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THE ECONOMICS OF RECYCLING IN FRANCE: INSTITUTIONAL FRAMEWORK AND TECHNOLOGICAL ADOPTION

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Abstract: The aim of this paper is to explore the main features of the new regime for packaging waste management established in France in 1992. A description of the institutional organisation is provided. Then, the paper analyses how the packaging tax implemented in France may allow the optimal application of recycling techniques, combined with waste-to-energy facilities. Nevertheless, this optimal utilisation is lessened by weak or even negative incentives which may lead to a sub-optimal equilibrium. The conclusion is that institutional conditions are directly affecting the investment behaviour of municipalities. The consequence will be the development of recycling at levels well below the objectives of policy makers.

Keywords: packaging waste management, recycling, economic approach, France, technological adoption, incentives.

Introduction

The annual production of municipal waste in France is estimated to be 20.5 million tonnes, which represents an average of 360 kg per inhabitant per year (Ademe, 1993). That mass of waste has constantly increased, by 60% since 1960. Packaging and paperboard (especially newspaper and magazines) are the main cause of this increase. Such large growth in the volume of waste to be treated has been followed by a saturation, even a reduction, in treatment and elimination capacities: most landfill sites do not comply with existing standards of environmental protection, while hostile reactions from local populations prevent the creation of new landfills and incineration facilities. The public service of waste management seems to be threatened in its long-term technical, ecological and political viability as, since 1990, 52% of municipal wastes have been disposed of through dumping, and 38% through incineration.

In this context of garbage crisis, France, like many other countries, decided in 1992 to develop a new approach: selective collection, sorting and recycling of packaging waste on the one hand and waste-to-energy conversion on the other (Basse, 1994; Hong, Adams & Love, 1993). In France, the target to be attained is ambitious: between 1992 and 2002, more than 6 millions tonnes of packaging waste (representing 56% of the total amount of packaging waste and almost 35% of municipal waste) is to be recycled. The true challenge for the French authorities has been to set a new institutional mechanism to induce a shift in the municipalities' choice in favour of recycling.

The aim of this paper is to explore the main features of the institutional organisation established in France in 1992. We will see if this organisation is likely to be able to induce the widespread and sustainable adoption of recycling techniques by municipalities. In section 1, a description of the institutional organisation will be provided. In section 2, we will study how the packaging tax may allow an optimal use of recycling techniques. Section 3 will show that weak or even negative incentives may lead to a reduced adoption of these recycling techniques. In section 4, we will see that the actual institutional setting in France could be directly responsible in the years ahead for the stabilisation of recycling rates at a sub-optimal level. This will be followed by concluding remarks.

Section 1. Institutional organisation of packaging waste management

The main targets in the field of waste management, formulated in the Outline-law of 1992, are to prevent or to reduce the production and toxicity of wastes, to limit their carriage and to ensure their valorisation by reuse, recycling "or any other action to obtain re-utilised material or energy from waste" (Law n°92-646 of 13/07/92). The 1992 Law also stipulates that, from July 2002, dumping facilities will only be authorised to receive what is termed

"final waste", i.e. waste that it is not economically efficient or technologically feasible to treat, nor to transform to a less-polluting form. A tax of 40FF./tonne of waste will have to be paid by operators of dumping installations to generate funds so as to subsidise new valorisation facilities. The same law states what can be called "the proximity principle", which makes restriction of the carriage of waste, in distance and volume, a specific goal in its own right. Thus, county ("departement" in French) plans for municipal waste management should henceforth be formulated in accordance with this principle.

The valorisation of packaging waste requires special attention. The Decree of April 1992 obliges packaging firms (producers and packagers) to ensure the management of the waste they are responsible for, this obligation to be carried out either by themselves or by a sub-contractor. A private company, Eco-Emballages has been created by these business groups to respond to this legal obligation. The objective stated by this company in its approval record is to valorise at least 75% of the packaging released on to the market by the year 2002.

Municipalities are responsible for managing municipal waste, i.e. the collection and disposal of waste. However, a specific incentive mechanism has been put in place to stimulate recycling. Eco-Emballages' shareholding is mostly held by packagers, and to a lesser extent, by distributors and material producers. The task of Eco-Emballages is to make packaging waste valorisation a viable option. Opting for an economic approach, Eco-Emballages has developed a strategy based upon free contracts, not only with packaging firms transferring the management of their packaging waste to it, but also with municipalities.

Figure 1 : schedule of contribution for Eco-Emballages
(in French centimes, for packaging "rigid empty elements")

> 30 0001 cm ³	10 c.
3 001 to 30 000 cm ³	2.5 c.
201 to 3 000 cm ³	1 c.
151 to 200 cm ³	0.5 c.
101 to 150 cm ³	0.25 c.
50 to 100 cm ³	0.10 c.
< 50 cm ³	0.10 c.

source : Eco-Emballages, 1992, p.50

The packaging contractors have to pay Eco-Emballages a contribution for each package sold. In return they have the right to affix a "green dot" on their product certifying that they are exempt from the retaking obligations. Contributions will be used by Eco-Emballages to financially support selective collection and sorting schemes managed by the municipalities. The initial rates have been fixed at an average of 1 centime per packaging (figure 1), expected to reach 3 centimes¹ in a few years time, when the system will be working at full pace. Contributions paid do not vary according to materials or types of packages : all packages, whatever their composition, are subject to the same charge.

¹ One Franc = 100 centimes. 1 US dollar = 5 francs

To encourage municipalities to develop selective collection and sorting, Eco-Emballages offers them contracts supposed to ensure minimal profit per tonne of sorted material. Furthermore, under the aegis of Public Authorities, fixed retaking prices have been negotiated between Eco-Emballages and representative associations of different material producers in charge of recycling. These fixed prices provide the basis for contracts between these recycling firms and municipalities, according to the schedule specified in figure 2. There is a parallel with subsidies and fixed prices : detailed quality standards have to be met by municipalities as regards delivered recycled materials (Minimum Technical Prescriptions, MTP).

Figure 2 : Payments by Eco-Emballages and material producers to the municipalities

	Direct subsidy Eco-Emballages	Fixed prices paid by materials producers	Minimal gain for municipality
Plastic	1500 F/t	free collection	1500 F/t
Aluminium			
- not burned	1500 F/t	1000 to 1500 F/t	2500 F/t
- burned	500 F/t	500 to 1000 F/t	1000 F/t
Iron / Steel			
- not burned	300 F/t	50 to 200 F/t	350 F/t
- burned	75 F/t	0 to 50 F/t	75 F/t
Paper / cardboard	750 F/t	free collection	750 F/t
Glass	0 to 50 F/t	150 F/t	150 F/t

source : Eco-Emballages, 1993, pp. 10-11

The aim of this system of guaranteed prices is to secure a market for recovery materials through the creation of predictable exploitation conditions for selective collection and sorting, so as to encourage municipalities to invest in these new options. In fact, for a long time, the main economic source of weakness of the recovery sector has been a chronic instability of recovery materials prices. This has resulted in sub-optimal investment and low technological development. This instability was accounted for by the specific function of the recovery sector : to counterbalance price movements of first-hand raw materials. These materials were themselves subject to fluctuations that various efforts at stabilisation - through specific stabilising funds or long term contracts - have never overcome (Giraud, 1983).

Eco-Emballages may be seen as an institutional framework devoted to the dissemination and widespread adoption of recycling techniques. The goal to be reached is to collect, sort and recycle or re-use $\frac{3}{4}$ of the packaging waste. Within this 75% target, a secondary goal is explicitly acknowledged : materials recycling ought to attain the level of $\frac{3}{4}$ of packaging waste valorisation. Waste-to-energy is not thought likely to become superior to a $\frac{1}{4}$ share commitment, though this is only a recommendation defining a benchmark (Eco-Emballages, 1992). It is assumed that waste-to-energy may improve with technological developments and better information on costs and performance of selective collection, sorting

and recycling technologies. A tax on waste disposal by landfill is being implemented to raise funds to aid the development of new technologies.

Section 2. Packaging fees and recycling subsidies may allow an optimal combination of techniques

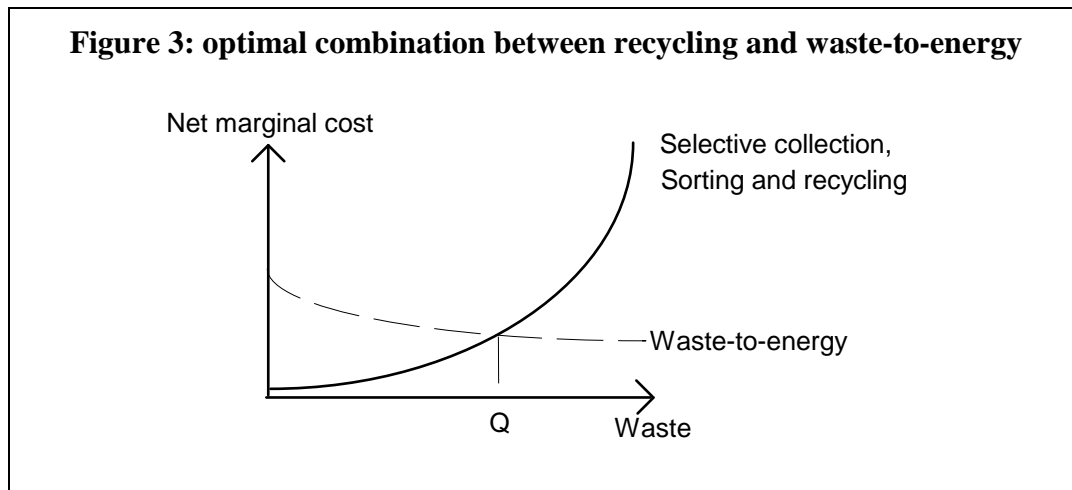
The main instrument used by Eco-Emballages to induce a development of selective collection and sorting is to offer a direct subsidy to municipalities. The “ green dot ” allocated by the packagers plays the role of a subsidy to reduce the price of selective collection and sorting. The level of subsidy is determined so as to cover the cost difference between collective selection and sorting and the average cost of up-to-date waste-to-energy facilities. Through the Eco-Emballages system, packaging industries will only bear the average additional cost associated with selective collection and sorting, and not the increasing marginal total cost of the whole set of operations needed to carry out the treatment and elimination of waste resulting from their products.

Obviously, the “ green dot ” appears to be one of the possible forms of financial mechanisms in the field of environmental protection (Godard, O., 1993b). As such, contributions paid to Eco-Emballages are not playing the role of a direct incentive ; they have no incentive effect on the behaviour of the packager. On the one hand, undifferentiated contributions do not allow the transmission of economic information on the specific social cost differences of using each material. On the other hand, with their low absolute level, contribution rates cannot act as strong price-signals to the packaging firms. This is an important difference compared with the German system, DSD (Defeuilley & Quirion, 1994). In the French case, the amount of funds to be raised is calculated, on the basis of a budget-neutrality principle. The idea is that the funds should be just sufficient to cover the additional costs of selective collection and sorting compared with a traditional collection and a waste-to-energy treatment, for the proportion of municipalities expected to accept a switch to new approaches.

Such a financial device might theoretically be designed so as to induce an optimal combination between waste-to-energy and recycling techniques. In a theoretical model, this level will be determined under some assumptions such as the following : a) marginal net costs of waste-to-energy are a decreasing function of the flow of waste to be treated, b) marginal costs of sorting and recycling are an increasing function of the flow percentage to be treated this way (i.e. the more the waste stream is sorted and recycled, the higher the cost associated with the marginal unit of waste to treat). With these characteristics, an optimum level can be determined at the point where marginal cost of sorting and recycling is equal to the marginal cost of waste-to-energy (Bertolini, 1987). Therefore, a “ least-cost ” function will emerge,

combining the lower marginal costs sections of recycling and waste-to-energy functions (Pearce & Turner, 1992).

In this way, any valorisation target may be amenable to a minimum cost of attainment with the setting of an optimum combination of waste-to-energy and recycling, provided that decentralised agents (municipalities, firms) are given sufficient flexibility and appropriate economic information (prices reflecting opportunity costs of using resources).



In practice, things may be very different. Currently, prices and performances of selective collection, sorting and recycling are very difficult to assess, because of uncertainties and dispersion of local situations and technologies. Therefore, readily identifying a single, unique “least-cost” function between recycling and waste-to-energy is out of reach. In attempts to overcome this difficulty, in some situations adjustment procedures have been applied to the packaging fees in order to improve information and to progressively incorporate technological innovation (Cropper & Oates, 1992).

Eco-Emballages in France has adopted a strategy incorporating an experimental dimension, in order to develop collective learning with municipalities. During an initial period, it focused on the identification of a group of representative cases to manage from a diversity of situations, from poorly occupied rural areas to collective buildings in urban neighbourhoods, before extending its level of action. After the selection of candidates, 41 "pilot sites" were chosen, representing a wide range of situations, technical combinations and organisational methods for collection and treatment. These sites will be supervised and assisted by Eco-Emballages, who will provide municipalities with the information gained from these experiences. This type of procedure is used as a "laboratory experiment" to "select", from a wide spectrum of organisational methods and technologies, those judged to be the most suitable and efficient for each type of "stylised situation". Then a limited selection of reference models could emerge, allowing a degree of stabilisation of the technical-economic landscape (Eco-Emballages, 1993). Providing this selection of approved options would also

allow private firms and local authorities to adopt combinations of techniques to suit individual, local demands and needs. This will be an additional contribution to economic efficiency that a more standardised and centralised approach would have missed.

Furthermore, a fund for the modernisation of waste management (financed by the 40FF. “ dumping tax ” paid by operators of landfills) provides assistance for the development of innovative techniques and for their diffusion. If investment into municipalities, as a whole, is sufficiently provided over time, there should be a regular integration of technical innovations ; risks of technological "lock-in" (Arthur, 1989) are then limited. It is important to avoid a source of rigidity which, as well as causing economic inefficiency, could be a source of embarrassment if the utilised techniques are ultimately proven to be inferior or to be the source of uncontrolled environmental risks (Godard, 1993a).

In the short run at least, an optimal combination of techniques may allow reduction of the average cost of valorisation, by ensuring an optimal utilisation level of recycling (until the level at which the decreasing yield of recycling equilibrates the increasing yield of incineration). This optimal level of dissemination of recycling is hard to compute in practical terms, due to partial and piecemeal information on basic inputs ; but we may expect it to be approached if appropriate incentives are given to municipalities and firms by the financial mechanisms (packaging fees and recycling subsidies) of Eco-Emballages. Until now there has been some evidence that this is not the case. There is indeed a likelihood that dissemination of recycling techniques could be decreased in the future by weak, or even counter-productive, incentives.

Section 3. Pace of dissemination of recycling techniques could be slow and could stabilise at a moderate share of waste treatment, due to weak incentives

In order to exploit opportunities opened up by decentralised choices to work towards an efficient collective allocation of efforts, one fundamental condition has to be satisfied : decentralised agents have to be in an economic environment providing appropriate signals. It is in these terms that the present French system could be strengthened. Municipalities are not facing economic incentives to invest in selective collection and sorting which are strong enough to supply recovery materials to material producers. On the contrary, they may bear uncompensated additional risks if they adopt this type of technology. This paradoxical result is related to several features of the current regime :

* The duration of guarantees given by Eco-Emballages does not seem sufficient as regards the long time period required for depreciating investments granted by municipalities to establish the selective collection and sorting. Such investments require a 15 to 20 year depreciation period, while the Eco-Emballages' agreements have a maximum duration of 6 years, the public acceptance granted to that firm being itself only conceded for 6 years !

Within a behavioural logic inspiring private activity, this time-scale may be considered as a normal risk to be born by the contractor. But this is not the logic of public local authorities : it is not their role to take such entrepreneurial risks, but rather to manage wisely the interests of local populations.

* The financial support from Eco-Emballages could be insufficient to compensate for the expenditures that municipalities will be exposed to in organising selective collection and sorting of waste. The basic principle adopted is that Eco-Emballages will cover only the additional cost faced by the municipalities, providing the municipalities commit themselves to a system combining traditional collection and an up-to-date incineration facility meeting the most recent pollution standards. So the baseline scenario on which additional costs are estimated is not the current situation in which municipalities consider the opportunity to invest in the newest approach, but the situation in which they would be placed if they had already invested in a brand new system of incineration. In fact, this means that municipalities will have to bear more net charges for waste treatment if they switch to selective collection and sorting than they currently do, and that they can expect to go on bearing these costs if they extend the useful life of their existing waste treatment facilities. Moreover, the real costs of new options are not well-known, and Eco-Emballages has defined its financial mechanism on the basis of estimations which municipality representatives often deem to be rather conservative.

Therefore, positive incentives do not seem to be provided by the financial mechanism, which appears, at best, as neutral in regard to the adoption of recycling. If an incentive is to come into being at all, it has to be sought in some other area of the regime. One variable of this sort could be the level of price paid by material producers to municipalities for taking back sorted materials. More generally, a broad development of recycling could be imagined, if firms and municipalities find, in the system adopted, a common ground on which to develop a long-lasting partnership, reducing the level of conflict of interests. However this too does not seem to be the case.

* Quality standards for sorted materials, defined by material producers, have given rise to sharp tension between the two parties, on technical as well as on institutional grounds. The municipalities have been gaining experience for some time in the field of selective collection and contend that they frequently have a technical incapacity to meet these standards, due to the variability of the composition of the waste to be treated and the level of technological capability they could afford. Such an incapacity will be the common experience of most municipalities taking this risky route. In addition to the technical disagreement, there is some paradox with municipalities being placed under the supervision of private firms, involving an inversion of the traditional direction of injunction. Though the packaging firms are supposed to be obliged, on the grounds of public interest, to take the necessary steps to manage the waste of their products, it appears that the municipalities would have to satisfy strict

standardised requirements on the quality of raw materials delivered to the concerned firms, in the same way as any other supplier on the market, giving the firms the right to be absolved of their obligations in cases of insufficient quality ! The process of defining quality standards appears to be a difficult operation, not simply because of technical concerns, but also because of the necessity of assigning responsibilities and risks among partners. This is potentially a source of serious crisis for the whole system, avoided at present, but not solved by such a system of temporary derogations.

* Firms are not positively motivated to develop the recycling, but rather to reduce its expansion. There are two reasons for this : firstly, as more recycling develops, Eco-Emballages has to provide more financing, so the contributions required from the packers increases. Secondly, the more the recycling develops, the more the material producers have to take significant quantities of secondary raw materials back, and the more they may face serious financial and technical problems, especially the producers of plastic. Therefore, through the assessment of MTP and the liberty of Eco-Emballages as regards contractual relations with the municipalities, the firms can limit the financing needs required by them.

One of the important characteristics of the new organisation adopted was the process of prior consultation and negotiation : it is essentially an organisation formed by the concerned firms on a voluntary agreement basis. The main aim of this type of policy instrument is to promote firms' involvement in the policy making process, to increase their motivation to meet environmental targets and to design environmental policy adapted to the realms of economics (Glachant, 1993). Voluntary agreements may reduce implementation problems and increase effectiveness of environmental policy. Nevertheless, these results will be reached only if a) policy makers make strong and credible commitments; b) appropriate incentives are implemented in order to induce a real shift in firms' motivations and interests. In the new regime of packaging waste management in France, commitments and incentives are not designed to encourage packaging firms and material producers to really become involved in a broad development of recycling. On the contrary, the relationships between municipalities and firms are acting as counterproductive incentive devices and may induce municipalities to make investment decisions which oppose recycling.

Section 4. A systemic loop leading to a sub-optimal level of recycling

As Pindyck (1991) has pointed out, changing economic (but also institutional) conditions can have a large impact on investment decisions. This is because economic and institutional conditions affect the perceived riskiness of future cash flows and spending associated with an investment. If municipalities perceive selective collection, sorting and recycling to be much more risky and random than waste-to-energy, they will not get involved

in this technological path. Currently, the new packaging waste management regime is still subject to extreme uncertainties in several fields:

- * Technological uncertainties: possibilities of reaching normalised production of secondary materials, technological performances of selective collection and sorting.

- * Economic uncertainties : level of costs, methods of payment.

- * Institutional uncertainties : stabilisation of relationships between material producers and municipalities, motivations and behaviours of firms regarding recycling, credibility of commitments towards Eco-Emballages, evolution path of the « green dot », etc.

This range of uncertainties may result in stabilisation of the new regime around a sub-optimal equilibrium corresponding to a low rate of recycling of packaging waste : restricted investment by the municipalities (too risky, too expensive) in this technological path; restricted financial assistance from Eco-Emballages; low level of subsidy through the « green dot »; inability of a large number of municipalities to satisfy the quality standards for recovered materials. Therefore, we can assert that inappropriate institutional conditions will divert the municipalities from selective collection and sorting investments. This unfitness of institutional conditions is directly related to the lack of appropriate incentives to involve firms in the broad development of recycling schemes.

On this basis, we may wonder if the new regime, including Eco-Emballages as a flagship, has not been conceived primarily as a means of blocking the dissemination of other national or European initiatives believed by French firms to be ill-timed and to induce excessive costs, and secondly as a useful experiment for convincing the main partners (public authorities, municipalities) that packaging waste-to-energy valorisation should be followed as the most economically realistic option. To this extent the current regime may be seen as a transitory arrangement during the shake-down process.

Concluding Remarks

Technological adoption and diffusion are generally analysed on the demand side (Freeman, 1994), including the so-called "network externalities" phenomena (Katz & Shapiro, 1994). But, packaging waste management in France shows that technological adoption and diffusion are not only induced by demand-pull phenomena. In this paper we have shown that adoption and diffusion of recycling techniques are closely related to the institutional framework. Institutional barriers (principally, in this case, the lack of appropriate incentives) are central elements which need to be taken into account for analysis of the patterns of technological adoption and diffusion.

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