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Waste management and producer responsibility: a score behind – a new ahead

In 2001, the Organisation for Economic Co-operation and Development (OECD) defined 'extended producer responsibility' (EPR) as '(...) an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle'. The aim was to encourage adoption of EPR principles such that manufacturers would design their products to optimize the potential for recycling the materials and minimize end-of-life impacts on the waste stream. The EPR concept has since gained in importance, particularly in Europe, as a key policy tool. By now, important waste streams such as packaging waste, end-of-life vehicles (ELV), waste electric and electronic equipment (WEEE) and batteries are regulated under EPR schemes.

EPR-like elements had already been incorporated into waste legislation much earlier. In 1991, the German 'Ordinance on the Avoidance of Packaging Waste' and the Green-Dot System became an international model for many EPR schemes. This ordinance precipitated a radical break with the traditional, municipality-based waste management practices. It made producers and retailers organizationally and financially generally responsible for the take-back, recovery and disposal of packaging waste.

A key question remains: how best to evaluate the effectiveness of EPR programmes in relation to waste prevention, improved recovery of resources, design for recycling, and cost effectiveness in recycling?

The achievements in terms of recovery of post-consumer waste materials are clear. As a result of the ordinance, comprehensive, property-close collection of plastics, tin plate and aluminum cans, and beverage cartons developed within a short time, expanding the existing paper and glass recycling schemes. Recycling rates markedly increased and reached levels of 70 to 90% of the packaging material put on the market.

With regard to waste prevention, it is clear that over the past 20 years the total amount of packaging waste in Germany did not decrease and, despite the existence of EPR schemes, in many other countries it even increased. The amount of reusable bottles used for drinks dropped in Germany from 73.5% in 1993 to 44.0% in 2009, due to the consumer demand for one-use polyethylene terephthalate (PET) bottles.

How have the economics of EPR worked out for packaging waste management over 20 years? In the initial stage, due to monopoly structures in the German system, consumers faced increasing product prices due to the additional costs incurred by manufacturers. In 1993, the levy to cover collection, sorting and reprocessing of packaging waste amounted to about 1.50 € kg^{-1} of plastic packaging, which is considerably higher than for the disposal of any other type of waste. At the same time the high system costs in Germany were aggravating the so called 'free rider' phenomenon. In spite of various efforts to fine-tune the ordinance, some market participants remained outside the system, enabling them to avoid incurring costs that others must bear. Nevertheless, with increasing competition and other market factors, the cost for the packaging industries to comply with the law significantly declined over time, as did the incremental price paid by consumers.

Unlike packaging waste, EPR for WEEE evolved largely in the light of its hazardous content and pollution potential. Minimum standards for disposal were defined and recycling quotas set. At the European level, there has been a rapidly increasing volume of WEEE but only slowly growing return rates, not only in the new member states but also in developed countries such as Finland, Austria, Germany or Belgium. The extent to which these numbers are due to the export of WEEE as electronic second-hand goods and/or the unsanctioned co-disposal with municipal solid waste is still unclear. The increasingly common photos of scavengers working at electronic waste mounds in Africa and Asia indicate that EPR programmes are not yet sufficiently effective to achieve the intended degree of global environmental protection.

On the other hand, WEEE collected in Europe is being recycled at rates of between 80 and 95%, although a few member states score lower. This is surely a success story! But are those recycling achievements alone sufficient to close the loops? Regarding the issue of precious metals recovery, a comparative analysis between Germany and the USA shows that, with or without stringent EPR legislation, the collection rates and total recovery rates might be different but overall losses of valuable metals such as gold and palladium from small-sized WEEE are comparable and significant, with discard rates of 72 and 75% in Germany and the USA, respectively. The influence of WEEE legislation on these rates is not yet measurable.

The financial implications of the WEEE directive vary between member states. In Germany, the national WEEE law established a highly competitive producer responsibility system that largely avoids monopoly structures, as compared to the earlier packaging-related EPR scheme. As a consequence, this law has caused structural changes in the recycling industry, leading to significantly decreasing prices for recycling but also, as some players state, a reducing quality of recycling.

With regard to optimization in product design, the idea of EPR suggests a self-regulating feedback loop when the producer has to face the expense of recycling and disposing of the products he sells. Due to relatively short product cycles, the packaging industry can influence its recycling cost by reducing the weight of packaging and by standardizing the use of materials. The design incentives are, in the case of WEEE, product inherent lower. Today's electronics are designed as highly functional devices and, in general, are not optimized for high recyclability at the end of the product's lifecycle. Financial incentives to improve the recyclability of a product are minimal as the material value and the end-of-life costs are only a small fraction of the total product sales price.

How might future EPR systems look in order to enhance achievement of their objectives?

In the European Union, EPR targets are seen mainly in terms of achieving high recycling rates and covering a wide range of products in order to prevent them from entering landfills. Examples in Japan, Korea and in parts of the USA show that schemes for more defined product groups such as PET bottles, computers or mobile phones might be better adapted to the product specifics.

In general, collection is one of the bottlenecks in most EPR schemes in terms of effectiveness and cost. Thus, new and innovative take-back systems are needed that enable producers to have better access to the waste materials associated with their product's use and consumption. Customer-paid deposits or new technologies such as product identification through radio-frequency identification are one way, new business models reorganizing the material ownership of products might be another.

A key issue for planners of EPR programmes is the integration of the interests of municipalities, traditionally responsible for municipal solid waste management, and the typically private organizations emerging to set up and operate EPR systems. Municipalities are obliged to share their traditional tasks and to face varying (usually declining) waste flows and making related changes to their long-term waste management plans. Implementation of a full EPR system means that all parties must deal with fluctuating markets and prices for recycled materials, precluding the flexibility of cherry-picking from the waste stream only those materials with high prevailing prices.

EPR goes beyond national waste policies. Materials for the production of manufactured items come from all over the world, customers are often international, and many products may be subject to subsequent recycling or disposal far from the country of origin. Hence, EPR is a global issue, presenting a challenge to materials and waste managers worldwide, regardless of boundaries. This calls for the implementation of EPR programmes worldwide, not only in countries with sophisticated waste management infrastructures.

Last but not least, the objectives of waste management and the role of EPR need to be redefined. Waste prevention and recycling should help to lower the overall environmental burden of a product. The existence of solely weight-based recycling targets does not lead to an optimal degree of depollution and resource conservation. Material-specific targets for resources that will be scarce in the future should set incentives for differentiated recycling.

Ultimately one question remains: to what extent are manufacturers the key to the achievement of these objectives? EPR is a means, not a goal. Dealing with resources responsibly is a challenge not only to producers but also to municipalities, the recycling industry and, last but not least, to consumers.

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