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## **Optimising Markets for Recycling**

### **Executive Summary**

### **The European Commission – DG Environment**

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## **EXECUTIVE SUMMARY**

The spontaneous attitude with respect to waste in modern developed countries is to consider it as an undesirable side-product of our consumption. In this respect, it is hardly surprising that the pre-dominant attitude with respect to waste management is to find ways to get rid of waste in such a way that this minimizes, or at least reduces, the harmful side-effects of disposal. Relatively limited thought is being given to finding valuable applications for recycled waste instead.

However, waste could also be considered in the first place as just another raw natural resource that needs some further processing before it can be made suitable for human use. In such an approach, waste collection and processing is regarded as an industry producing valuable products. Of course, this does imply that we should downplay the environmental hazards, but rather that we should recognize that environmental hazards are present in almost all industrial processes, and that they are not specific to waste.

Actually, in some circumstances, a vibrant market in recycled products can be observed – this quite naturally raises the question under what conditions a market in recycled products will develop.

Economic theory tells us that, in a market without government intervention, recycling will take place up to the point where the price of the recycled product equals the cost of producing an additional recycled product – in economic jargon, up to the point where price equals marginal cost.

This implies that recycling will increase whenever:

- The price customers are willing pay for a recycled product increases – this is, whenever demand increases.
- The cost of producing additional units of recycled products decreases – this is, whenever supply increases.

This simple framework provides a useful starting point to understand why actual recycling rates are not always as high as they could, or should, be and to understand why they vary over time and space.

Whenever actual market outcomes differ from the market outcomes that would lead to the highest benefits for society as a whole, it is said that market failures occur.

In the case of waste recycling, market failures occur both at the demand and the supply side.

At the demand side, market failures in recycling occur for the following reasons:

- Collected waste is often contaminated by other waste streams. Whenever it is difficult for a buyer to verify the quality of the recycled product, demand will be lower than for a primary product.

- If the users of recycled products have some market power, they use that power to push down prices (which restricts volumes recycled).

At the supply side, the following market failures in recycling occur:

- The producers of primary products do not design products with their eventual “recyclability” in mind. Therefore, it is often expensive to prepare waste for recycling. If this is the case, a “technological externality” is said to occur.
- If collection or recycling firms have some market power, they push up prices for the recycled products (which restricts volumes recycled).

Finally, due to transaction and search costs, demand and supply will not always be “matched” in their most valuable application.

However, the most obvious market failures in the field of waste management are related to the environmental impacts of the alternatives to recycling (illegal dumping, landfilling and incineration).

As these costs are in general not internalised, the costs of the alternative treatment or disposal methods are too low compared to the cost of recycling. Or, in other words, the costs of recycling are too high compared to the cost of the alternatives. This implies that any measure that better internalises the environmental effects of the alternatives to recycling will lead to higher recycling rates as well.

This brings us to the purpose of this study: on the one hand, *understanding how dealing with the market imperfections in recycling markets can help overcome the lack of internalisation of the environmental side-effects of the alternatives*, and, on the other hand, *understanding how a better internalisation of the environmental side-effects of the alternative can improve the market prospects of recycled products*.

The study has been spilt into three tasks.

Task 1 has identified, through a process of prioritization, ten markets which offer the greatest potential environmental and economic benefits from perspectives of improved market operation – the report of Task 1 is included as an Annex.

The concern of Task 2 was to identify market failures, at EU, national and regional level. In task 3, we have discussed policy options which might reduce or remove the market failures.

In discussion with the Commission, it was decided to limit the analysis in step 2 and 3 to the following waste streams:

- Cardboard
- PVC
- Batteries

- Food Waste

6 countries have been selected for the case studies: the region of Flanders in Belgium, the UK, France, Estonia, Poland and Spain.

The report has been built up as follows:

- It starts with a brief overview of the state of the art in those topics of economic analysis that are relevant for our study. This overview contains a general discussion of market failures (including in technological innovation), of environmental externalities related to resource use and on the economics of waste collection and disposal.
- It gives an overview of the EU regulatory context, including of the most important Community initiatives taken to promote environmental technologies.
- It provides the essential fact and figures on production and recycling of the considered waste streams in the EU.
- It contains a description of the state of the art of collection and recycling technologies for the considered waste streams.
- After a first assessment of the market situation at the European level, the analysis proceeds to an in-depth analysis of the 6 countries chosen for the case studies.

The 6 member states covered in this study have very diverse levels of per capita income, geographical structure and histories of waste management. The quality and the relevance of the data we have obtained were also very heterogeneous. Drawing any common lessons from these experiences is therefore challenging, and extrapolating to other waste streams even more so.

The lessons learnt can be split up in two main categories: those concerning the organisation of collection in general, and those linked to specific waste streams. Indeed, when analysing the supply side, it is useful to distinguish between the collection and the recycling phases. In its essence, waste collection is a transport service characterised by economies of density, and it faces very specific issues of market organisation.

For each waste stream, the following questions need to be asked:

- Does the price of the recycled product cover the costs of collection and recycling? In this case, a market will often develop without government intervention.
- Does the price of the recycled products cover the cost of recycling, even if it does not cover the cost of collection? In this case, a market will develop if the

government carries the burden of collection, if it *imposes* the collection on private actors or if it finds ways to reduce the burden of collection – this could be justifiable if market failures occur in the collection phase that the government can solve.

In both cases, tackling the other market failures could help (1) create a market where there is none (2) further develop the market where there already is one. This applies both to the market failures in the recycling market and those related to imperfect internalisation of environmental externalities. Thus, market failures can explain why it could be optimal to have recycling, even if the price of the recycled product does not cover the operational costs of recycling.

The answer to the questions listed above depends on a lot of factors that cannot directly be influenced by policy makers:

- The existence of competing primary products puts an upper bound on the price that can be asked for a recycled product. Therefore, the following questions need to be addressed: What are the primary products the recycled products will be competing with? Are recycled and primary products close substitutes? What factors influence these substitution possibilities?
- The costs of collection depend on the cost of labour, but also on energy prices.
- Sometimes, recycling requires investment that cannot be recovered if the recycling activity is stopped. It is then said that the investment is “sunk”. In this case there can be an important difference between the optimal decision before the costs are sunk and the optimal decision after the costs have been sunk. This implies that optimal waste policies can be path-dependent.

It follows from this that the optimal approach to recycling can vary substantially through time and space.

Yet, the investigations into the economic drivers and barriers that we have conducted here highlight the way that economic analysis of recycling very often clarifies the problems that should best be tackled by policy.

An additional constraint in the actual design of policies is that much of the information listed above is not currently available, particularly on future prices. In Task 1 of this project, we have set out to identify the ten markets which offered the greatest potential for environmental and economic benefits thanks to an improved market operation. A rough assessment has been made, based upon the information that is publicly available in the EU, but we have to acknowledge that a lot of information is fragmentary, outdated, inconsistent across countries or simply missing. Even the information we have identified for our detailed case studies suffers from these flaws.

Therefore, our objective has been to seek policy conclusions that are robust to changes in factors outside the influence of policy makers, and to avoid recommending policies that are dependent upon the existence of information that is currently not being collected.

### **Collection**

With respect to the organisations of the collection phase, the main lessons learned are:

- Waste collection for residences and small enterprises is generally characterised by economies of density: the average costs of waste collection decrease as the volume of waste collected from a fixed length of network increases. If this is the case, competition in the market is not sustainable. Selective collection of recyclable material exacerbates this problem.
- If competition in the market is not the optimal approach, in-house collection services by the public authorities could be a solution. Alternatively, the collection could be left in the hands of the private sector, but regulated by the public authorities. The two fundamental options are then to either negotiate a contract with a private waste operator or to create “competition for the market” through competitive tendering. An advantage of privatisation is that experiences acquired in other markets (e.g. other regions) can be transposed to new situations. Therefore, multinational companies can play an important role in the diffusion of innovative approaches to waste collection.
- Although there are solid arguments in favour of a decentralisation of municipal waste management, the availability of specialised technical competences imposes constraints on the efficiency of local government. Privatisation is likely to exacerbate these problems rather than to solve them. Therefore, cooperation between local governments and the exchange of good practices are essential if decentralisation is supposed to work.
- Extended producer responsibility (EPR) requires firms, which manufacture, import and/or sell products and packaging, to be financially or physically responsible for such products after their useful life. They must either take back spent products and manage them through reuse, recycling or in energy production, or delegate this responsibility to a third party, a so-called producer responsibility organization (PRO). EPR shifts responsibility for waste from government to private industry, obliging producers, importers and/or sellers to internalise waste management costs in their product prices.

- Across Europe, there is a lack of transparent and consistent data that would allow an objective comparison of the performance of different approaches to Producer Responsibility Organisations (PROs). A useful step would be the creation of a benchmarking system at the European level. This would allow PROs and regulators to compare structures and improve the efficiency of arrangements.
- Whatever the legal form of the PRO, supervision is essential. In order to make supervision viable, auctioning the market to a limited number of organisations may be a good option. However, we have found no arguments in favour of creating monopolies.
- Small and Medium Enterprises (SMEs) face a series of very specific problems (limited competition due to economies of density, high transaction costs). The most promising instrument for stimulating waste sorting by SMEs is probably to pay them subsidies to do so. Good practice exchange could be helpful as well.

### **PVC**

Although recycling of PVC has increased substantially in the recent past, it is still very small compared to annual waste arising.

On the demand side of the market, the following measures could be taken to stimulate collection: public procurement, clear end-of-waste criteria and encouraging contractual specifications that are targeted at performance. Landfilling and incineration should be further discouraged.

On the supply side, the sorting at the source of PVC waste is crucial, certainly in construction and demolition waste. Due to the long life span of PVC, introducing Extended Producer Responsibility is maybe not the most appropriate instrument to stimulate this. A more promising approach would be to provide increased financial incentives for sorting.

With respect to REACH, an important policy trade-off is to be made between, on the one hand, the benefits of recycling and, on the other hand, the external costs linked to additives that were used 30 years ago but that have been banned since.

Other needs for further action include the gathering of better data.

### **Batteries**

Due to the current high prices of lead, the selective collection and recycling of lead acid batteries is currently organised profitably by the private sector. An additional factor is that the expense of a separate collection network can be saved because collection naturally takes place through garages. The only real concern raised with

respect to this category is the existence of a black market in waste lead batteries as a way to circumvent the environmental requirements.

There is however no certainty that high collection and recycling rates will last if the price of lead would drop. Taking into account the long time lags that would be needed for policy changes in case this market would become unprofitable, there certainly is no scope for a laissez-faire approach.

One possible approach would be to leave it up to the market to find the most efficient logistical channels and the most valuable applications of the recycled material, while at the same time monitoring whether these applications do not lead to harmful side-effects, and committing to policy interventions should selective collection no longer be profitable.

The situation is different in the case of portable batteries. Our analysis suggests that the introduction of producer responsibility and the existence of a network for selective collection strongly affect collection rates.

In most countries, the current metal prices cover the operational costs of recycling for the following battery types: Nickel Cadmium, Nickel Metal Hydride and Lithium Ion. Thus, for these battery types, imposing selective collection is a necessary but also sufficient condition to create a viable market for recycling. This is economically justified if the external costs linked to incineration and landfilling of these battery types are higher than the cost of selective collection.

The revenues from sales of zinc and manganese however do not cover the *operational* costs of recycling. Thus, imposing selective collection does not suffice to make recycling financially viable: explicit and binding recycling objectives are necessary on top of collection targets. This is economically justified if the external costs linked to incineration and landfilling of these battery types are higher than the combined cost of selective collection *and* of recycling.

On the demand side for collected batteries, the following barriers are important:

- some battery recyclers enjoy market power; existing provisions on the transportation of waste lead to increased transportation costs, further segment the market and therefore exacerbate the problem of market power;
- the use of some recovered materials is prohibited in certain applications.

However, the central constraint on an expansion of batteries recycling is hoarding and illegal disposal by households. The following instruments can be used to reduce this: increase the convenience of the collection system; invest in awareness campaigns; provide financial incentives for bringing back used batteries.

A second issue on the supply side is that disposal through landfilling and incineration is still too cheap and easy compared to the alternatives. As the externalities linked to these options vary from country to country, this does however not imply that a one-size-fits-all solution would be appropriate.

Free-riding in producer responsibility is an important problem because it directly affects the financial resources that are available for the PROs. It is therefore important to create cooperation mechanisms between PROs in order to fight free-riding. The existence of a national registry of producers and of recovery organisations seems an absolute pre-requisite in the fight against free-riding. The lack of enforcement of the WEEE Directive is a specific issue- the establishment of a link between the WEEE and the battery registries would already be a step forward.

With respect to the organisation of battery PRO, we do not see a case for a legal monopoly but we do think that a monopoly could well be the natural outcome with high communication and enforcement costs. If monopoly is indeed the outcome, competition in the collection phase can still be obtained through periodic tendering or "yardstick competition"<sup>1</sup>.

The new Battery Directive imposes collection targets and recycling efficiencies for all batteries and introduces EPR as a regulatory instrument. It can therefore be expected that the transposition of the new Battery Directive will have a radical impact in the countries that have not been forerunners in this field.

One approach in the field of prevention that is worthwhile investigating lies in the stimulation of the demand for rechargeable batteries and for electricity taken from the grid, while recognizing that these are not perfect substitutes for primary batteries. A second option would be to have the financial contribution to PROs depend on the expected life time of batteries.

Finally, we should keep in mind that, at current market prices, zinc and manganese do not cover the *operational* costs of recycling. Thus, imposing selective collection does not suffice to obtain recycling: explicit and binding recycling objectives are necessary on top of collection targets.

### **Food waste and biodegradable waste**

None of the countries covered by our analysis has a policy on food waste "as such". What happens with food waste depends on a series of policies that are often uncoordinated or whose primary objective is not to increase useful applications of food waste.

Due to the absence of more specific policies, our analysis has often covered biodegradable waste in general – this includes garden and park waste on the one hand, and paper and cardboard on the other hand.

There exist a wide variety of potential markets for recycled food: compost, technical applications, livestock feed, pet food, biogas production, energy recovery in cement kilns etc. In practice, the information we have found is almost entirely focused on the market for compost.

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<sup>1</sup> This refers to a system where incentives are awarded based upon the relative performance compared to other collectors who face a similar market environment.

In the case of Flanders, though, we have also been able to conduct an analysis of the system for selective collection of frying fats and oils, of the uses of industrial organic waste and of animal by-products. These cases clearly show that, in specific circumstances, both waste collection and recycling can be commercially viable:

The Belgian government has imposed an acceptance obligation for waste frying fats and oils in order to shift the financial burden of waste disposal from the municipalities to the producers. However, due to the current high demand from the biodiesel and "green stream" sectors, the collection of frying fats and oils from the catering sector is now commercially viable. This leads to the parallel existence of, on the one hand, an "official" circuit and, on the other hand, an "informal" sector. Thanks to high market prices for biodiesel and co-incineration, there is, currently, no risk that these waste streams will get back into the food chain. Therefore, the "informal" sector is not a source of major environmental concern. The reason why it is not commercially viable yet to collect waste frying fats and oils from households is linked to the logistics of the collection phase.

The collection of fallen stock in Flanders illustrates how varying market conditions throughout time can affect collection and recycling. In the unregulated market for animal by-products until 1993, prices for meal and fats were high, and collection and processing were profitable businesses. This changed in the 1990s, mainly due to fluctuations in the value of the US dollar and to increased environmental requirements. In order to maintain the viability of collection the Flemish government provided a guaranteed turnover for one specific company (Rendac), thereby creating a de facto monopoly. The collection system is now financed jointly by the Flemish Government and the cattle industry. Cattle holders can choose between paying an annual contribution or a contribution per animal that needs to be collected. The Flemish government guaranteed Rendac's return on capital on top of the reimbursement of all costs – however, this had led to an important increase of the equity capital of Rendac at the expense of the Flemish taxpayer. The collector now receives a fixed sum per ton on top of the cost of collection, treatment and disposal of fallen stock. While this system limits the transfers from the taxpayer to the regulated companies, its drawback is that it does not provide incentives for cost efficiency.

Let us now turn to the issue of compost.

Although recent research has concluded that the market potential in Europe is twice the size of the maximum production potential, 95% of composting plants depend on the gate fee to make a profit. This shows that the demand for compost is currently too low to cover the costs of production.

Although the factors affecting demand and supply can vary significantly between countries, one common factor across countries is that the main motivation behind their policies is to comply with the Landfill Directive by reducing the amounts of

biodegradable waste going to landfill. Therefore, compost policy is mainly supply-driven and measures that could contribute to the further development of the market potential are not a priority. This leads to the paradoxical situation that even where the level of recycling is high, the actual use of the recycled product remains limited. At the supply side, the low quality of compost in some countries has been identified as the main obstacle to further market development. Mixed waste composting is generally of low quality and is mainly used in relatively low-end applications such as agriculture, land restoration and landfill covers.

Selective collection of biodegradable waste has led to mixed results but has performed quite well in some cases. Contamination appears to be relatively limited but effective collection rates can differ widely. A more widespread dissemination of good practices in this regard could be a fruitful area for public intervention.

In the UK some technological externalities linked to food packaging have been identified but there are processes on the way to tackle these issues.

However, most problems in the market for compost occur downstream of collection.

A prominent issue here is clearly the distrust of potential end users with respect to the quality of compost – we have here a typical example of asymmetric information as a market failure.

The existence of credible systems of quality assurance and certification is crucial in order to overcome these problems. Some countries have now established such systems, but others have a long way to go. Moreover, a credible system of quality control is probably just a *necessary* condition for creating a viable market for compost. On top of the issues of asymmetric information, we have identified the following barriers as being significant:

- Because the application of nitrogen and phosphorous loads on farmland is limited, applications in agriculture are constrained by the competition from other fertilizers in general, and manure in particular.
- Because of these limitations, demand in regions with important manure production can be very limited. However, high transportation costs compared to the market value of compost act as a barrier to trade to regions where there is no issue of excessive manure supply or where there is a high potential use for compost (for instance, to fight soil erosion).
- Sewage sludges and soil from construction works can act as additional competitors to organic waste compost.

It is clear that these factors can be highly country-specific.

Inasmuch as selective collection of biodegradable waste could contribute to a better quality of biodegradable waste, it would lead to better market prospects for compost. However, not everyone shares this view- some favour the development of mechanical sorting followed by biogas recovery.

Determining “end of waste” criteria at the European level would certainly be a significant step forward compared to the current situation. In this perspective, it is encouraging to see that the new Framework Directive has created a regulatory framework for “end-of-waste” criteria and that compost is covered by one of the case studies undertaken by the JRC – this would allow overcoming problems of asymmetric information and transaction costs. The cost of quality monitoring could however lead to consolidation in the sector, certainly if additional requirements would result from REACH.

The following policy instruments could also be envisaged:

- Pilot and demonstration projects could also play an important role in overcoming distrust and showing the benefits of compost.
- Due to the competition from manure as a fertilizer, stimulating demand for compost could also require modifications in agricultural policy, including the Cross Compliance requirements.
- The market value of compost does not do justice to its external benefits (prevention of soil erosion, carbon sink, humus reproduction, disease suppressing properties, reduction of methane gas production by avoiding landfills etc). Although existing studies have been unable to quantify all such benefits, synergies with the EU Soil Strategy and the European Climate Change Programme should be investigated.
- Review the CAP, the Nitrate Directive and the APBR in the light of their impact on food waste.
- Public procurement could be used to stimulate demand (for instance in public parks).

The extension of Extended Producer Responsibility to food waste is an interesting idea to explore. It could well be that food producers, confronted with the cost of food waste, would take more measures to reduce the amounts thrown away by households: smaller quantities per unit of packaging for instance<sup>2</sup>.

The new Waste Framework Directive also requires to promote selective collection with a view to composting and digestion and to stimulate demand.

Finally, high energy prices and the increasing number of government schemes stimulating the demand for renewable energy provide strong incentives for energy recovery from bio-mass (including manure), which will certainly lead to a degree of stronger demand in the future.

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<sup>2</sup> Even though, as a side-effect, this could lead to increases in packaging waste!

## **Cardboard**

Due to limitations in data availability, we often had to analyse cardboard in combination with paper recycling.

In comparison with other waste streams, very high levels of recycling are obtained on average across Europe. This success can be attributed to the combination of high rates of selective collection, high recycling efficiencies and a high demand for recovered fibres.

The very low levels of recycling that are obtained in a limited number of countries are due in the first place to differences in the organisation of selective collection.

Although some technological externalities have been identified in the study, industry has also found ways to set up structural collaboration to deal with these issues.

There are some issues with respect to the monitoring of quality in the collection phase, but these can be largely overcome with modern technology (use of magnetic keys, adapted lids).

Belgium, France, Spain and the UK all comfortably meet the targets the Packaging Waste Directive. However, the data available prevent us from making strong claims with respect to the relative efficiency of the organisation of recovery. The low price of the Packaging Recovery Notes in the UK suggests that, once the collection system to reach the recovery and recycling targets of the Packaging Waste Directive has been put in place, the marginal costs of exceeding this target is relatively low.

The low rates of recycling and recovery in Poland and Estonia can certainly not be attributed entirely to the ill-functioning of the collection systems. Indeed, increasing selective collection makes little sense if there is no appropriate infrastructure to deal with the collected materials. Both countries have a waste management heritage based upon landfilling that cannot be shaken off lightly. Moving away from landfilling requires important investments, and, with limited resources, priorities need to be set that can be highly country-dependent. In the case of Estonia, oil shale waste also constitutes an important additional burden that is specific to this country. The abundance of forest resources in the Baltic area also limits the demand for recycled fibre.

Only 2 countries have introduced a (limited) system of producer responsibility for the advertisement sector and the printed press. This is surprising, taking into account that the contribution of these sectors to paper consumption can hardly be qualified as negligible.

In countries where recycling rates are low, it would be a natural step to focus on supply side measures.

- As in most other cases, the most effective policy instrument to stimulate recycling would be to increase landfill and incineration taxes, and thus to divert paper from these landfill and incineration.

- If these instruments are not available, for instance for reasons of political feasibility, imposing selective collection or financing selective collection by ERP schemes are of course valuable second best solutions.
- At the collection side, the significant recent increase of collection rates in Spain has also shown the crucial importance of a dense, customer oriented collection system combined with active information campaigns.

This does of course not imply that we need not look at the demand side. After all, all other things being equal, the higher market prices for recovered paper, the more market segments become suitable for commercially viable selective collection. Moreover, we have also indicated that we cannot take for granted that demand and prices will remain high: changes in transportation costs may have an impact on future demand from the Far East and other sources of fibre are being explored as potential substitutes.

Public procurement can for instance lead to further improvements in the market position of recovered paper.

The mutual recognition of brokers and transporters could lead to more intra-European trade. The same argument applies to "end of waste" criteria.

It is not clear what environmental benefits would follow from export restrictions or recycled content standards.

Beverage cartons merit a separate discussion. Indeed, recycling and recovery rates are substantially lower than for other types of carton. Moreover, with the exception of France, Green Dot rates for beverage cartons are substantially higher than for other carton types. Finally, in the countries where we have obtained data on the subject, the market value of waste beverage cartons is low or even negative.

The main reason underlying these differences are the significant technological externalities in beverage cartons. However, no specific regulatory action appears to be necessary, except confronting every actor in the chain with the external costs linked to his actions. If, for some reason, this turns out not to be possible, the next decision is to decide what disposal option is required. However, the answer to this question depends largely on local factors, such as the logistics of the collection system, that do not need a uniform answer across the Community.

### **Recommendations for the use of economic analysis**

This study aimed at using economic analysis of market failures in recycling markets to identify the policy options that would be most effective at increasing rates of recycling in the EU, where appropriate.

We have analysed in some depth 4 waste streams in 6 member states with very diverse levels of per capita income, geographical structure and histories of waste management. The quality and the relevance of the data we have obtained were also

very heterogeneous. The actual recycling outcomes turned out to widely divergent across countries and waste streams.

Our study has shown that economic analysis provides a powerful tool to understand how apparently small differences in institutional and policy contexts can sometimes have an important effect on outcomes. The in-depth investigations provide examples of the way in which economic analysis can provide insight. By investigating the blocks to high levels of supply or of demand of recycled products, we can see where removing market failures would be likely to lead to higher levels of recycling. This analysis should allow us to identify where policy will be efficient in increasing recycling – and where it may be ineffective, because another remaining market failure will still hold back recycling.

The analysis starts from the consideration that the recycled material is a valuable resource and asks the question "Why isn't that value being realised?". Often, that is for reasons that are due to failures in the economic functioning of the market – issues which may be independent of the environmental problem being tackled. Assessing these market failures using economics identifies the stakeholders' behaviour in terms of the incentives they face, the constraints to which they are subjected (including the technological ones) and the information that is available when they make decisions. This points to appropriate policy action.

For instance, we find that on the supply side, the organisation of collection makes a great difference to outcomes (whatever the policy) and that analysis of the collection market and issues of market power by recycling plants can suggest policy options.

The economic framework helps us identifying unanticipated or counterproductive behavioural responses from policy and points out that even where markets appear to be failing or policy does not exist, private parties can often, but not always, find alternative arrangements for mutually beneficial exchange. It warns us against designing policies that are not robust to changes in market conditions, that overlook the idiosyncrasies of a given situation or that require superhuman skills from those who have to implement these policies. Last but not least, the questions asked by economics can assist us in drafting an inventory of the data that authorities would need to collect in order to take informed decisions.

Maybe a few words should be added on the specific issue of data availability. We have repeatedly pointed to important deficiencies in the data that are available, and we certainly think that better thought should be given on what data needs to be collected in order to support policy. However, a lot of information can be gathered from indirect information.

For instance, suppose that an informal collection network develops in parallel with official collection services. This is only possible, if, for the waste stream in question, there are no economies of density or because there are important costs of environmental and safety compliance that can be avoided in the informal network. We cannot say on prior grounds which hypothesis is correct – it could well be that both are true. However, the lesson from this example is that economics allows to quickly identify the relevant questions to ask.

Another example of indirect evidence is how the low price of the Packaging Recovery Notes is an indicator of the low marginal costs of exceeding the target of the Packaging Waste Directive in the UK.

### **Policy recommendations**

Drawing any common lessons for the use of specific policy instruments from these experiences of different waste streams is challenging, as each situation has its own specifics. Extrapolating to other waste streams on the basis of our analysis is even more so. If we would have to draw a shortlist of measures that are common to all waste streams and countries we have covered, we would propose:

- **Stimulate optimisation of the logistics in the collection phase.** In order to avoid contamination and high sorting costs, selective collection is almost a *conditio sine qua non* for successful recycling. However, selective collection can be expensive. Moreover, if collection is subject to economies of density, selective collection is almost surely incompatible with competition in the market. This does not imply that selective collection needs to be put in public hands and lose the incentive of competition. There exist several ways to “simulate” competition, such as competitive tendering and yardstick competition. However, organising and supervising this requires strong and competent authorities. Exchanges of good practice can play an important role in improving the quality of supervision. This should of course not lead to uniformity in practices. Even in household waste collection, the logistics can be highly idiosyncratic (think of city centres with narrow streets versus residential areas with broad avenues). An important limitation of our current knowledge is that we can only guess at the extent to which the marginal costs of selective collection are justified by the environmental benefits. This is mainly due to a lack of data that would allow a meaningful comparison. The European Union could contribute to our understanding by stimulating the creation of international benchmarking schemes.
- **Rethink the approach to trade.** It is a fundamental insight of economics that division of labour is the basis of all prosperity. If waste were a “normal” product, there would be an unambiguous case for letting the market decide where it could be put to its most productive use. In reality, trade in waste is governed by strict rules. These rules are justified inasmuch as trade imposes risks and costs on other parties than those who have agreed voluntarily to trade the waste. In reality, it has been suggested by some stakeholders that some national authorities use the rules on imports and exports in order to protect their own recycling industry. Potential gains to trade are therefore lost, even when there are no clear environmental benefits. A worthwhile idea to pursue would be to rethink rules on imports and exports from the assumption

that free trade should be the rule and to leave the burden of proof to those who want to restrict it. Probably, for most waste streams, the outcome of this process will be the same as what we observe now. But some unjustified barriers, or alternative approaches to dealing with the hazards linked to transportation, may well be identified.

- **Recycled materials should not be discriminated against.** A recurring theme during our stakeholder consultations is that recycled materials sometimes are being discriminated against for reasons that are very hard to understand. Why should compost be subject to regulations in heavy metals and the ABPR, and manure not? Why should tenders impose the use of some specific materials or products, rather than describe the functional requirements? Defining clear end of waste criteria could make an important contribution in this area. Avoiding discrimination does however not imply that the specificity of recycled materials should not be recognized – this is a specific concern with respect to the implications of REACH.
- **Disseminate good practices.** We have already mentioned this with respect to good practices in regulation and organisation, but it could also refer to the adoption of new collection and recycling technologies. Of course, large cities are often already involved in European networks. However, European support could be especially helpful for small towns. As there already exists a multitude of European initiatives to promote innovation, it is important that additional initiatives do not lead to an increase in search costs.
- **Make sure that landfill and incineration taxes correctly represent the external costs of landfilling and incineration:** Our stated objective was to look at the policy options that would lead to a better functioning of recycling markets even in the absence of a correct internalisation of the environmental impacts of resource use. However, our stakeholder consultation has shown that these are the favourite instruments of most stakeholders. This does not imply that uniform landfill or incineration taxes should be promoted at the European level. Several environmental impacts (most notably those related to disamenities) are very local in nature - therefore landfill taxes may very well depend on the population density and the geographical structure of a country. To the best of our knowledge, there is also no reason why landfills and incinerators should be subject to other environmental requirements with respect to their emissions than other sources of pollution.
- **Investigate the possibility to introduce producer responsibility in other waste streams, especially if this could help promote design for the environment.** Where producer responsibility has been introduced, it has

turned out to be a very powerful tool. Our study has shown the importance of avoiding a “one size fits all” approach. We have observed a wide variety of EPR systems and have found no model to be clearly superior to all others. Diversity can be a powerful source of learning lessons. However, some schemes clearly did not function very well – the underlying causes were mostly related to poor surveillance of the system, and we have suggested some policy changes that could improve upon the current situation.

- **Ensure that pricing of services for waste holders<sup>3</sup> reflects marginal costs.** If disposal costs reflect externalities, and if producer responsibility schemes are in place, then passing on these (dis)incentives for waste holders to make proper use of selective collection schemes can play an important role in maximising the capture of material for recycling. Such pricing schemes – widely applied in Flanders (and many other countries not included in the case studies) at the household level – can have a powerful incentive effect. However, exchanges of good practice should also consider that such schemes can also – where the selective collection system is not so well designed – generate problems of contamination of the selectively collected fraction. This will for instance be the case if the authorities apply a “pay as you throw” policy and the price for the residual fraction is high compared to the price for the selectively collected fraction – this provides incentives for mixing residual waste with selectively collected waste.

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<sup>3</sup> According to the Waste Framework Directive, “waste holder” means the waste producer or the natural or legal person who is in possession of the waste.