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## Secondary raw materials market creation: Waste stock exchange

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# **SECONDARY RAW MATERIALS MARKET CREATION: WASTE STOCK EXCHANGE**

By Francesca Coda Canati  
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## **1. Introduction**

Environmental law has evolved rapidly during the last few years. Since the European Single Act, introduced in 1987, environmental principles have changed until the Maastricht Agreement, in 1992, put environment on a first level position.

Since 1973 five Environmental Action Plans have been launched. These Environmental Action Plans propose new legislation and general guidelines for environmental policies, but most importantly, have formed the basis for a comprehensive environmental law.

In the waste management field, particularly, the Community Action is based on preventive action and correction principles at the environmental damages source, and also on the “polluter pays” principle.

The first law adopted about waste is contained in the Dir. n.442/1975. It was, then, almost completely changed by the Dir. 156/1991 regarding “regulation on waste”.

The three principal objectives of the Community Action about waste management, are:

1. Waste reduction at the source;
2. Increase of recycling and recovery actions;
3. Safe waste disposal.

This Directive does not distinguish between waste destined to elimination and waste destined to recovery. This is its main shortcoming.

In fact, according to article 1 point a), waste is: “every material or object included in the Appendix 1 whose holder either gets rid of or has decided to get rid of or has an obligation to get rid of”.

Since the 1970, environmental policies have evolved from relying on command and control instruments, first by integrating then with voluntary instruments ( market-based instruments ), then by recognising the importance of economic incentives in making such policies more efficient both economically and environmentally.

The objectives of the European Community Countries aim to reduce waste while providing incentives for treatment systems that encourage waste recycling and reinsertion into the economic system.

In this context European Community Countries have developed a more extensive waste recovery and recycling system ( glass, plastic, paper and aluminium ).

Germany and France have started immediately. The first has developed a system, called DSD, Dual System Deutschland that collects packaging material and sends or sells them to recovery, recycling and refuse centres.

In 1993 France created the Eco - Emballages Consortium, a recovery and re-use system of used packaging material.

Italy has conformed slowly to the Community legislation and has finally approved the Dir. 62/1994 about packaging material, Dir. 156/1991 about wastes, Dir. 689/1991 about dangerous wastes, with the Ronchi Decree n. 22/1997.

This would lead to think that the new legislation has led to an efficient waste management system, and that recovery and recycling operations covered by the law would expand as they have elsewhere in Europe.

However, waste management problems have not been solved. Huge economic interests have hindered an activity which should be ready to take off.

This is due to market factors and excessive bureaucratisation, connected to the above mentioned activities.

With regards to market factors, since disposal costs are very low ( due in part to non – compliance with regulation ), the economic efficiency of waste recovery depends on the costs of imported raw materials.

At the same time there isn't a real primary raw materials market, in which supply and demand can meet.

Demand, in particular, is very variable, and depends on primary raw materials market trends.

In fact, in most cases there is a reduction in supply and demand is insufficient or inexistent.

In this situation secondary raw materials are transported to the refuse disposal sites, increasing the environmental and economic problems tied to refuse and wasting raw materials and semimanufactured products and their energetic content.

Even though it is the law that creates the framework for recycling and recovery activities, the real incentive towards their development is economic.

Legislators need to realise this, first by making waste disposal less convenient for private operators then by increasing industrial waste recovery convenience instead of primary raw material use.

In addition to an efficient regulation enforcement system, economic instruments are needed that will encourage private operators to be more mindful of environmental problems that hinder the recovery sector. Such instruments can also make up for the lack of an appropriate legislative framework, and the lack of incentives that favour the development of a secondary raw materials market.

The solution is the co-operation between the public authorities that create legislation and set economic incentives, and the private sector.

The Waste Stock Exchange Project aims at creating such a market.

## 2. Waste utilisation and secondary raw materials market creation.

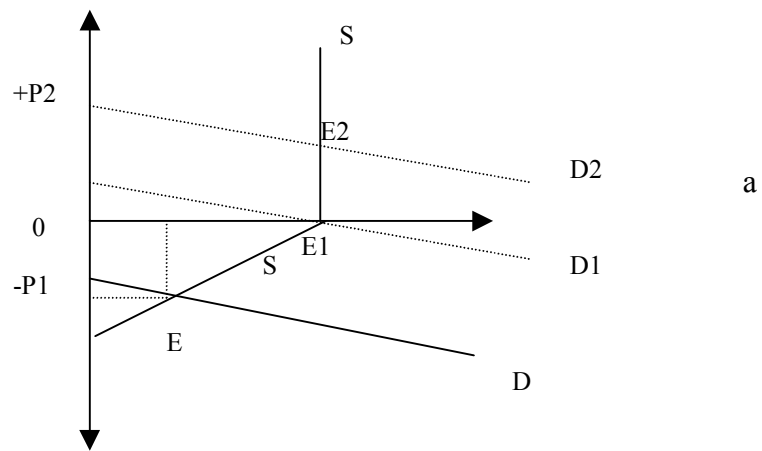
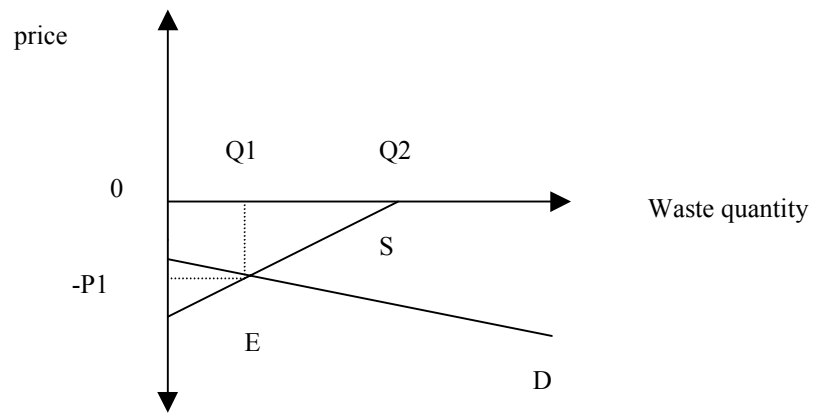
The refuse disposal site solution has obvious limits and disadvantages.

In fact, refuse disposal sites imply environmental pollution, low technological levels, limited investment and therefore low propensity to development. In particular they imply dealing with waste only at the end of the consumption and production process.

The solution lies somewhere else: it is in waste utilisation, recycling and recovery.

Waste, whether it is derived from production processes or as the end product of consumption, becomes valuable not when it is discarded, but when it is reused.

This value is due , on the one hand, to the lack of disposal costs, on the other hand, to the price that the potential buyer is willing to pay to use it in place of primary raw material.



b

Figure II.1. Secondary raw materials market

According to graphs a and b, in figure II.1, the x-axis represents waste quantity, the y-axis waste price.

In economics, wastes are goods with negative utility and therefore negative price.

This means that the waste seller will have to pay the buyer to collect wastes.

Therefore, the supply (S) rises as the paid negative price decreases, until it will be maximum for zero price ( free collection ); retriever demand (D), instead, is zero when prices are low and rises when offered price is rising.

Without any regulation, trade quantity will be  $Q_1$  and paid price will be  $-P_1$  ( buyer receives  $P_1$  for all collected quantity ):

This reasoning holds if wastes don't have a positive value and therefore are not used by retriever for their following sale.

The waste producer that produces  $Q_2$  will dispose of the rest, reducing rejects, recovering a part of them and disposing of the rest illegally.

The higher the requested price, the lower the quantity of waste delivered to the retriever will be. On the contrary, the producer will find it more convenient to go to waste disposal or do it himself; even with a law that identifies appropriate facilities for the recovery of industrial wastes, the firm will act in an economically convenient way, and will turn to the least expensive alternative.

Matters are different when talking about urban wastes, whose tax payment is mandatory and independent of delivered quantity: if that is the case, there will be no problems, but there will also not be any incentives to reduce waste production.

According to graph b, in figure II.2, it is evident that, if a part of waste has a positive value, the demand curve for those moves above the x-axis ( in  $D_1$  ): in that case wastes are collected without payment.

In many cases, those who produce waste ( which has an economic value of its own ), sell them for a profit.

If their value rises again, the demand curve moves towards  $D_2$  and the price becomes positive.

With zero price waste supply is highest: in fact producers deliver all their wastes to retrievers.

From that point on, the supply will be rigid, unless the production of goods which create waste rises. Since industrial wastes are always "rejects", their supply cannot rise.

Therefore, a positive price provides incentives for producers to deliver wastes that, at this point, become by-products.

The effect obtained with a waste market value modification is not the same when the law forces producers to dispose of waste in environmentally sound ways or when it sets future recovery objectives. In this case producers look for the least-cost alternative ( legal or illegal ), while waste disposal retrievers, once they have been paid, will try to dispose of unsold waste in the least costly way.

Therefore, if, like Waste Stock Exchange provides for, it is possible to transform wastes into goods with a positive value in Q2, WSE takes care of recovery wastes collecting and recycling, without controls and public organisation of transport and recovery authorisations.

Waste Stock Exchange tries to organise a market for waste with positive market value where it is possible to recover waste and to allow it to exceed the positive price barrier.

Since in order to draw recycling interest, secondary raw materials cost needs to be less than primary raw materials cost ( with their qualitative differences ), the contribution has been calculated on the differences between secondary raw materials collection and mobility cost and primary raw materials prices.

If secondary raw materials market organisation bridges the gap between costs, the contributions are not necessary.

In this way the attraction for waste buyers increases, lowering the price they have to pay for using secondary raw materials, and transaction costs decrease ( often transaction costs are higher and discourage potential users ).

### 3. The Waste Stock Exchange Project

The Waste Stock Exchange Project is going to create a Web-based secondary raw materials market that solves logistical and qualitative problems for all public and private entities that could use, potentially, some kind of waste in their production cycles that implement recycling and recovery programs.

If a retrieval waste buyer and an opposing seller have been free to act on the market, they are faced with problems with regards to sustainable costs of information collection, market competition, risk management...

A mediator will be introduced between two opposite businessmen; the mediator operates through a society and deals with the whole management system.

WSE participants become partners by paying an annual membership fee.

The WSE management board uses the subscription to cover system management costs and receives a profit.

WSE must be profitable not only for participating firms, but also for the management board.

The innovation is the company structure ( Society/consortium ), which combines the cost-sharing aspects of the Consortium with the profit-making potential of the Society. This company structure answers to the necessity of not only supplying the society with a system management funds collection, but also to directly involve associated firms in the same system operative control.

WSE' s primary function is to provide a service to both those who possess reusable wastes with a potentially positive market value and to those who are interested in acquiring such goods to use them in their own productive processes.

WSE doesn't just provide firms with a service, but it includes any participant that could find it profitable to enter into this market:

1. firms that produce wastes that could be reused in production cycles;
2. firms that produce wastes and transform them into retrievable wastes, to then sell them to potential consumers;
3. firms that buy secondary raw material directly from manufacturing firms or from firms that recycle and recover it in their productive cycles;
4. companies taken over by municipal agencies that recycle energy;
5. every kind of consortium, obligatory or not;
6. collecting and transport firms, that could favour WSE firms with a profitable pricing system, for a potentially wide range of clients;
7. environmental consulting societies, that can support participating firms.

Once the system is in place, it can be extended to many people involved in the waste sector, creating a real business.

Regards to WSE' s principal function, the operative phases in the system will be examined. They are:

1. Waste accreditation. Waste, to be admitted into quotation and following negotiation, must meet certain quality and safety standards. For these purposes,



some guidelines will be drafted, with the collaboration of a certified board, that represent waste rating standard parameters. Thanks to certification, wastes exchanged on WSE, automatically become “ad hoc” wastes and for this reason they are in compliance with the law that safeguards environment and pollution. Potential buyer firms have described the type of waste they seek, to provide incentives for the immediate search for such a product. A research mechanism then set up that will allow other by-products to be added to the baseline price list, and that will be other actors to enter the market. The firm can enter the market provided it has gone through the steps described in 1.

2. Firm accreditation. Before entering into the system, the firm has to give its personal data description ( state contract, financial assets ). The accredited firm can go on exposing waste personal data description and acceding to quotation of the same waste, by fitting in a suitable list.

3. Proposals are listed on the Web by price ( both asking and selling ). The seller/ buyer, along with the characterising quantity of the waste are shown. The price reflects the list trend, while the price of those materials not included in the list depends on the seller’s convenience. Buyer counterproposals can reflect initial price but they must stay within certain limits. The negotiations occur through an auction mechanism. Proposals can only take place during working hours, during which the managers, through the telecommunication system operation, receive and evaluate the orders. The system will have its own access procedures that will allow users to insert proposals and bid on them. It is not possible to withdraw proposals after quotation stop and orders have been sent out. Proposals can be changed during negotiation, provided they respect the range of variation set out in the system. Proposals ( buying and sale ) are not admitted to negotiation if the price is outside the range of variation.

4. Waste price evaluation. The system includes a general list of waste types admitted into negotiation. This list will initially be made up according to values obtained, for example, from Chamber of Commerce market reports. As the market develops, this list will be up dated and extended to retrievable waste. This list is accessible, without access limitation, to anyone who wishes to know specific waste market values. The list is a vital part of the WSE system, because it regulates the state of the market with mathematical and statistical functions

and it is created and maintained for the total protection of the users. The price for materials offered could be positive or negative. A negative price favours competition and when the system will go to full speed and achieve efficiency, this competition will augment. The list specifies market value through previous periods, for each individual good, also giving a real time and historical statistic about market value trends.

5. Market value calculation. Calculating market value means giving a value to every material present in the list, by the end of the day. This represent its price for the following day's negotiations.

6. Negotiation conclusion through electronic signature. Under this current system once a negotiation has been successfully concluded, the contract must be signed in person. WSE proposes a quicker and more efficient solution: contract stipulation with electronic signature. This proposal is justified because the whole transaction goes through the telecommunication network. WSE put the contracting parties in contact, in order to reveal their respective identities and to start the actual exchange operation.

To support this management operation, there is a simple and highly automated structure, with an expert staff:

- system analyst/waste manager;
- system administrator;
- information specialist.

The WSE structure can be summarised with a simple diagram.

#### 4. Waste Stock Exchange feasibility analysis

After having analysed WSE organisational structure and system, it is necessary to specify why it is profitable to create a wastes telecommunication exchange, while underlining profitable factors for the participants.

WSE was derived from a project by a consultant society, CGSS that operates in Pavia.

WSE was planned to solve the waste management problems in Lombardy. In fact the data used refers to the situation in Lombardy.

WSE is a model for a larger system, that could then also operate at a national, European and international level.

This can happen as an Internet based system makes communication easier and distances irrelevant.

The main advantage of participating in WSE is joining a well-regulated system and operating in a free and competitive market.

The greatest incentives to enter in the system derive from WSE' s organisational and operative structure.

Thanks to its structure, WSE stimulates the creation of ties between the various actors that help to bring about various agreements, economic co-operation, and long term supply contracts which help to maintain price stability.

This structure allows the partner to be more closely involved, and this efficient collaboration between partners encourages the development of new market positions and continued growth of the system.

The intermediary nature of the management board controls not only secondary raw materials ( the object of transactions ) but also the participating firms.

WSE proposes incentives both to those who recover waste and those who make differentiated collection; in addition other incentives exist to create waste reduction infrastructure ( both with regards to quantity and levels of hazard ), and for the development of market and economic strengths.

Participating in WSE is not only economically convenient, it also shows a commitment to the environment and to citizens.

Through WSE, recycling and recovery operations are further developed, and allow the firms to add environmental considerations to their strategic variables, adapting them to European and International policies.

The Web-based network allows for quicker acquisition of information; and for communication with anyone anywhere ( encouraging the development of a market information communication in real time ).

The Web-based network, not only provides incentives for contacts, negotiations, communications between operators, but also provides procedures to the users for communications about negotiation, assistance and consulting or for simple data communication.

Moreover, the communication network keeps everyone informed on quantities supplied, sale and buying proposals, and additional services.

At the same time, WSE favours the acquisition of some advantages for the participating firms, thanks to a free market approach and to a greater competitiveness versus other systems in place in other European countries.

The most important objective connected to WSE' s creation is the expansion of the system over national borders and the creation of an international secondary raw materials market.

WSE extends environmental responsibilities to all interested persons, public authorities and private firms.

We have to keep in mind that there are some problems in the WSE plan, that need state or legal intervention in order to be resolved.

The first problem is the lack of an efficient recovery activity, due to the fact the firms find waste disposal less costly.

The public administration could act in the firm's interest by providing financial incentives for undertaking recovery activities.

Moreover, WSE, being the place where demand and supply meet, has been organised so as to favour the demand for retrievable materials and, indirectly, its supply.

How is this possible? The primary raw materials and the secondary raw materials market trends abroad, do not provide incentives for buying secondary raw materials in Italy.

A system like WSE, does not work if its function depends on other market trends.

The only way to remedy this is to create a system of fiscal incentives which would make it inconvenient to buy secondary raw material from abroad.

After WSE expansion, the service management board could promote other functions such as the control function.

In this way, the management board could not only certify waste and eco-label materials that use secondary raw materials, but serves as a true controlling authority in the concession of authorisations and other paperworks.

In this way, WSE can combine the economic and juridical aspects, which today seem to be constantly contrasting each other.

A final aspect to consider is WSE's services.

We can think of a system that can act like an environmental and judicial consultant ( through the network ) that favours profitable contract agreements, ( with economies of scale ), with collection, transport, treatment, and recovery firms, to further facilitate secondary raw materials exchange.

The obvious conclusion is that WSE can operate only if public authorities involved with waste management and the private sector which can profit from this field co-operate with each other.

At this point the problem is to see up to which point it is convenient to create Waste Stock Exchange.

Now we have to distinguish why it is convenient for the WSE management board to create the system, and why it is convenient for the participating firms.

With a costs-benefits analysis we can obtain some results.

In this analysis numerical values will only be used as examples, because the data are not sufficient.

The society is constituted by a private society and the Pavia provincial administration that will create it and bring in the company's initial capital, giving validity and continuity to the society.

At the same time, the management board will have to make more investments to finance WSE's structure and management.

Expenditure are divided into:

- technical
  - hardware, Web-based network
  - software, network management program
- operational
  - employees
  - structured expenditures

With regards to income, it is possible to make some reasonable assumptions.

In the first place it is presumed that potential subscribers will pay an annual subscription which will either be:

- annual fixed subscription;
- minimal initial annual fixed subscription, with a percentage on transaction brought to a successful conclusion;
- only a percentage on transaction brought to a successful conclusion.

Other revenues could include:

- state and European subsidies ( to apply ecolabel or to certify secondary raw materials );
- sponsors, financiers and investors.

At this point we need to identify when the society will be at the break even point, and from what point on it will begin to take a profit.

The break even point will be at the point where the sum of N years of subscription value multiplied by the number of participants, plus potential subsidies, is equal to the expenditures made in the same timeframe.

It's reasonable to believe that at the beginning the subscription costs of the firms participating in WSE will not be able to cover the total society expenditure.

We hypothesise that the society will expect to recover its costs within WSE' s fifth year of existence. From that point on revenues will exceed costs.

Let's look at the following graphic.

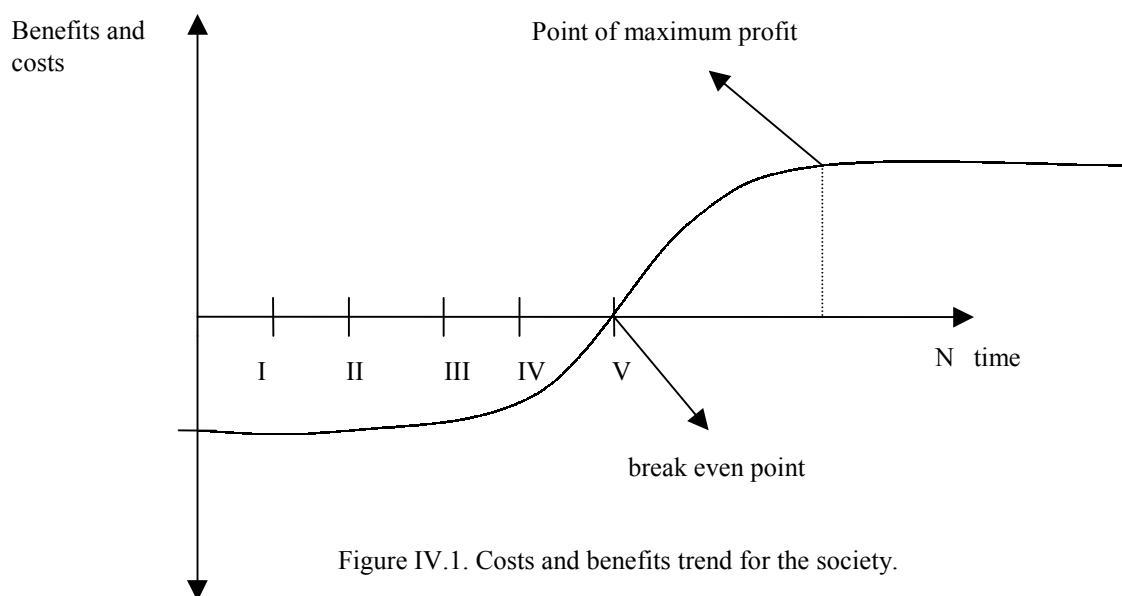


Figure IV.1. Costs and benefits trend for the society.

Once we know the number of the firms that would like to participate in WSE, it is possible to give a numeric value to the subscription fee.

The subscription fee is considered estimable if, after obtaining a reasonable percentage of interested firms, the total five year cost is distributed among the participants.

Alternatively, it is possible to estimate the number of the necessary participants to take the system to the break even point in a brief amount of time, given that a subscription value has already been set.

Thirdly, given a set number of participants and a set subscription value, we could estimate how long it would take to reach break even point.

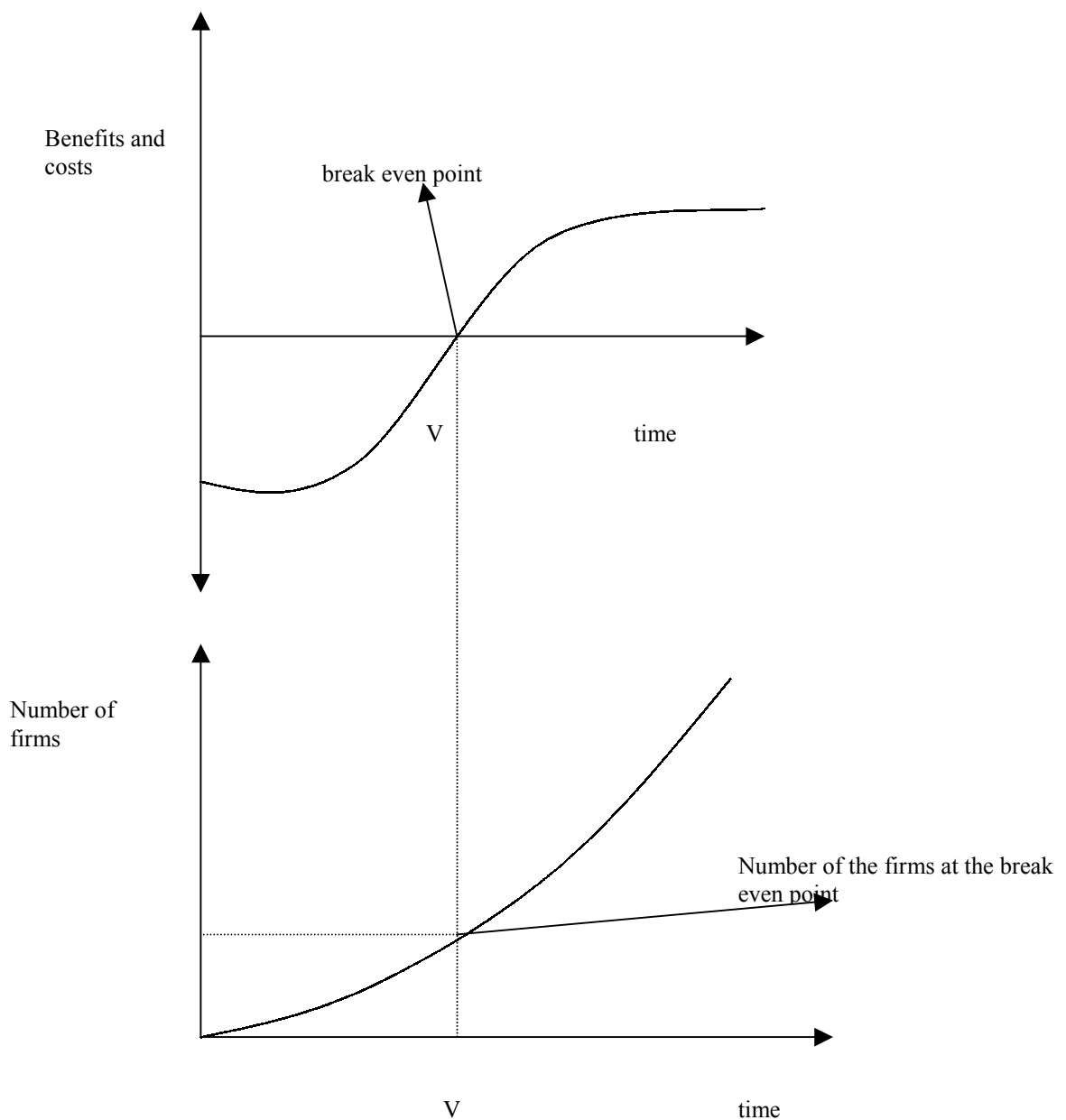


Figure IV.2. Costs and Benefits break even point

The first step to do a comparison has been to point out the society' s sustained costs. Now the subscription value must be specified and some assumptions have to be made about it. In order to obtain the subscription value, we need to know the number of participants.

We have to consider:

- the number of the firms that produce retrievable wastes and use secondary raw materials in their production cycles;
- the total number of the firms in Lombardy; from this number we can extrapolate a reasonable percentage, to use as a sample.

The sustained costs divided by the number of firms above, gives as a result the WSE subscription fee.

Now we have to consider the possible implications regarding the subscription fee.

We will make some assumptions about the subscription value once the system will be functioning:

- $S=0$   $\longrightarrow$  first year; the society will have a loss equivalent to the costs sustained to constitute the WSE system and to maintain it during the first functioning year. A percentage will be applied to successfully concluded transactions.

Despite the fact that the participants don't pay the subscription, they are effective partners of the society and they make any transaction they wish.

Their participation is thus favoured and we can calculate the potential number of firms that will take advantage of the system the following year.

- $S>0$   $\longrightarrow$  from the second year on the subscription will assume different values, such as:

$S$  initially fixed;

after a certain period minimum  $S$  with a percentage on successful concluded transactions.

We can presume that the number of firms participating in WSE in the following years will remain the same, some could leave because  $S>0$  and they did not conclude any transactions the previous years.

Others, instead, could enter into the system because they have received some financial support and they have reviewed their production infrastructure, either to reuse wastes, or to sell treated waste to recycling.



We can suppose the firms that have concluded some transactions the previous year, are encouraged to stay in WSE; if they leave the system, they could lose some potential customers and supplies.

If a participating firm is satisfied the previous year, it will certainly continue to stay in the WSE system.

All the firms have to aim towards growth, a stagnant firm will fail.

Some firm, on the contrary, could choose to contract a buying and selling commitment personally without WSE as a mediator.

In this case, there will be barriers put in place for firms which have completed successful transactions that want to leave WSE.

In any case I don't think this will happen, since if free market rules apply, the possibility of acquiring new clients is so high that participating in the WSE can become a strategic tool.

Now we have to stress that before the project is realised, it is important to undertake an advertising campaign to promote the project, and to draw up some questionnaires for all those interested to the project.

As the project is still in the planning stage and has encountered some difficulties in the feasibility study due to lack of data, the above should be taken as mere assumption.

In order to provide incentives to stay in the system, firms will have the option to change their fixed subscription to a minimum subscription, and pay a percentage on successful transactions. In this way, barriers to entry will be eliminated.

By paying the subscription fee, the firm becomes a partner in the consortium, and can therefore participate in the society's management and eventually has a share of the society's income.

The advantage of constituting a Society/Consortium is that the responsibility for functioning of the system is extended to the partner firms. They will therefore be more involved.

When the subscription is set, we have to ask which economic factors will make participation in the WSE convenient.

From a qualitative point of view, there are some hard to quantify arguments that can provide incentive for participating in WSE. These include:

- the presence of even more strict laws aimed at encouraging waste recovery and recycling as opposed to disposal;

- granting of government incentives for those who receive retrievable wastes and for those who use it as an input in their production processes;
- the possibility of quickly obtaining authorisations from the public administration that comes from being part of the Consortium;
- the necessity to find a market for secondary raw materials, to facilitate the meeting between supply and demand;
- speed of the information obtained: available in real time on the market;
- the creation of a Consortium that goes towards regulation. This takes into consideration firms that weigh the benefits of disposing of waste in legal ways versus disposing of it illegally and risk of fires;
- similar experiences are already successfully underway in other countries;
- the creation of a Society/Consortium is the first step towards conforming to the processes, costs and starting a dialogue with those countries more concerned with environmental problems, such as France and Germany;
- additionally, the Consortium could go beyond simple information support activities, and by becoming a managerial board, it could organise, with evident logistic advantages, transportation of materials, by creating storage platforms, favour costs abatement through economies of scale and create a strong market that can compete with European structures;
- to all this, we must add the fact that, for the first year, the entry into the Consortium is free and, despite this, the firm becomes a full partner.

From the point of view of costs/benefits analysis, the economic advantages derived to the firms should be apparent by comparing the situation before and after the creation of WSE.

Now we can distinguish between retrievable waste and buyer firms of the same. We have to look the advantages for both categories:

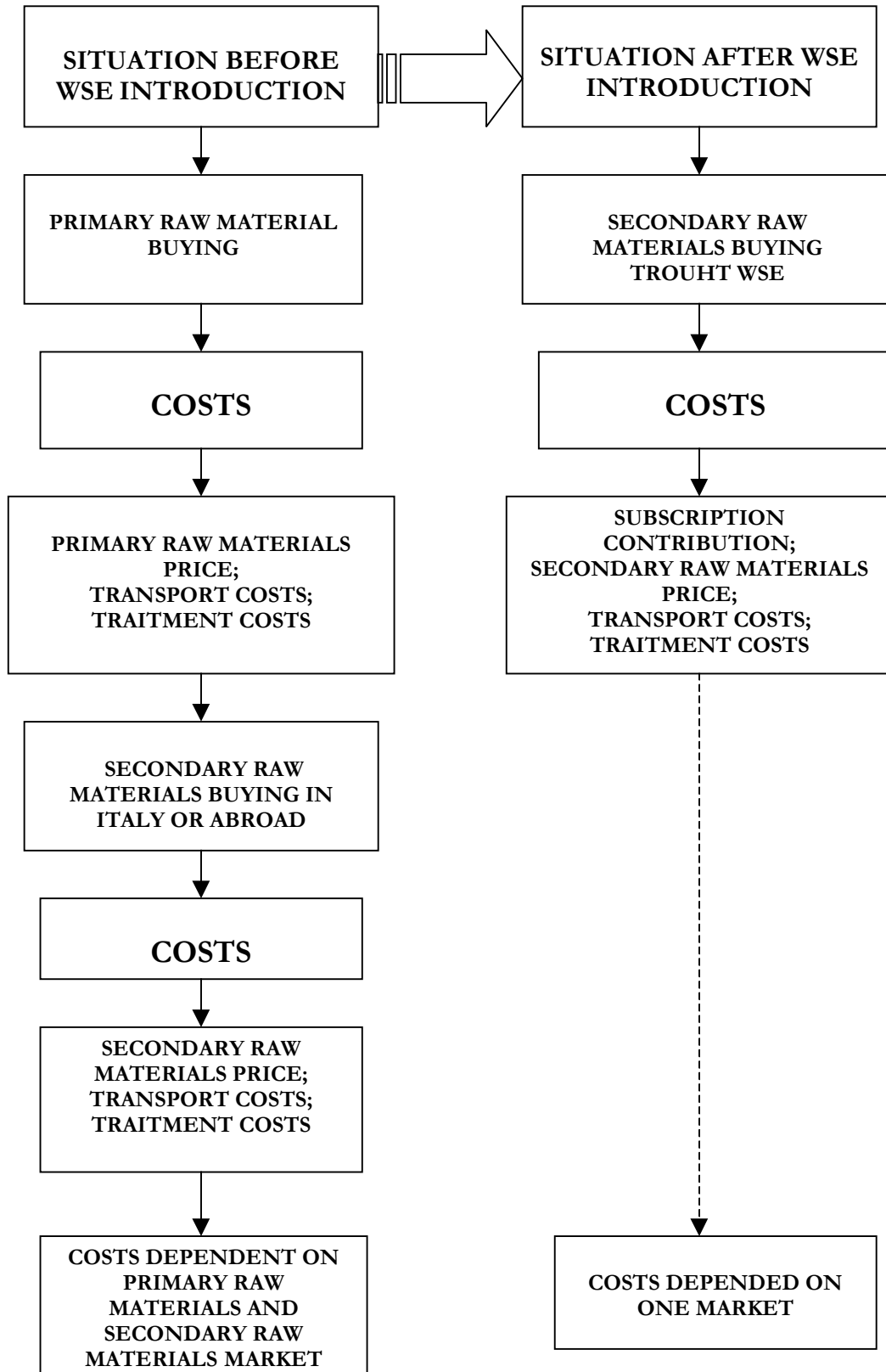


Figure IV. 3. Costs and Benefits model, before and after the WSE introduction

At this point, therefore, we are faced with the situation before and after WSE introduction.

In the first situation wastes disposal costs include: collection, separation, transport, environmental taxes, disposal site costs. For recovery: collection, transport, eventual treatment costs, income lack of disposal costs and eventual selling price of secondary raw materials.

In the second case, after WSE introduction, a market is born in which those who already recycled waste will profit, while for those who disposed waste due to high recovery costs, this market provides an other alternative.

As you can see, the process is more complicated, but at the same time it is economically more convenient.

If, in fact, there are initial difficulties regarding, for example, separation processes, ( which are still too expensive in Italy ). Once the market is developed, those costs are abated thanks to a rise in savings.

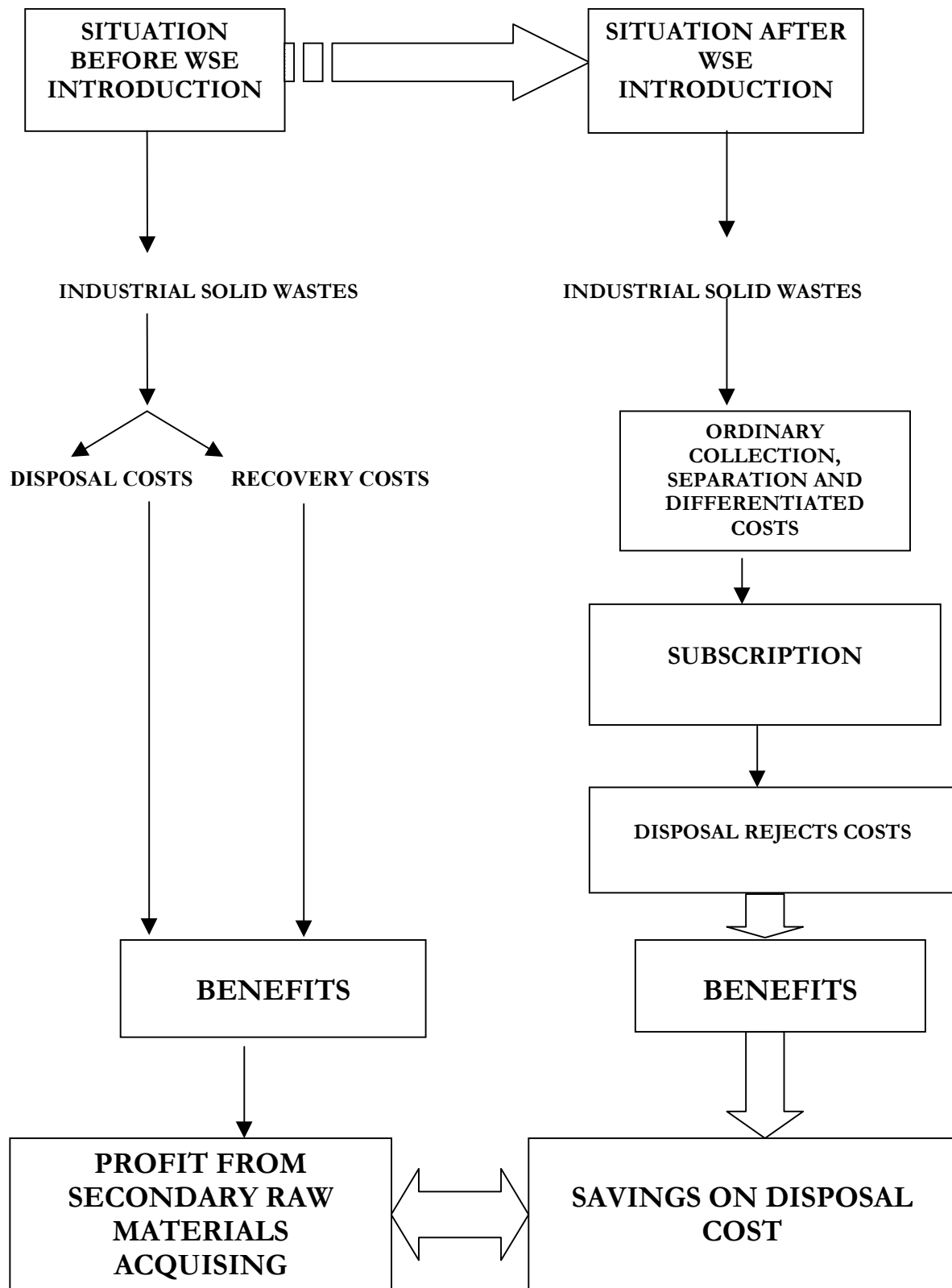
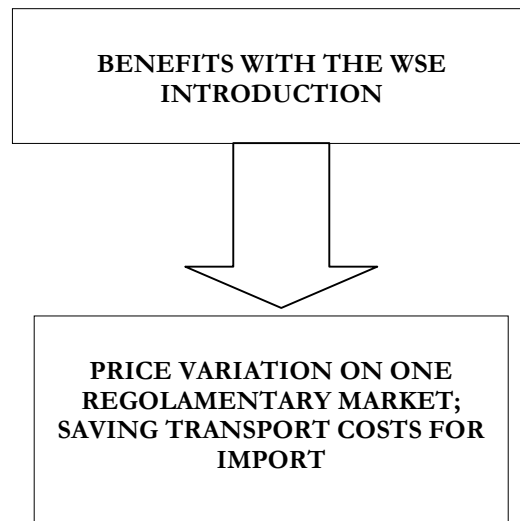
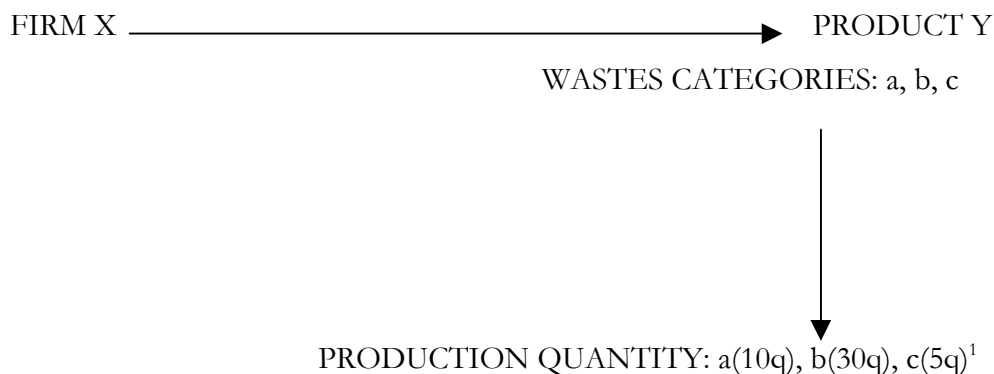


Figure IV.4. Costs representation model, before and after the WSE introduction.



The chart presented are not referable to single real life situations, but involve all these and show their possible costs and benefits.

Finally, we look at the above with a simple graph with numeric values taken from concrete cases ( keep in mind that costs vary not only with regards to the material considered and to the place in which it has been produced, but also with regards to the discretion of those who furnish the various services connected to its management).



The category b, in our case, is composed by retrievable waste, in this case refused.

Total refuse costs, in this situation (A), are:

- transport<sup>2</sup> for £ 80/kilograms, total is £360.000;
- undifferentiated<sup>3</sup> collection, for £ 100/kilograms, total is £450.000;
- disposal site costs for £ 100/kilograms, total is £ 450.000

The expenditures to refuse those materials amount to a total of £ 1.260.000 in a year<sup>4</sup>.

<sup>1</sup> q is the measurement unit.

<sup>2</sup> Superficially, we consider transport costs united only to transported material weight.

<sup>3</sup> This example doesn't consider wastes not needed for any kind of treatment.

<b>Transport costs account for about 38%</b>
<b>Undifferentiated collection costs account for about 35%</b>
<b>Disposal site costs account for about 35%</b>

Now we look at the case in which 30q of the category b are recovered through WSE. Total costs, in the new situation (B), are:

- transport for £120.000/kilogram ( 30 q are taken by the buyer at his expense );
- differentiated collection for £ 220/kilogram, total is £ 330.000;
- undifferentiated collection: £ 150.000;
- disposal site: £ 150.000;

total costs is now £ 750.000, with a saving of £,510.000.

In particular, we need to consider the subscription contribution, which in any case is not too high. With a subscription cost of £ 100.000, the total cost is £ 750.000 + S(£ 100.000). Besides we have to remember the retrievable waste category has a value and a market price; in all the firm X sustains expenses for £ 750.000 + S - (+/-P).

What are the percentages on the total cost?

<b>Transport costs account for 16%</b>
<b>Undifferentiated collection costs account for 20%</b>
<b>Differentiated collection costs account for 44%</b>
<b>Disposal site costs account for 20%</b>

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<sup>4</sup> Another hypothesis considers that waste quantity is the same every year.

If we compare the two situations:

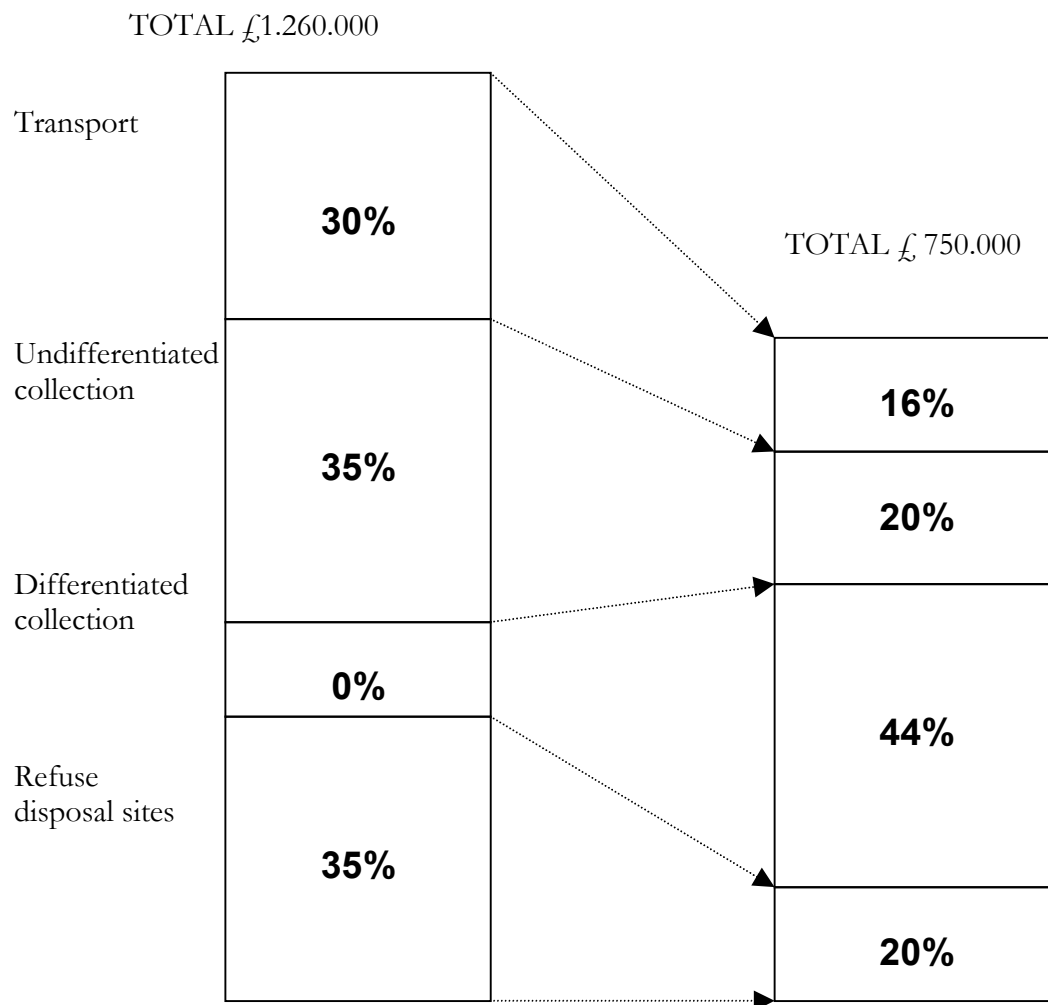


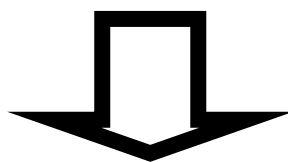
Figure IV.5. Disposal and recovery costs comparison ( category B )

Costs saving amounts to £ 510.000.

It is profitable to participate in WSE where:

$$S - (+/-P) \leq \text{£ } 510.000$$

**It's profitable to participate to Waste Sock Exchange!**



$$S \leq \text{difference between disposal and recovery costs} + (+/-P)$$



Finally, we also consider the case of secondary raw materials buyers.

We have said that the alternatives to buying in a new internal market are procuring primary raw materials or secondary raw materials abroad, because their cost is low and their quality is better.

Now we look at the behaviour of a firm, called A, that produces a product, R. To produce R, for example, A needs a certain quantity of material M. How will it act? Every choice depends on primary raw materials and secondary raw materials market trends. We suppose that the firm prefers to use, in its production process, secondary raw materials instead of primary raw materials, because the latter is too expensive, and because by using retrievable material it saves energy in its production process.

In order to use secondary raw materials the firm needs to obtain the necessary infrastructure.

In which situation will the firm A decide to use this new production input?

Certainly, if there is a market where the firm can supply itself without being affected by fluctuating price trends.

In WSE, there will be many bidders and many selling prices, so that different demands will be favoured.

Under WSE, the problem of foreign primary raw materials and secondary raw materials markets disappears.

Everything, happens under one market created to regulate exchanges and to limit competition from foreign markets.

**The firm A will participate to WSE if:**

$$S - (+/-P) < P (\text{Transport}) - (+/-P)$$

We can look at the extreme example, in which the firm A finds it more convenient to buy secondary raw materials to use as production input. However, in Italy the retrievable paper supply is inelastic with regards to price because the recovery market is not developed and the supply doesn't adapt rapidly to a demand that, on the contrary, is more elastic about the price.

Let's suppose now that the retrievable paper demand rises, along with the price, and so it happens that, the German supply being high, Germany offers retrievable paper for free in order to get rid of as much as possible.

The firm A will certainly buy M in Germany instead of Italy.

The above does not apply to all secondary raw materials, but even if competition from foreign secondary raw materials is not taken into account, one has to consider competition from primary raw materials. The same reasoning applies to these.

With WSE demand and supply meet on one market, without competition from other markets.

Price trends don't affect market position, since are a lot of supplies, different prices and demands.

In fact WSE not only provides incentives for materials exchange, but it also allows for the balance of all positions on one market, in order to avoid situations of unbalance that would make other markets profitable.

In WSE also the supply becomes elastic with regards to price and moves as a function of the demand.

The innovation is that now both supply and demand are different for the same material, but they can compensate for each other where there are discrepancies.

## References

- Ambiente Italia 1997, *Rapporto sullo stato del paese e analisi della questione infrastrutture*. Le infrastrutture necessarie al sistema di gestione dei rifiuti, disegnato dal Dlgs 22/97.
- G. Amendola, *Materie prime secondarie: un decreto da rifare*, in *Foro it.*, 1990, V, 210.
- S. Ascari et al., *I rifiuti industriali. La risposta della società e del sistema produttivo*, Franco Angeli, 1992.
- S. Ascari, *External Costs and Benefits of Energy Recovery from Waste Incineration and Landfilling*. Research Report to the European Commission, D.G XII, Brussels, 1995.
- S. Ascari, *La gestione dei rifiuti in una società sostenibile*, *Rifiuti solidi*, vol. XI, n. 3 maggio-giugno 1997, pp. 178-185.
- E. Barni, *La tematica dei rifiuti nella Conferenza Nazionale Energia e Ambiente*, in *Ricicla* 1998, *Atti dei Seminari*, 1998, pp.25-30.
- F. Belfiore, *La minimizzazione come primo passo di un corretto sistema integrato di gestione dei rifiuti*, in *Ricicla* 1998, *Atti dei Seminari*, 1998, pp.137-141.
- M. Boato, *Nuove strategie in Italia e in Europa di riduzione e gestione dei rifiuti. In particolare gli imballaggi*, in *Ricicla* 1998, *Atti dei Seminari*, 1998, pp.189-194.
- M. Bresso, *Il significato economico del recupero dei rifiuti*, in *Impresa Ambiente*, 3/1990.
- M. Di Fidio, *Economia dei rifiuti e politica ambientale*, Pirola Ed, 1995.
- T. M. Dinan, *Economic Efficiency Effects of Alternative Policies for Reducing Waste Disposal*, in *Journal of Environmental Economics and Management*, 1987, pp. 242 ss.
- M. Dubini, *Strumenti economici: una soluzione al problema rifiuti?* *Atti del Seminario di studio*, Milano, 20 giugno 1991.
- F. Finzi, R. Lararia, L. Morselli, *Dalla strategia dei flussi prioritari dei rifiuti all'attuazione del recupero*. *Atti del Congresso Ricicla 1997*, Gea, Supplemento al fascicolo 1, 1998, pp.146-157.
- W. Ganapini, *La risorsa rifiuti. Tutela ambientale e nuova cultura dello sviluppo*, ETAS Ed., Milano, 1978.

- F. Giampietro, *La CEE conferma il bivio tra smaltimento e recupero*, in *Impresa Ambiente*, n. 5, 1992.
- P. Giampietro, *Il rifiuto, la materia prima seconda e la materia prima secondaria, tra leggi quadro e legislazione nazionale*, in *Riv. Giur. Amb.*, 1989, pp.259 ss.
- M. Gillet, *Economic Aspects of Waste Management in the European Union*, Helsinki, Finnish Forest Industries Federation Conference, 16 dicembre 1993.
- E. Gerelli, *Società post-industriale e ambientale*, Laterza, 1995.
- I. R. e R., *La gestione dei rifiuti industriali. Tecnologie pulite, riciclaggio, borse rifiuti*, Milano, 1984, p.41.
- A. Jazzetti, *Le nuove norme sui rifiuti e residui*, Pirola Ed., 1995.
- S. Lindhquist, *L'estensione della responsabilità del produttore*, 1993.
- S. Lombardini, R. Malaman, *Rifiuti e Ambiente*, Mulino, Bologna, 1993.
- A. Majocchi, *Se il rifiuto diventa Risorsa*, in *L'Impresa Ambiente*, n. 3/94, pp. 22-25.
- M. P. Marini, *La produzione dei rifiuti in Lombardia. Quadro conoscitivo fornito dal MUD*, UNION CAMERE LOMBARDIA, Milano, 18 marzo 1998.
- L. Morselli, *Dal ciclo di vita integrato per la gestione dei rifiuti al ruolo di riciclo, riuso, recupero*, in *Ricicla* 1998, Atti dei Seminari, 1998, pp.122-127.
- G. Natta, *Più Stato e più privato nel settore ambientale*, *Il Sole 24 Ore*, nov. 1994.
- G. Panella, *Recenti tendenze delle politiche di gestione dei rifiuti industriali*, in *Economia e Ambiente*, 1985.
- P. Sraffa, *Produzione di merci a mezzo di merci*, Einaudi, Torino, 1960.

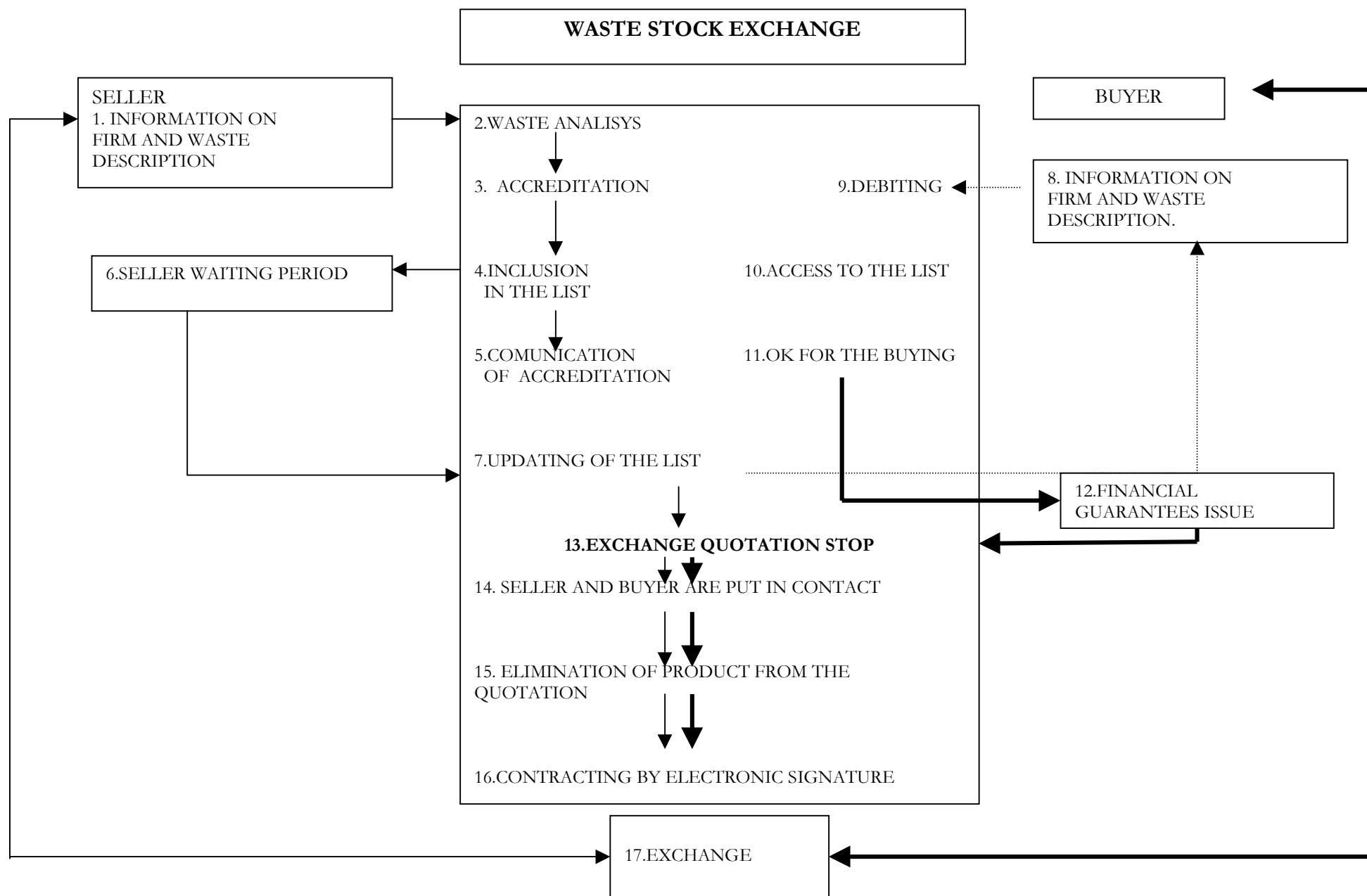


Figura III.1. Waste Stock Exchange Model



