Draft for Comments

Materials Exchanges: An Exploratory U.S. Survey

July 31, 2000

Clinton J. Andrews* and Jamie Maurer
Department of Urban Planning and Policy Development
Rutgers University
33 Livingston Avenue, Suite 302
New Brunswick, NJ 08901
Tel 732-932-3822 x721
Fax 732-932-2253
E-mail: CJA1@rci.rutgers.edu

* Corresponding author

Acknowledgements: We thank Christine McCoy and the National Recycling Coalition for sharing data, the survey respondents for sharing their insights, and the National Science Foundation and Lucent Technologies Foundation for their financial support. A list of survey respondents is available on the web at http://radburn.rutgers.edu/andrews/projects/.

Materials Exchanges: An Exploratory U.S. Survey

Abstract: U.S. solid waste policy employs a reduce-reuse-recycle-dispose hierarchy, but available economic data tell us little about the extent of reuse and recycling activities. We characterize some of these activities by means of an exploratory survey of U.S. materials exchanges, with sixty-three respondents classified by materials handled, organization type, and implementation strategy. Few exchanges handle hazardous materials; most focus on pre-consumer items such as building materials or post-consumer durable goods such as appliances. Non-profit organizations and state/local government agencies predominate in this niche. There are three distinct implementation strategies: passive listers of materials, active brokers who become involved in each transaction, and those who take possession of materials for storage and display in a warehouse. Most popular are warehouse operations, which typically have a local focus, and passive listing services, which serve larger areas. Passive listing services appear to be relatively marginal enterprises, although the adoption of Internet technology is improving their viability.

In nature, recyclers often account for a majority of the biological activity in an ecosystem. A focus only on the primary food chain linking grass, antelopes, and lions would miss most of the life on the savannah, for example. Much more ubiquitous are the decomposers, those bacteria, insects, birds, and other creatures that scavenge or break down dead organic matter into reusable materials (Begon et al, 1996).

Descriptive industrial ecology has tended to focus on the primary value-added chain linking extraction, manufacturing, and consumption in part because there is little data on the economy's decomposers. Given nature's model, researchers worry that the available economic data may be missing something important. Researchers who have looked have found much and varied reuse and recycling activity, some organized by government or the nonprofit sector, and some by market actors. This study investigates materials exchanges, one of the loosely defined group of actors motivated by the "waste as feedstock" mantra of industrial ecology.

Background

Many useful materials fall through the cracks in the existing reuse, remanufacturing, and recycling infrastructure. Although the remanufacturing and reuse communities divert some items before they are even counted as generated waste, a walk down any U.S. street on garbage pickup day will show that much is missed. Once in the waste stream, the probability of diversion remains low. By weight, less than one third of the municipal solid waste that is generated in the United States is diverted from landfills and incinerators; for durable goods the diversion rate is only 17% (USEPA, 1997). The figures differ for industrial wastes, but the sense that valuable materials are not being recaptured persists.

Frosch and Gallopoulos (1989), who coined the phrase “industrial ecology,” show that loop-closing does take place in several economic sectors. Materials ranging from precious metals to iron to plastic are captured at the end of a product's life by intricate networks of for-profit recyclers linking junkyards to middlemen to reprocessers.

Market forces have always supported some reuse and recycling of products. In addition to the ever-present junkman, the formal economy sees ubiquitous remanufacturing of durable goods such as automobile parts and electric motors at a scale of some $53,000 million/year in the United States (Lund, 1996:43). At a local scale, thrift shops and second-hand stores find new homes for a variety of consumer durables such as clothing, books, and household furnishings. The informal economy of flea markets and garage sales provides further opportunities to place consumer durables back into use, but few statistics are available to characterize these niches. Hand-me-downs among family members perform a similar function, also largely invisible.

Governments have established a variety of regulations and incentives to build a robust reuse and recycling infrastructure in the United States. Lead recycling by firms in the United States increased dramatically following state-level regulatory bans on disposal of lead-acid batteries in landfills (Battery Council International, 2000). State-imposed deposit-refund regulations for beverage containers have likewise generated a large amount of private sector economic activity in recycling. State and local recycling mandates have led to the collection of large quantities of paper, metal, glass, and plastic, which in turn has spurred the expansion of commodity markets for these recycled materials. Federal income tax laws allow taxpayers to deduct the fair market value of items donated to non-profit organizations from their tax bills.

The line separating market-based and government-driven recycling and reuse activities is vague and often shifting. Some of this middle ground is occupied, appropriately enough, by nonprofit organizations. Goodwill Industries is one of the largest, a non-profit retail chain with 1776 independently operated thrift stores (most in the United States) and total annual revenues of $1650 million in 1999 (Goodwill Industries International, 2000). Goodwill was founded in 1902 on the principle of "a hand up not a handout," and it is world's largest employer of people with disabilities. It accepts donations of post-consumer products such as clothing, appliances, and even automobiles for refurbishment and resale in retail thrift shops. The Salvation Army, another large non-profit, has 1629 thrift shops in the United States which provide 23% of this charity's annual income in 1998 (Salvation Army USA, 2000). Many other non-profits also accept donations of post-consumer products, which are then given to needy

people or sold into reuse and recycling markets to provide revenue supporting each organization's charitable mission.

Ecologically speaking, some non-profits are specialists rather than generalists. Many parts of the United States have durable medical equipment clearinghouses, for example, that accept items such as wheelchairs and crutches from those who no longer need them, and give them to needy patients.

More recently, a class of organizations has appeared that is motivated more by environmental than economic or charitable concerns. They go by various names—such as waste exchange, materials exchange, or recyclable commodities broker—and they overlap the niches of existing nonprofits, for-profits, and government agencies.

We conducted an exploratory survey to begin identifying and characterizing these new actors in the U.S. industrial ecosystem. Our primary goal was to classify the new organizations' niches in relation to long-standing members of the reuse and recycling sectors. In addition, we wanted to understand their viability, successes and failures, and needs.

Transaction costs—expenditures of resources, time, and effort to complete transactions—often hinder the development of viable markets in recycling and reuse. The cost of collecting residential recyclables may exceed their market value, for example. The challenge of matching sellers or donors of used products with interested users is another example of a daunting transaction cost. In the past, such costs have diminished the viability of organizations like waste exchanges (Rich, 1984). With the advent of Internet technology, there appears to be some potential for reducing transaction costs associated with searching for materials and matching buyers and sellers. Thus, an

important focus of this study is on the role of information technology in the reuse and recycling sectors.

The U.S. literature on waste exchanges and materials exchanges is surprisingly sparse, given that exchanges have existed for decades, often with the help of public funds. Trade publications have provided the most coverage, beginning after the passage of the Resource Conservation and Recovery Act of 1976 (PL 94-580, RCRA). The materials exchange concept is said to have originated in Europe during the early 1970s (Rich, 1984), but our survey identifies one U.S. exchange that has been operating since 1938. Origins aside, the RCRA law and its more stringent state counterparts are seen as barriers to successful exchanges of industrial materials, especially hazardous wastes (Florida Chamber of Commerce, 1983; *Chemical Business*, 1984; Rich, 1984; DiPietro, 1994). The laws heighten firms' concerns about potential liability for improper disposal, and thus make the reputation of the other party in any waste exchange transaction a major focus. Much of this literature portrays the exchange as a marginal venture: "The number of domestic exchanges ballooned from 3 in 1978 to around 24 by the end of 1983; but a combination of regulatory impediments, businessmen's indifference and bad site location have caused at least 15 to fold in the same time span" (Rich, 1984: 58). A 1990 directory contained only 13 U.S. entries (Powell and Lynch, 1990). But not all exchanges are the same, and their characteristics and viability vary systematically.

The trade press segments exchanges along several dimensions, as shown in Table 2 (Rich, 1984; Powell and Lynch, 1990; DiPietro, 1994). First is the type of material exchanged—the exchange of hazardous waste involves substantially more legal paperwork and due diligence than transactions involving non-hazardous materials. Non-

hazardous materials are further divided into pre-consumer (industrial) commodities such as metal scrap and paper, and post-consumer products such as furniture and appliances. Second is the type of organization, where nonprofit organizations are more likely to be motivated by environmental and social concerns, while for-profit organizations focus narrowly on the bottom line. Our survey adds government as a third major player. Third is the implementation strategy along a spectrum from passive to active participation in the transaction. Passive exchanges merely list materials, put parties in contact with one another, and step out of the picture; whereas active exchanges play a broker's role in closing the deal; entities with warehouse space go even further and take possession of the material at some point during the transaction.

Recent surveys have identified a substantial number of exchanges, although it is not clear whether this is a result of growth in their numbers or a broadening of the definition. Certainly, the materials exchange concept has enjoyed a resurgence, and a round of federal seed grants has allowed new players to enter the game (Covey and Shew, 2000). One recent directory included 39 listings (Block and Wood, 1998) and another had 47 listings of various types (Cornell Waste Management Institute, 1998). Our survey garnered 63 responses, and we suspect that the current population of materials exchanges is several times that amount.

Data and Methods

During March and April, 2000, we mailed a questionnaire to the directors of entities throughout the United States that had been tentatively identified as waste or materials exchanges (an entirely semantic distinction, it turned out). We adapted a

survey instrument originally used in 1999 by the National Recycling Coalition's Board of Trade Recyclables Exchange, the Reuse Development Organization, and Princeton University's Center for Energy and Environmental Studies, adding several new questions. The 1999 survey generated 39 usable U.S. responses; see NRC et al (1999) for the results. For our survey, we asked additional questions of the 39 original respondents and sent the full questionnaire to a large number of additional targets. The instrument asked a total of 41 substantive questions, including both open- and closed-ended queries, as well as confirming name/address information.

Using a "snowball" sampling technique in which we solicited survey targets from knowledgeable people, including early respondents, we developed a list of 148 targets. Following the initial mailing, a follow-up fax, and one or more telephoned reminders, we received 40 usable responses. In addition, 17 surveys were returned to us marked "addressee unknown;" some fraction of this group has probably gone out of business. Two targets had merged with other respondents, and one target was a duplicate, leaving 65 non-respondents. Some of the non-respondents are definitely still in business, but others may not be, or may have been inappropriately targeted. For non-respondents who answered the 1999 survey, we pooled their responses with those from our survey, yielding 63 total usable U.S. responses to most questions. Since there is no clearly defined population of materials and waste exchanges, we cannot judge whether we have a representative or biased sample of that population. Instead, it is better to think of the survey results as exploratory—a characterization of broad features in an unfamiliar landscape. A list of survey respondents is available from the authors (see acknowledgements).

Results

Our discussion of the survey results is divided into two parts. First are descriptive findings that characterize the types of materials exchanges and their key features. Second are prescriptive findings that report on what the operators of exchanges want or need.

Descriptive Findings

Transactions at materials exchanges involve a great variety of items, as shown in Table 1. Respondents have carved out distinct niches that have minimal overlap with other actors; relatively few exchanges deal with those post-consumer products such as books and clothing that are the mainstays of Goodwill Industries, Salvation Army, and traditional thrift shops, for example. Building materials, office furniture, and appliances are the most widely exchanged items. The materials in Table 1 can be grouped into three categories: hazardous materials, non-hazardous commodities (both pre- and post-consumer), and post-consumer products.

According to Table 2, the distinction among pre-consumer hazardous, pre-consumer non-hazardous, and post-consumer materials is a weak basis for characterizing exchanges, because many deal in two or more categories of materials. Many exchanges could be said to have a user orientation that leads them to focus either on the reuse or recycling markets (see bottom of Table 5).

In comparison with the waste exchanges of the 1980s, when surveys usually identified 11-15 exchanges that listed hazardous wastes (Chemical Business, 1984; Rich, 1984, Powell and Lynch, 1990), Table 2 indicates that relatively few currently deal with

hazardous wastes, and then only as passive listers. For our sample, the average number of transactions per month involving hazardous materials is 11, for non-hazardous pre-consumer materials it is 56, and for post-consumer materials it is 386, all with large variances. The dampening effect of RCRA liability fears is apparent. Overall, post-consumer materials are the most broadly exchanged.

Although scrap dealers and professional scavengers exist in every city in the country, this survey identifies very few for-profit firms. Given our snowball sampling approach, this suggests that for-profit firms typically do not participate in the same networks as the non-profit and governmental materials exchanges that are our primary survey targets. Among our small sample, two of the three respondents believe that active involvement in the transaction is the more profitable strategy. No for-profit firm reports trafficking in hazardous materials.

Some 24 exchanges are agencies of state or local government, and the vast majority of these are passive listers of industrial and post-consumer materials. Most of these exchanges are attached to governmental solid waste management offices and are tasked with encouraging waste diversion to reduce landfill tonnages.

The non-profit sector accounts for 36 of the respondents. Non-profits show a split between active and passive implementation strategies: a majority of those specializing in post-consumer materials actively take possession, whereas a majority of those specializing in pre-consumer materials are passive listers. Only three non-profits choose the brokering strategy. Part of this divergence can be explained by funding source, as shown in Table 3. Government is the predominant supporter of passive listers, especially

for pre-consumer materials, whereas organizations that are willing to take possession (especially of post-consumer materials) can rely more heavily on user fees.

Reasons given for starting materials exchanges vary by type of organization, as shown in Table 4. They do not vary systematically by other characteristics. The predominant reason given for state or local government to start an exchange is the desire to divert waste from the landfill or incinerator. For-profit firms naturally give greatest weight to the profit motive. Non-profits show a broader range of primary motivations, with a plurality for waste diversion, and minorities seeking either cheap sources of materials or disposal cost savings, or harboring moral objections to the disposal of reusable products.

Across all cases, the average number of employees at a passive listing organization is 3.3, whereas it is 1.6 at active brokerages, and a much larger 13.9 when the exchange takes possession of materials. The high level of government involvement in providing or funding passive listings may reflect the fact that it is a relatively low-cost option.

There are visible differences in cost structure across organizations with different implementation strategies, but not for other characteristics. Figure 1 shows the breakdown in costs, on average, for all strategies combined, passive listers, active brokers, and those taking possession of materials. In all cases, wages and salaries are the primary expense. Passive listers typically have smaller overall totals, higher relative advertising expenditures, and negligible transportation, rent, and utility expenses. By contrast, exchanges taking possession of materials incur significant transportation, rent,

and utility expenses. Figure 2 shows that the distribution of employee functions follows a similar pattern.

Preferred communication method varies substantially by implementation strategy, but not by other characteristics. Table 5 shows that passive listers strongly prefer email over other methods, whereas active brokers and those taking possession of materials are more catholic. Preferred listing technique also varies by implementation strategy but not by other characteristics. Unsurprisingly, Table 5 shows that passive listers strongly prefer Internet and catalog listings, whereas those taking possession of materials rely on their warehouse to display available items. It is noteworthy, however, that the Internet is by far the preferred listing technology, suggesting that the reuse sector is firmly embedded in the New Economy.

The geographic area served varies substantially by implementation strategy, but not by other characteristics. Table 5 shows that exchanges taking possession of materials most often serve only their local community, whereas passive listers and active brokers most often serve a much larger region, ranging from the county to the globe.

On average, exchanges that take possession of materials are older. The mean year of establishment is 1987 for exchanges that take possession, 1997 for active brokerages and 1992 for passive listers. Across all respondents, the modal and median startup year is 1994, the mean is 1990, the earliest is 1939, and the latest is 1998.

Prescriptive Findings

When asked which of eleven services such as training materials or policy updates would be the most beneficial to the respondent's organization, most gave a directory of

exchanges/organizations their highest priority. Least requested was a peer matching service. Passive listing and brokering exchanges were particularly interested in expanding their on-line networking capability, whereas exchanges that take possession of materials were interested in simply getting on-line with a bulletin board or web service. Other differences in response to the desired services question showed little variation, none at a statistically significant level.

When asked of their need for information on a dozen topics such as regulatory information and product quality guidelines, the two highest priority needs were for marketing/publicity strategies and sources of and outlets for materials. There was little interest expressed in regulatory information. Non-profits were highly interested in additional funding/financing sources, whereas governmental entities and those operating passive listing exchanges were not. As expected, passive listing exchanges also had little interest in learning more about topics of interest to those taking possession of materials—material pricing, inventory management/control, warehousing and distribution.

When asked what is their greatest challenge, respondents frequently mentioned the following items in open-ended responses:

- All types of respondents mentioned outreach and marketing to both donors/suppliers and users/customers.
- Passive listers frequently mentioned lack of funds.
- Passive listers also mentioned the lack of reporting on the outcomes of exchange attempts by users of their lists.
- Non-profits frequently mentioned the need for culture change and public awareness of reuse and recycling options.

When asked to describe their greatest success to date, typical responses to this open-ended question included the following:

- All types of respondents frequently mentioned receiving press coverage and feeling its positive impacts on their operations.
- All types of respondents also frequently mentioned building a reputation by word-of-mouth, with attendant benefits.
- Non-profits often mentioned their participation in events such as trade fairs, exhibits, festivals, and workshops as being beneficial.
- Passive listers often mentioned the success of their website or e-mail listserv.
- Passive listers also mentioned the value of joining or establishing a collegial network of actors in the solid waste management arena.

Creative suggestions respondents offered for increasing the number of people using their services most often included the following open-ended responses:

- Outreach activities of various types were the most frequently mentioned suggestions.
- Partnering with local economic development programs such as chambers of commerce and economic development agencies was also often mentioned.
- Organizations taking possession of materials often recommended spreading the gospel on the reuse concept.

Discussion

The most striking feature of the new materials exchanges is that they strongly overlap existing niches in the reuse community. They target the same broad categories of materials and actors as scrap dealers, thrift shops, flea markets, and recycled materials brokers. Yet it would not be accurate to say that materials exchanges compete with these other entities, because competition implies scarce resources whereas there is plenty of untapped value remaining in the U.S. solid waste stream.

Exchanges that take possession of materials are in many ways a variant of the local thrift shop or non-profit Goodwill store. They subsist on user fees and the occasional grant for startup and capital improvements. They are firmly embedded in the social fabric of their local communities. However, they differ in a few important respects. First, they often tap into a different materials stream—many accept building materials, appliances, office equipment, bulk paper, and other items that a thrift shop typically refuses. Second, they often serve specialized constituencies. Among our respondents are several exchanges serving primarily low-income home builders, teachers, or non-profit offices. Third, many of those founding exchanges are motivated by their sense of moral outrage against obvious waste and environmental degradation. Respondents write: “It’s not promoting our services [that] we need, it’s a cultural change to stop being a wasteful society...Make it illegal to throw reusable things away!" “Promote more general awareness of reuse.” “More environmental education at all levels of society.”

Passive listers are a distinctive new species. Although the mode of operation traces back to the government surplus listings that became ubiquitous after World War II in the United States, these organizations instead have a focus on matching third parties

for mutually beneficial exchanges. They are a low-effort variant of the active brokerage, typically supported at a minimal level by government. And although they existed before the advent of the Internet, their feasibility has been dramatically enhanced by the new telecommunication technologies, which have reduced the transaction costs associated with the passive listing strategy. Respondents write: "Development of [an] e-mail listserver has done more to promote exchanges than anything else we've done lately…Employ Internet technologies as much as possible. Our site saves us thousands in staff costs by automating our operations." "Our website has opened many doors to our program. The simplicity of using the site has encouraged many new users to register materials on-line." "Developing a website is key."

Neither model completely solves the transaction cost issue. Spreading the word about material exchange opportunities is the biggest challenge reported by our respondents. Bringing people into the network or warehouse dramatically reduces the search costs associated with finding suitable matches. Yet advertising and outreach are not costless activities—someone has to pay for the staff time and air time. Unlike their private sector counterparts who pay for advertising, non-profits and governmental agencies involved in materials exchanges are always on the lookout for free publicity, the more sensational the better. Respondents write: "We exchanged a house via our website. There was quite a bit of press on this, which I think really helped promote our site." "When we had a break-in and vandalism we got terrific press coverage." "We look forward to the publicity benefits accruing from our pending exchange of a 747 jet airplane."

We believe that some materials exchanges will carve out permanent niches in the industrial ecosystem, but many will fail. Exchanges that take possession of materials and serve local markets have already demonstrated longevity and success, provided that they are well managed. The fact that some are motivated by environmental rather than charitable or profit-making concerns seems irrelevant to their success, in part because these goals are so often complementary.

Passive listing exchanges appear to be much more marginal endeavors. Those that survive will probably become more like active brokers, equipped with modern telecommunications technology and able to measure their success quantitatively. Both our data and the literature (Powell & Lynch, 1990) show a consolidation among passive listing exchanges, so that fewer of them cover a larger area. The Internet will only accelerate this consolidation.

It is increasingly common to see overlap among these implementation strategies. One exchange started as a passive lister but found it necessary to become an active broker in order to increase the number of transactions. Once the number of donors increased, it then became necessary to acquire warehouse space for storing and displaying items for customers. Likewise, several warehouses have inaugurated websites that let them branch into the passive listing business. There are synergistic benefits in terms of attracting more participants and matching the level of assistance required to the needs of each transaction.

Conclusions

This exploratory survey of U.S. materials exchanges suggests that the term is too broad, because it encompasses distinct species with different optimal scales of operation.

Some will thrive and others will disappear. While it is clear that recyclers and reusers are not the dominant life forms in the industrial ecosystem, they are varied and ubiquitous. Technological change is reducing the transaction costs associated with loop-closing activities, but many remain economically marginal. Government should continue to support innovators and entrepreneurs in this area, so that the reuse and recycling sectors can evolve at the same pace as the rest of the economy.

References

Battery Council International. (2000) Lead-Acid batteries head list of recycled products. Press release. Available on-line at http://www.batterycouncil.org/ or by writing to 401 North Michigan Avenue, Chicago, Illinois 60611, USA.

Begon, M., Harper, J. & Townsend, C. (1996) *Ecology : individuals, populations, and communities*. 3rd ed. (Oxford: Blackwell Science), pp. 672-680.

Block, D., & Wood, A. (1998) Rescuing materials from landfills, *Biocycle* (February) pp. 66-68.

Chemical Business. (1984) Waste exchanges: A little-known option for a growing dilemma, 14 (10), pp. 25-28.

Cornell Waste Management Institute. (1998) *New York City Materials Exchange Roundtable November 14, 1997: A Final Report*. Prepared for the U.S. Environmental Protection Agency Region 2 and the New York City Department of Sanitation. (Ithaca, NY: Cornell University).

Covey, S.K., & Shew, D. (2000) Building partnerships? The Ohio Materials Exchange, *Resources, Conservation and Recycling*, 28, pp. 265-277.

DiPietro, R. (1994) How can waste exchanges work better? *Biocycle* (January), pp. 75-76.

Florida Chamber of Commerce et al. (1983) *Proceedings of the National Waste Exchange Conference,* 14 (9) (Tallahassee, FL).

Frosch, R., & Gallopoulos, N. (1989) Strategies for manufacturing, *Scientific American*, 261(3), pp.144-152.

Goodwill Industries International. (2000) Corporate website, visited June 29th. http://www.goodwill.org or write to 9200 Rockville Pike, Bethesda, MD 20814, USA.

Lund, R. (1996) *The Remanufacturing Industry: Hidden Giant*. Report prepared for Argonne National Laboratory. (Boston, MA: Boston University, Department of Manufacturing Engineering).

National Recycling Coalition's Board of Trade Recyclables Echange, the Reuse Development Organization, and Princeton University's Center for Energy and Environmental Studies (NRC et al). (1999) Materials Exchange Survey. Contact Christine McCoy at the National Recycling Coalition Inc., 1727 King Street, Suite 105, Alexandria, Virginia 22314, USA, http://www.nrc-recycle.org/.

PL 94-580, U.S. Resource Conservation and Recovery Act of 1976 (RCRA).

Powell, J. & Lynch, M. (1990) Successfully simple: The waste exchange, *Resource Recycling* (April), pp. 82-85, 106.

Rich, L. (1984) Waste exchanges: An underutilized way to help the bottom line, *Chemical Week,* 14 (9), pp. 58-61.

Salvation Army USA. (2000) Corporate website visited July 5th. http://www.salvationarmyusa.org/ or write to 615 Slaters Lane, Alexandria, VA 22313, USA.

U.S. Environmental Protection Agency (USEPA). (1997) *Characterization of Municipal Solid Waste in the United States: 1996 Update*. Prepared by Franklin Associates, Ltd., Prairie Village, KS, (June).

Table 1: Number of Organizations Exchanging Each Type of Material
(N = 63 Organizations)

Number	Material		Number	Material
Pre-Consumer Recyclable Commodities			*Post-Consumer Products*	
11	Hazardous Materials		40	Building Materials
Other Pre-Consumer			40	Office Equipment/Furniture
35	Building Materials		36	Appliances/Electronics
26	Aluminum Scrap		29	Art Supplies/Materials
25	Steel Scrap		28	Paint
25	Textile Scrap/Fluff		18	Domestic Furnishings
24	Paper/Fiber		13	Clothing
22	Plastic Resin		10	Antiques
13	Industrial Sludges		10	Housewares
Post-Consumer Recyclable Commodities			10	Sporting Goods
21	Paper		9	Books/Movies/Music
20	Plastic Containers		9	Collectibles
14	Glass Beverage Containers		6	Food
14	Tires/Crumb Rubber		5	Jewelry
13	Aluminum Containers		5	Toys/Dolls
11	Other		14	Other

Table 2: Respondents by Type of Exchange

Material Type / Organization Type/Strategy	Pre-Consumer Hazardous*	Pre-Consumer Non-Hazardous*	Post-Consumer*	Total Responses
For-Profit Firm				3
Passive Lister		1		1
Active Broker				0
Takes Possession		2	2	2
Non-Profit Organization				36
Passive Lister	5	9	8	14
Active Broker		3	3	3
Takes Possession		4	18	19
State-Local Government				24
Passive Lister	4	17	13	21
Active Broker				0
Takes Possession		3	2	3
Total by Material Type	9	39	46	94/63

* The sum of cells in each row is usually greater than the total responses because many organizations exchange more than one type of material.

Table 3: Nonprofits by Funding Source

Material Type Strategy/Funding Source	Hazardous Commodities	Non-Hazardous Commodities	Post-Consumer Products	Total Responses*
Passive Lister				
Fee for service	1	2	4	7
Grant funding	3	6	5	14
Government funding	5	7	7	19
Private sector funding	2	3	2	7
Active Broker				
Fee for service		1	1	2
Grant funding		2	2	4
Government funding		2	2	4
Private sector funding		1	1	2
Takes Possession				
Fee for service		3	16	19
Grant funding		2	10	12
Government funding			6	6
Private sector funding		1	8	9
Total Responses*	11	30	64	105

* The totals in each row and column are greater than the total responses (N = 36) because many organizations exchange more than one type of material and receive funding from more than one source.

Table 4: Primary Reason for Starting Exchange by Organization Type

Organization Type What was the initiative to start this business?*	For-Profit Firm	Non-Profit Organization	State-Local Government	Total Responses
Divert waste from landfill/incinerator		7	13	20
Moral objection to waste		4	3	7
Cheap source of materials		3	1	4
Disposal cost savings		3	1	4
Profit/Revenue	2	1		3
Economic development strategy		1		1
Environmental impact reduction		1		1
Total Responses	2	20	18	40

* This was an open-ended question. Responses were categorized into the categories shown by the authors. More than one reason was often given for starting an exchange; in addition to the reasons listed, promoting a sense of community was sometimes mentioned as a secondary reason. N = 40 for this question, which was only asked in the 2000 survey, not the 1999 survey.

Table 5: Networking Characteristics of Respondents by Implementation Strategy

Implementation Strategy *Preferred Communication Strategy*	*Passive Lister*	*Active Broker*	*Takes Possession*	*Total Responses**
Phone	8	3	10	21
Fax	10		8	18
E-mail	31	3	10	44
Mail	9		10	19
Total Responses*	58	6	38	102
Preferred Listing Technique				
Internet	33	3	3	39
Electronic Bulletin Board	4	1	1	6
Catalog (by mail)	26	1		27
Newspaper	8		4	12
Brokerage Service (personal communication)	2	1		3
Warehouse (showroom)			21	21
Total Responses*	73	6	29	108
Geographic Area Served				
Local Community	6		20	26
Larger Area (county, state, nation, international)	30	3	4	37
Total Responses	36	3	24	63
Target Market				
Reuse (users include individuals, non-profits, & retail firms)	6		21	27
Recycling (users also include manufacturers & waste management industry)	30	3	3	36
Total Responses	36	3	24	63
Trade Organization Memberships				
National Recycling Coalition	15	2	5	22
Reuse Development Organization	8		13	21

Solid Waste Association of North America	7		1	8
Used Building Material Association			3	3
State/Local Organizations	17	1	7	25
Others	8	2	3	13
Total Responses*	55	5	32	92

*The totals in each row and column are greater than the total number of survey responses (N = 63) because many organizations employ more than one communication strategy and listing technique, and join more than one trade organization.

Figure 1: Average Cost Structures for Three Types of Materials Exchanges

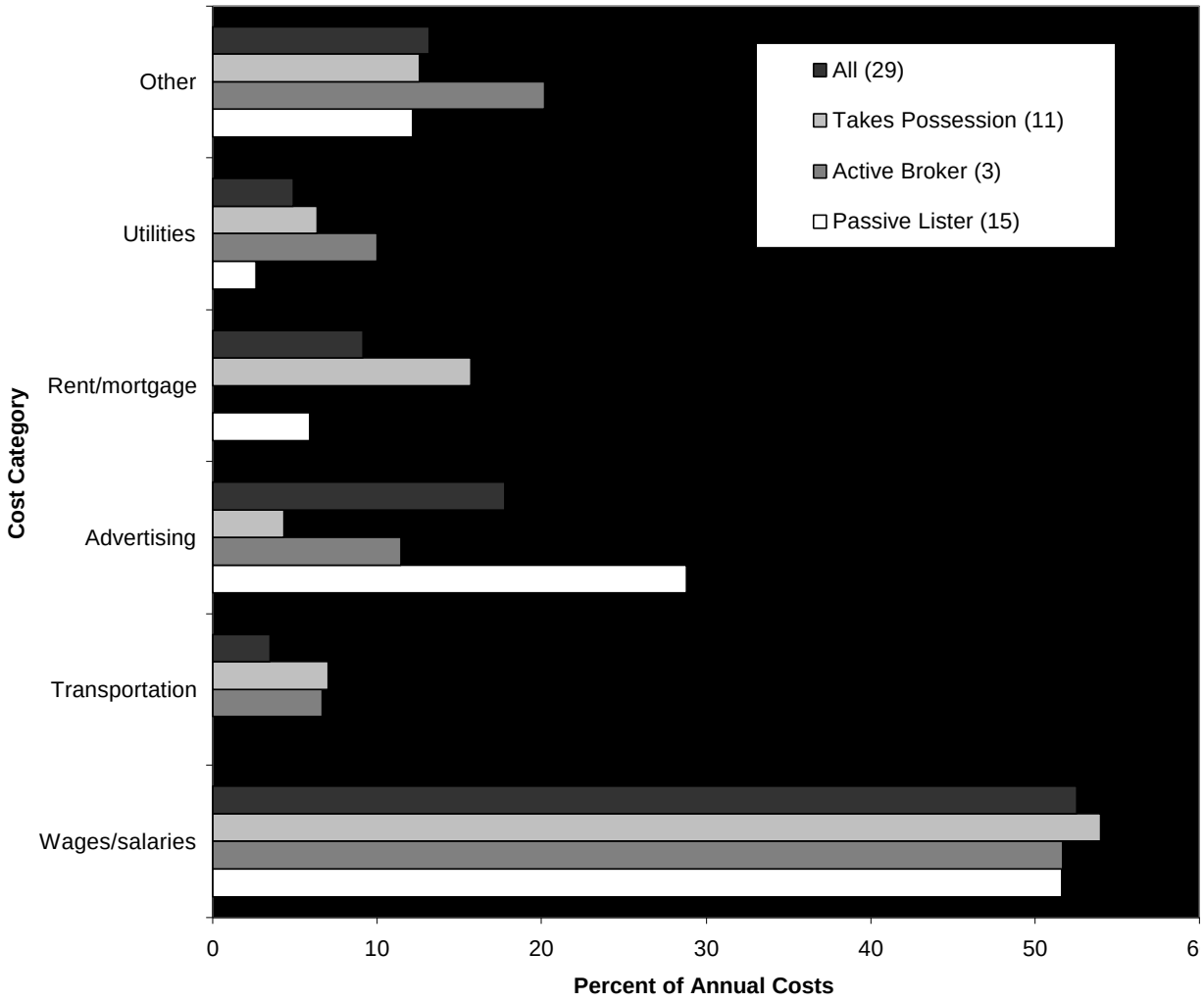

Figure 2: Average Distribution of Employee Functions for Three Types of Materials Excl