

Recycling of Materials

Local or global?

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1. INTRODUCTION

Recycling is generally considered an important strategy for alleviating the pressures of society on the environment. Natural resources can be saved, emissions can be decreased, and the burden of solid waste can be reduced. Likewise, recycling in the cases of some materials is an important economic activity that creates employment and attracts investments.

The term “recycling” has two dimensions—recovery and utilization. Recovery refers to the diversion and collection of waste materials from landfills, incinerators, or other disposal methods. Utilization refers to the processing of diverted waste into new and useful materials and products. In recent years the industrialised countries of the North have observed significant increases in the quantity of waste recovered and utilized. These trends have resulted from higher disposal costs, increased public concern about the health and environmental impacts of waste disposal, and a general perception that recycling can result in resource conservation. In many countries of the North, policies have been adopted to encourage or mandate the recovery of waste materials. Policies have also been adopted to mandate the utilization of wastes—for example, mandated recycle material content in selected products and government procurement practices that favour recycled materials.

Another trend is the increasing trade of secondary materials between the North and the South. Waste materials recovered in the North increasingly are being exported to the South for utilization. As a result, the North has developed into a net supplier of recyclable waste while the South has developed into a net importer. As is the case with any commodity, international trade of secondary materials allows countries with different comparative advantages to exercise those advantages to bring about a more efficient allocation of resources. In the absence of market failures, international trade in secondary materials allows gains in both the North and the South. However, when market failures occur — such as health and environmental externalities — international trade may lead to an increase rather than a decrease in total environmental damages. Further, international trade in secondary materials may lead to development patterns in the South that are in contrast to the preferences of both the South and the North.

The increased trade of secondary materials between the North and the South raises the question whether recycling in the South is different from recycling in the North, and whether international trade in secondary materials has positive or negative economic, environmental, and social impacts. Not only are these issues relevant for national policy makers who must decide about legislation concerning this type of trade; these issues also are important to international interest groups, such as the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and the World Trade Organisation (WTO).

This paper highlights the specific factors that drive recycling in both regions and addresses the various impacts of international trade of recyclable waste. In Section 2 empirical evidence is presented to illustrate a number of global trends in recycling and trade. In Section 3, the impacts of these developments are discussed, both for OECD and non-OECD countries. Finally, conclusions are drawn with respect to potential social and economic costs and benefits. In addition, suggestions are made for future research.

2. EMPIRICAL FINDINGS

Empirical evidence on recycling on a global scale is scant. Often data on recycling and international trade of secondary materials are only provided on national levels. Still, based on the scarce information available, several typical tendencies in global recycling can be identified and are presented below. It should be realised that these specific examples are no justification to generalise these tendencies across all secondary flows. Generalisation would require additional empirical analysis. Special emphasis is placed on differences between industrialised and developing countries.

2.1.1 RECYCLING IS INCREASING ON A GLOBAL SCALE

More and more the value of material residues is recognised by entrepreneurs and municipal organisations. As a result, the recycling rates for various materials have grown rapidly on a global scale. Several examples support this trend. The global average recovery rate of waste paper increased from 29 to 40 percent between 1973 and 1991 (Beukering and Duraïappah 1996). The global recycling rate of aluminium increased from 20 to 30 percent between 1972 and 1988 while also glass recycling in Europe increased rapidly from 20 to 39 percent between 1981 and 1989 (UNEP 1991). Recycling of plastics waste, a relatively new process, increased by 22 percent between 1993 and 1994 (APME 1996).

Forces driving recycling differ between the North and the South. In industrialized countries, initial incentives were provided primarily by national governments. Recovery schemes and government procurement schemes for recycled products created the necessary conditions for increased recycling activities. Although developing countries are in the process of preparing policies and regulations for recycling, alternatives to waste disposal have not yet received much attention. Recycling in the South is generally a purely market driven practice.

2.1.2 INTERNATIONAL TRADE OF SECONDARY MATERIALS IS ENHANCING ASYMMETRICALLY

The ratio between internationally traded and globally recovered secondary materials is increasing gradually. This implies that relatively more secondary materials are exported for utilization in foreign countries. For example, in 1975, only 5.8 percent of globally recovered waste paper crossed borders. This rate increased to 14.2 percent in 1994. The trade in waste plastic increased from 1.5 million tons in 1993 to 2.4 million tons in 1994. Cheaper freight transport and overall trade liberalisation might have been factors which contributed to this development (Anderson *et al.* 1995). Also the overall specialisation of the recovery sector and the recycling industry created supply and demand structures for a larger range of secondary materials, which can only be matched through international trade.

A comparison between secondary and primary material movements shows how these trade flows are structurally different (see table 1). While industrialised countries are the major importers of primary flows, secondary flows generally find their way to developing countries. The North is characterised as a net-exporter of secondary materials, while the South is characterised as a net-importer. This is not a static situation. In the period 1990-1994, imports of

various secondary materials in the South grew much faster, almost 10 times as fast as in the North¹.

Table 1 Direction of primary and secondary materials (1991-1992)

from exporter to importer	Secondary plastic (in percent)	Primary plastic (in percent)	Secondary metal (in percent)	Primary metal (in percent)	Secondary paper (in percent)	Primary pa- per (in percent)
North-North	27	53	46	51	51	78
North-South	51	23	44	24	40	11
South-North	4	11	5	14	0	7
South-South	18	13	5	11	9	4
Import North	31	64	51	65	51	85
Import South	69	36	49	35	49	15
Export North	78	76	90	75	91	89
Export South	22	24	10	25	9	11

source: TRAINS, UNCTAD 1994

This typical trade pattern raises the question whether developing countries have a comparative advantage in the utilization of secondary materials, as compared to the production of virgin materials. A number of factors may, in fact, support the hypothesis that the South does have a comparative advantage. Compared to primary production, many of the less sophisticated recycling processes have a higher labour intensity (mainly caused by the required manual sorting before processing). Since labour is relatively cheap in developing countries, utilization of secondary materials may have a comparative advantage in the South. Also, many current recycling methods use relatively simple and less capital-intensive technologies. Since financial, physical, and human capital are relatively scarce in developing countries, the South may have a comparative advantage in the utilization of secondary materials. The same can be reasoned for energy. Recycling processes generally consume less energy for production. Since most developing countries are energy importers (which requires the use of their limited hard currency) recycling is a comparatively attractive option for production in the South.

In view of the caveats of data limitations and uncertainties, great caution should be taken in interpreting these empirical results. Nevertheless, it may be concluded that the mutual interdependencies between the trading partners' consumption and production patterns have increased. Particularly in developing countries, this increase has been more prominent for secondary material flows than primary material flows.

¹ This figure represents the average growth rate of imports of metal slag, tyres, paper and non-ferrous metals, based on trade statistics from the UNCTAD.

3. IMPACT OF TRADE ON RECYCLING

A better understanding of trends in the international trade of secondary materials is important not only for the firms involved in such trades. Possibly more important are (1) the health and environmental impacts of these international trades, (2) the impacts of these trades in promoting or hindering the development of countries in the South, and (3) implications of these trades for technology development in both the North and the South. It is not likely that a unique answer to this question can be provided. The outcome will differ from material to material, from country to country, and, given asymmetric technological development in both secondary and primary production processes, will also not be constant in time. Nevertheless, various positive and negative impacts of recycling and trade of secondary materials can be identified, and the pros and cons of alternative policies in both the North and South can be evaluated.

As stated earlier, international trade of secondary materials can take advantage of comparative advantages in both the North and the South. Comparative advantages may be derived from differences in wage rates, the availability of physical and financial capital, differences in skills of the labour force, and variations in allocations of natural resources. By taking advantage of these comparative advantages, the total quantity of materials recycled in the North and the South may increase beyond the case where no international trade is allowed. Several cases, not only between the North and the South but also between Southern countries have been reported in the literature which support this positive relation between trade and recycling:

- Namibia does not possess proper facilities to recycle waste sufficiently since the quantities produced domestically are very small. The existence of trade channels is an appropriate incentive to recover and store secondary materials until the quantity is sufficient to export it to neighboring countries, such as South Africa where they are recycled. Presently it is not feasible to set up recycling plants in Namibia due to the small amounts of recyclable materials available. Also lack of water is a hampering factor. Recycling of waste from Namibia in South Africa takes place for glass, cans, and used oil (Kohrs 1996);
- It has been estimated that the waste recycling industry in Colombia provides employment for 1 to 2 percent of the labor force. International trade in recyclable materials takes advantage of the existing differences in technical capabilities and the need for raw materials. For many years, Colombia has imported scrap iron from the Netherlands to serve as an important input in the recycling industry (Pacheco 1992);
- About 90% of the waste paper collected in Hong Kong is exported. Unlike waste paper, all aluminum cans are exported since no company producing aluminum cans operates in Hong Kong (Yeung & Ness 1993). Without the possibility of exports this waste would have to be disposed or incinerated;
- “In Phnom Penh, garbage collection trucks are rarely seen on many streets but the city’s mostly-women waste pickers are a common sight. These pickers go from door to door to pick-up reusable or recyclable items. The materials are then sold to middlemen who export most of these items to Vietnam and Thailand” (Lapid 1997);

- Several waste materials are collected by itinerant waste buyers and waste pickers in Katmandu. After sorting and cleaning, these materials are exported to the neighboring country, India, where these materials are recycled. Again it is doubtful whether these recovery activities would be performed without the demand from the Indian recyclers (Beukering & Badrinath 1995)

In the cases where the overall level of recycling increases both in the North and the South, and the increased recycling activities will substitute for virgin production processes, the positive impacts are likely to outweigh the negative effects. International trade of secondary materials may promote economic growth in both the North and the South, may result in fewer health and environmental damages, and may conserve total resources. Table 2 gives an overview of the potential gains of increased recycling.

Table 2 Reduction in Environmental Impact by Substituting Virgin for Secondary Production

	Potential Savings (percent)			
	Aluminum	Steel	Paper	Glass
Energy use	90-97	47-74	23-74	4-23
Air pollution	95	85	74	20
Water pollution	97	76	35	-
Mining wastes	-	97	-	80
water use	-	40	58	50

Source: Bartone, 1990

On the other hand, international trade of recyclables may lead to unacceptable outcomes due to market distortions, political and cultural differences, and institutional barriers. For example, since the distinction between hazardous waste and secondary materials is not always easy to make, developing countries run the risk of importing unwanted materials which cause additional burdens for the waste management sector. A similar problem, or concern, may arise if countries in the North and countries in the South have different standards of processing secondary waste. While one environmental standard may be acceptable to the South (i.e., its people, firms, and government), that same standard may not be acceptable to the North. Because of a potentially high degree of contamination, working with waste can be an unhealthy activity which may increase morbidity. Is it acceptable to have higher morbidity in the South than in the North? Who decides what is acceptable?

Further, international trade in secondary materials may lead to development in the South that are in contrast to the preferences of both the South and the North. Moreover, relatively cheap imported materials may damage the local market for recyclable waste. In Europe this effect was clearly demonstrated when the recovery of waste paper in Germany increased rapidly in the late eighties as a result of the introduction of new laws which forced producers to take back their packaging materials. Since the recycling capacity at that time was insufficient to absorb this growing supply, a large amount was exported to neighboring countries. The price of waste paper even reached negative levels, which in turn almost caused the collapse of the waste paper recovery sector in these countries. Subsidies by for example the Dutch government prevented the recoverers from bankruptcy. Obviously, governments in developing countries will not be in the position to act as a buffer to these external shocks. Therefore, some

waste experts claim that policies to promote re-use, recycling and minimization of waste generation should include measures to protect the local recycling market against the importation of cheap waste materials from the industrialized countries (Klundert 1997).

In close relation to this, other problems may arise. The “leak” of recovered materials abroad may reduce the incentive to set up recycling facilities domestically. Also, the trade of secondary materials may have a significant impact on technology development in both the South and the North. In the South, the availability of secondary materials may lead the developing country to invest in low-tech recycle processes as an alternative to investments in high-tech virgin material production. This may place the developing country on a different development path. Technologies in the North may also be impacted. For example, restrictions on the export of plastic waste may lead the developed countries to develop and refine new and sophisticated chemical recycling methods as substitutes for the low-tech secondary processes now available. If chemical recycling can be made economically viable, these chemical processes may be applicable to a much larger range of plastic wastes, and, as a result, the total quantity of plastics recovered and utilized in the North could increase dramatically. The availability of international markets may mean there is little incentive to develop these more sophisticated and robust technologies.

The above enumeration of potential positive and negative effects indicates the complexity of evaluating the impacts of the international trade of secondary materials and potential impediments to that trade. Various unknown parameters play a role in this respect. Crucial are the substitution effects between secondary versus primary materials on the one hand, and local versus foreign secondary materials on the other hand. Moreover, different degrees of social and environmental externalities accrue with both secondary and primary production which may differ between the North and the South and which need to be incorporated in decisions to trade in recyclable waste. Life cycle analysis (LCA) provides a useful tool to capture these effects of trade of secondary materials.

An issue which becomes particularly important for implementation of the findings of these analyses is the present condition of national and international markets to trade secondary materials. Do barriers exist that may prevent the optimal allocation of resources, and what are the potential impacts of those distortions? Market distortions may include the following. First, as the international market of secondary materials is not as well established as the primary materials market, informational constraints may exist. Excessive uncertainties about supplies and prices may create unfavourable trade conditions for recyclables. Second, national governments may intervene in international transactions by creating trade barriers through the establishment of import and export tariffs or quotas on secondary materials. Export controls may yield short-term economic gains, but generally only at significant long-term costs. In addition, government intervention on the national level, such as subsidies for recovery schemes, may create artificial markets to recover and utilize secondary materials. The continuation of these markets depends on the continuation of government supports, which leads to increased risk for firms that invest in infrastructures to provide recycling. Third, market distortions may arise from increased market concentration. For many recyclable materials a trend towards oligopolisation or even monopolisation may take place. Such concentrations in market power may have undesirable economic effects for the recycling sector.

CONCLUSIONS AND FUTURE RESEARCH

For quite different reasons, recycling of secondary materials has become important for countries in both the North and the South. International trade in secondary materials allows both regions to take advantage of their comparative advantages; and absent market distortions, international trade will lead to higher recycling rates, likely improvements in health and environmental conditions, and opportunities for economic growth in both regions. Concerns are being raised, however, that international trade of secondary materials occurs within markets that are distorted, and as a result there are no guarantees that the theoretical benefits of international trade will be realized. On the contrary, overall health and environmental conditions may be eroded; development in countries of the South may be hampered, and innovation that may lead to improved and lower-cost recycling technologies may be hindered. Further research is needed to address these fundamental issues.

The following specific research topics are identified as being most important.

- An empirical analysis of international flows of both secondary and virgin materials between and within OECD and non-OECD countries, and a cross-country analysis of the driving forces of these material flows;
- the development of research tools for the analysis of financial and external costs and benefits related to recycling processes in both the North and the South, such as a combined methodology of life cycle analysis and economic valuation;
- the impact of trade of secondary materials on the technological progress in the secondary and primary industries of the importing countries, and vice versa;
- identification and assessment of market distortions that may be present in national and international markets for secondary materials.
- research to understand the political and institutional incentives and barriers to the international trade of secondary materials.
- the design of policy instruments that can be implemented to counter market distortions that may lead to unacceptable conditions for countries in the North and/or the South.

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