase and complex components have made waste of electrical and electronic equipment (or e-waste) one of the most problematic waste streams worldwide. Precise information on its size on national, regional and global level has therefore been highlighted as prerequisite to obtain a proper management system. However, this is a very challenging task, especially in developing countries where both formal e-waste management system and necessary statistical data for e-waste estimation, i.e. data on the production, sale and trade of electrical and electronic equipment (EEE), are often lacking. Moreover, there is an inflow of non-registered electronic and electric equipment, which 'invisibly' enters the EEE domestic market and then is used for domestic consumption. The non-registration/invisibility and (in most of the case) illicit nature of this flow make it difficult or even impossible to be captured in any statistical system. The e-waste generated from it is thus often uncounted in current e-waste estimation based on statistical market data. Therefore, this study focuses on enhancing e-waste estimation in developing countries and proposing a calculation pathway to quantify the magnitude of the non-registered EEE inflow. An advanced Input-Out Analysis model (i.e. the Sale–Stock–Lifespan model) has been integrated in the calculation procedure. In general, Sale-Stock-Lifespan model assists to improve the quality of input data for modeling (i.e. perform data consolidation to create more accurate lifespan profile, model dynamic lifespan to take into account its changes over time), via which the quality of e-waste estimation can be improved. To demonstrate the above objectives, a case study on televisions (TVs) in Vietnam has been employed. The results show that the amount of waste TVs in Vietnam has increased four times since 2000 till now. This upward trend is expected to continue in the future. In 2035, a total of 9.51 million TVs are predicted to be discarded. Moreover, estimation of non-registered TV inflow shows that it might on average contribute about 15% to the total TVs sold on the Vietnamese market during the whole period of 2002 to 2013. To tackle potential uncertainties associated with estimation models and input data, sensitivity analysis has been applied. The results show that both estimations of waste and non-registered inflow depend on two parameters i.e. number of TVs used in household and the lifespan. Particularly, with a 1% increase in the TV in-use rate, the average market share of non-register inflow in the period 2002-2013 increases 0.95%. However, it decreases from 27% to 15% when the constant unadjusted lifespan is replaced by the dynamic adjusted lifespan. The effect of these two parameters on the amount of waste TV generation for each year is more complex and non-linear over time. To conclude, despite of remaining uncertainty, this study is the first attempt to apply the Sale-Stock-Lifespan model to improve the e-waste estimation in developing countries and to quantify the non-registered EEE inflow to domestic consumption. It therefore can be further improved in future with more knowledge and data.

Keywords : e-waste, non-registered electrical and electronic equipment, TVs, Vietnam
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