

Missouri Recycling Economic Information Study MOREIS

Final Report



Prepared for:

Environmental Improvement and Energy Resources Authority (EIERA)

Prepared by:

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DISCLAIMER

The following report was prepared for the Missouri Environmental Improvement and Energy Resources Authority (EIERA). The conclusions, observations, and recommendations contained in this report represent the opinions of the researchers and not necessarily those of the EIERA. The research relies on other data sources outlined in the report and the researchers have assumed the sources are accurate.

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EXECUTIVE SUMMARY

The recycling, remanufacturing, and reuse industry (RRR) plays an important role in Missouri by reducing the use of raw natural resources and by reducing energy consumption; however recycling activities also provide important economic benefits over and above environmental benefits. This study is designed to determine the extent to which the industry provides economic benefits for Missourians.

A survey was conducted of potential recycling, remanufacturing, and reuse firms in the state of Missouri. The study used a survey of a random sample of 750 from the total 1,886 firms identified as potential Missouri RRR firms. Information gathered from the individual firms in the survey included: number of physical locations the firm operates in the state, total number of employees, annual payroll and compensation paid to employees in 2003, total sales in 2003, and percent of recycling “covered activities” in which the firm is involved. The survey data along with data from the North American Industry Classification System (NAICS) was used to estimate the direct impact of the industry in Missouri. Indirect and induced effects were then calculated using IMPLAN, an input output model.

The study examined four business sectors, recycling collection, recycling processing, recycling manufacturing, and reuse and remanufacturing. The four business sectors are subdivided into 26 business categories. Data gathered from the mail survey were used in 11 business categories, a derivation based on industry data for 2 categories (found in Appendix G), and existing data were drawn from the NAICS for the remaining 13 categories. The approach used here permits comparison with the United States Recycling Economic Information Study (USREIS) and other state studies that were based upon the methodology used in USREIS.

Three levels of economic impact were used. Data are presented according to the direct effects (actual business employees, sales, and payroll), indirect effects (the effect of the direct firms purchasing products and services from other business in order to produce their product), and induced effects (wages paid to employees in the direct and supporting industries that are available for employees to purchase goods and services). The induced effect is the total effect the industry has on the region.

The study identified 1,228 firms with 28,026 employees directly involved in the RRR industry in Missouri. The direct effect of sales was \$5,122,436,000 and payroll of \$707,307,000. The Recycling Processing sector has the largest number of establishments (358) followed by the Reuse and Remanufacturing sector (357); however the Recycling Manufacturing sector provides the most benefit to the state with \$2,434,264,000 in direct sales, \$475,510,000 in direct payroll, and 17,962 in direct employees. The Recycling Manufacturing sector provides 48% of total direct sales, 67% of direct payroll, and 64% of direct employment (see below). These totals reflect the estimated impact of the firms identified as potential RRR firms in the survey. The direct totals represent a conservative

estimate of the industry because the researchers did not make any assumptions about the firms not identified as part of the original database.

Direct Effects of the Missouri RRR Industry

	Number of Establishments	Sales (\$1,000)	Payroll (\$1,000)	Employees
Recycling Collection	199	21,392	14,777	547
Recycling Processing	358	2,548,167	184,414	6,248
Recycling Manufacturing ¹	314	2,434,264	475,510	17,962
Reuse and Remanufacturing ²	357	118,613	32,606	3,269
Total	1,228	5,122,436	707,307	28,026

¹ Three NAICS codes did not disclose data and two business categories of the survey did not provide enough data to draw conclusions.

² Two NAICS codes did not disclose data.

The economic impact of the 26 recycling business categories was determined using economic modeling of the direct information collected in the survey, derivations, and existing NAICS data. The calculated economic impacts included:

- Indirect effects (the effect of the direct firms purchasing products and services from other business in order to produce their product)
- Induced effects (wages paid to employees in the direct and supporting industries are available for employees to purchase goods and services).

The total effects of the RRR industry are summarized in the Table below. For a complete assessment of direct, indirect, and induced effects see Table 14.

Total Effects of the RRR Industry by Business Sector

	Sales (\$1,000)	Payroll (\$1,000)	Employees
Recycling Collection	40,777	27,813	1,188
Recycling Processing	4,503,707	461,059	17,215
Recycling Manufacturing ¹	4,072,534	1,201,991	54,738
Reuse and Remanufacturing	226,242	68,474	6,878
Total	8,843,260	1,759,337	80,019

¹ Three NAICS codes did not disclose data and two business categories of the survey did not provide enough data to draw conclusions.

² Two NAICS codes did not disclose data.

INTRODUCTION

Overview

The recycling of materials is not new, recycling was an element of the war effort during World War II, for example, and recycling has continued in some sectors without active government involvement. Recycling became more prominent in the 1970s and 80s first because of environmental concerns, and later due to the decline in landfill capacity. These concerns culminated in the passage of SB 530 in 1990. The act strengthened the regulations of landfills, authorized the creation of solid waste management districts, and encouraged recycling of newsprint, batteries and tires, and other products. The resulting recycling activities produce indirect benefits, such as the reduction of environmental degradation caused by illegally disposed waste, including vehicle batteries and tires, but recycling activities also produce economic benefits over and above environmental benefits. This study is designed to explore these economic benefits of recycling in the state of Missouri.

The study examined four business sectors, recycling collection, recycling processing, recycling manufacturing, and reuse and remanufacturing. The four business sectors are subdivided into 26 business categories. See Table 1 and Appendix A for a description of the business categories. Data gathered from the mail survey were used in 11 business categories, a derivation based on industry data for 2 categories, and existing data were drawn from the NAICS for the remaining 13 categories. The approach used here was designed to be comparable to the United States Recycling Economic Information Study (USREIS) and the several state studies that have replicated that study.

The economic information gathered (direct effects) included:

- Total number of establishments involved in the RRR industry,
- Number of employees dedicated to RRR activities,
- Annual payroll to employees dedicated to RRR activities, and
- Annual receipts for RRR activities within the establishments.

The economic impact of the 26 recycling business categories was determined using economic modeling of the direct information collected in the survey, derivations, and existing NAICS data. The calculated economic impacts included:

- Indirect effects (the effect of the direct firms purchasing products and services from other business in order to produce their product)
- Induced effects (wages paid to employees in the direct and supporting industries that are available for employees to purchase goods and services).

Comparison to Other Studies

This study was commissioned by the Environmental Improvement and Energy Resources Authority (EIERA) to illustrate the economic impact the recycling industry has in

Missouri. The study methodology was based on the U.S. Recycling Economic Information Study (USREIS) conducted by R.W. Beck Inc. published in July 2001. Other reports reviewed for this study include Ohio Recycling Economic Information Study, Indiana Recycling Economic Information Study, and Economic Impact of Recycling in Iowa all conducted by R.W. Beck Inc. along with the St Louis Area Recycling Economic Information Study conducted by Joseph S. Martinich, Lee Fox, Alan Hauff, and Anand Jararaj of the University of Missouri - St. Louis. However, care should be taken when comparing this study to other studies; methodologies and interpretations may vary.

Intended Use for Study

The economic information contained in this report can be used to:

- Inform current RRR firms about the importance of their industry for the state,
- Inform lawmakers about the important impact of the RRR industry on the state,
- Inform the public about the importance of the RRR industry and educate them about RRR industry,
- Encourage current RRR firms to expand,
- Encourage new RRR firms to locate in Missouri, and
- Provide a baseline for additional studies in Missouri.

INFORMATION ABOUT THE DATA

Defining the Industry

The RRR industry is very complex and difficult to define for the purposes of this study because a firm may be completely devoted to recycling activities or recycling may be only a portion of its business activities. Examples of firms that are completely dependent on RRR include a firm that sorts or palletizes used plastic products or a paper mill that uses only recycled paper to make new products. In such cases, it is not difficult to determine the input, output, and employees involved in the RRR industry. Many firms, however, use both virgin and recycled materials in the processing of intermediate and end use products. It is more difficult to assess the impact of recycling when, for example, a steel mill or glass manufacturer uses both virgin and recycled materials to produce intermediate and end products. In such cases, it is necessary to determine whether the specific firm should be included in the study and, if so, what portion of the total business activities should be included. The MOREIS used the term “covered activities” to determine the amount of business activities of such firms that should be covered in the study.

The study includes a list of “covered activities” that are part of the “recycling and reuse” industry, taken directly from the USREIS (R. W. Beck, 2001):

- Collecting materials or used products for the purpose of intermediate processing, manufacturing, and/or distribution by reuse sales establishments;
- Intermediate processing of recovered materials or used products including sorting, cleaning, consolidating, treating, disassembling, densifying, and/or transferring ownership for use in processing, product manufacturing, and/or distribution by reuse sales establishments;
- Reclaiming of recovered materials or used products to produce refined raw materials and/or reusable products meeting the specifications of manufacturers, reuse sales establishments or end-users;
- Manufacturing “first stage” products containing recycled materials or used products;
- Operating wholesale or retail sale establishments that offer, largely or exclusively, used products prepared for reuse; and
- Intimately supporting the above activities through research, equipment development and sales, consulting, engineering, brokering, and exchange services.

This study is consistent with the USREIS methodology and thus includes “those activities that are most essential to the continued recycling of materials and reuse of used products.” (R. W. Beck, 2001). This study has boundaries similar to those used in the USREIS. It:

- Includes all “supply side” (providing used products) activities involved in recovering and preparing materials and products for resale;

- Includes “demand side” (providing products made of recycled materials) activities up to the first point at which the recovered materials or used products have successfully competed directly against their respective primary, virgin, counterparts;
- Excludes the activities of non-business entities including individuals and organizations that provide education or advocacy that does not directly add value to recovered materials or used products; and
- Excludes incineration activities or use of used materials for fuel.

Secondary Data

Secondary data, North American Industry Classification System (NAICS) data, from 1997 were used in the study. The 1997 data were the most recent data available for Missouri. The Census Bureau collected data in 2002, but these data are not yet available. Because the Census will not release data for specific NAICS codes if there are only a small number of firms involved in a specific industry sector to avoid disclosure of individual firm level data, five categories were excluded from analysis. There were too few firms in Missouri to release data on Glass Container Manufacturing Plants, Nonferrous Secondary Smelting and Refining, Steel Mills, Motor Vehicle Parts, and Retail Used Merchandise business categories. This is noted in the tables; therefore final totals will be understated to the extent that such firms operate in Missouri.

Challenges of the Study

There were three major challenges encountered in conducting this research: 1) creating an accurate, comprehensive list of all potential RRR firms; 2) designing an effective survey instrument; and 3) avoiding double counting.

Creating a comprehensive list of all firms involved in the RRR industry proved to be a very difficult task. A number of lists, obtained from the EIERA and the Missouri Department of Natural Resources, were combined to ensure the list was as complete as possible. After the review by EIERA, a small number of additional firms were added to the list from which the survey sample was drawn and on which the results were based. There was also an issue with incorrect address for firms that had moved or were no longer involved in RRR. If firms were not included in complete mailing list, the corresponding business category value will be understated.

Designing an effective survey instrument is a challenge with any type of survey work because the survey must be long enough to collect all the necessary data, yet short enough the firms will complete it. A pilot survey was used to aid with the development of the final survey instrument.

Double counting is an issue any time an economic impact study is conducted because business industries relate to each other in the form of a chain and products move through

the chain from raw (e.g. used plastic materials) to complete product ready for consumer use (new plastic bottles). An example is a collection firm selling used plastic bottles to another firm to palletize the plastic for further use. The palletizing firm will then sell the intermediate product to another firm that will turn the pallets into new bottles. If a single firm follows a product from recycled or virgin material to the final products there is no double counting.

There is no double counting in the direct effects, but double counting may come into play in the indirect and induced effects. The only way to eliminate double counting is to lump all related industries into one large sector, thus losing all the industry level data. This is not a large problem with the RRR industry but does arise because of the inter-industry and inter-business relationships included in the study. In industry sectors where double counting is a real issue, there may be up to a 15 percent bias due to double counting.

Business Categories

This study focuses on 26 RRR business categories. The businesses can be divided into the recycling industry sector and the reuse and remanufacturing industry sector. The recycling sector can be subdivided into recycling collection, recycling processing, and recycling manufacturing. Table 1 (R. W. Beck, 2001) provides a short description of the business categories; a more complete list is in Appendix A.

Table 1

Business Categories Descriptions	
Business Category	Description
<i>Recycling Collection</i>	
1. Government Staffed Residential Curbside Collection	Recyclables collection using government employees
2. Private Staffed Residential Curbside Collection	Private sector collection of recyclables, including contract collection on behalf of municipalities
<i>Recycling Processing Sector</i>	
3. Compost and Miscellaneous Organics Producers	Produce compost, mulch, bark, or bedding from yard and wood waste, biosolids, or other organics, also includes vermiculture
4. Materials Recovery Facilities	Process commingled or recovered materials, usually from curbside/drop-off collection or recyclables separated from solid waste
5. Recyclable Material Wholesalers	Paper stock dealers, scrap metal processors, and other establishments that sort, remove contaminants, and densify recovered materials and brokers of recovered materials

Business Category	Description
<i>Recycling Manufacturing</i>	
6. Glass Container Manufacturing Plants	Produce finished glass containers
7. Glass Product Producers (other recycled uses)	Produce glass products other than containers
8. Nonferrous Secondary Smelting and Refining Mills	Recycling and alloying of nonferrous metals, primary products include billets, ingots, and other basic shapes
9. Nonferrous Product Producers	Produce nonferrous products through extrusion, rolling, or drawing processes
10. Nonferrous Foundries	Produce castings from nonferrous metals
11. Paper, Paperboard, and Deinked Market Pulp Mills	Produce paper and paperboard products from recovered paper or market pulp and/or deink recovered paper and sell pulp
12. Paper-Based Product Manufacturers	Produce cellulose-based products from recovered paper or paperboard (e.g., cellulose insulation, hydro-seeding, animal bedding)
13. Pavement Mix Producers (asphalt and aggregate)	Produce asphalt paving mix from recycled materials such as crumb rubber, aggregates, or glass
14. Plastics Reclaimers	Transform recovered plastics directly into products (e.g., plastic lumber) or raw materials ready for remanufacture
15. Plastics Converters	Convert a recycled plastic clean flake or pellet into an intermediate or end product
16. Rubber Product Manufacturers	Manufacture products using crumb rubber or cut rubber shapes and stampings as feedstock
17. Steel Mills	Produce iron and steel slabs, billets, bar, plate, and sheet from scrap and/or raw materials
18. Iron and Steel Foundries	Produce cast iron or steel products
19. Other Recycling Processors/Manufacturers	Other processors and manufacturers not elsewhere classified, using ash, sludge, engineering application of tires or other recovered materials
<i>Reuse and Remanufacturing</i>	
20. Computer and Electronic Appliance Demanufacturers	Sort, grade, dismantle and/or rebuild used electronic appliances
21. Motor Vehicle Parts (used)	Clean, sort, inspect, and remanufacture used automobile parts
22. Retail Used Merchandise Sales	Retail thrift stores, antique shops, reuse centers, and other shops dedicated to selling used merchandise

Business Category	Description
<i>Reuse and Remanufacturing (cont.)</i>	
23. Tire Retreaders	Remove old tread from worn tires and add new tread
24. Wood Reuse	Process used wood for reuse (e.g., pallet rebuilders, construction materials)
25. Materials Exchange Services	Facilitate the reuse of products and materials by commercial and industrial establishments
26. Other Reuse	Other reuse or remanufacturing, not elsewhere classified

METHODOLOGY

Introduction

This study collected survey data on all 26 business sectors, however not all of the survey data were utilized in the analysis in order to be comparable with the USREIS methodology. The USREIS study used existing NAICS data on 13 business categories, collected survey data on 11 categories, and used a derivation on 2 categories. The derivation was calculated based on the equation used in the USREIS. In the recommendations for future studies at the end of the USREIS study, R. W. Beck (2001) recommended using NAICS data for an additional business category, Materials Recovery Facilities, because of the inconsistencies between the NAICS data and other published data. Therefore, in this study, one additional business category was included using existing NAICS data.

The USREIS analysis included Retail Used Merchandise Sales as one of the business categories. This sector includes used merchandise stores. No Missouri data exist for this category and consequently the number of firms and the estimated impact of the RRR industry in Missouri may be lower than found in other states.

The survey data from the additional 15 business categories were used as baseline figures to compare the NAICS data and derivations found in the Results section. Table 2 identifies the data development approach used in the analysis.

Locating RRR Firms in Missouri

The researchers worked with the EIARA, the Missouri Department of Natural Resources, and numerous other sources to compile a complete list of all potential RRR industry firms that conducted business in the state of Missouri. The creation of this list was very difficult and time consuming. The first step was to obtain a list of all Missouri firms identified in the USREIS, a list of all grant applicants to the EIARA, and a list of potential RRR industry firms obtained from the Department of Natural Resources. The lists were combined and duplicates were removed. Once the list was clean, it was divided up into the 20 Solid Waste Management Districts based on each firm's address and the lists were mailed to the respective Solid Waste Management District for review. The researchers asked the districts to add any missing firms and delete any that were not part of the RRR industry or no longer in business. A copy of the letter mailed to the Solid Waste Management Districts is presented in Appendix B. After the mailing was complete the researchers identified other possible sources of potential RRR firms. Other sources used to identify firms included the Missouri Recycling Association (MORA) directory, 2000 American Recycling Market Recycling Directories for Scrap Metal, 2000 American Recycling Market Recycling Directories for Mutlimaterials, Missouri Secretary of State web site for firms that met the "recycle" search term, and firms listed under "recycling" on www.whitepages.com.

Table 2

Data Development Approach by Business Category

Business Category	Data Source
<i>Recycling Collection</i>	
1. Government Staffed Residential Curbside Collection	Derivation ¹
2. Private Staffed Residential Curbside Collection	Derivation
<i>Recycling Processing Sector</i>	
3. Compost and Miscellaneous Organics Producers	Survey
4. Materials Recovery Facilities	NAICS ²
5. Recyclable Material Wholesalers	NAICS
<i>Recycling Manufacturing</i>	
6. Glass Container Manufacturing Plants	NAICS
7. Glass Product Producers (other recycled uses)	Survey
8. Nonferrous Secondary Smelting and Refining Mills	NAICS
9. Nonferrous Product Producers	NAICS
10. Nonferrous Foundries	NAICS
11. Paper, Paperboard, and Deinked Market Pulp Mills	NAICS
12. Paper-Based Product Manufacturers	Survey
13. Pavement Mix Producers (asphalt and aggregate)	Survey
14. Plastics Reclaimers	Survey ³
15. Plastics Converters	NAICS
16. Rubber Product Manufacturers	Survey
17. Steel Mills	NAICS
18. Iron and Steel Foundries	NAICS
19. Other Recycling Processors/Manufacturers	Survey
<i>Reuse and Remanufacturing</i>	
20. Computer and Electronic Appliance Demanufacturers	Survey
21. Motor Vehicle Parts (used)	NAICS
22. Retail Used Merchandise Sales	NAICS
23. Tire Retreaders	NAICS
24. Wood Reuse	Survey
25. Materials Exchange Services	Survey
26. Other Reuse	Survey

¹ Based on calculations found in Appendix G.

² Actual NAICS code(s) used and method used to calculate values are found in Appendix F.

³ USREIS used existing data developed by R.W. Beck based on American Plastics Council Handler & Reclaimer database.

Survey Data

The survey used to collect the data included a qualifying question to determine if the firm was part of the RRR industry. Previous studies did not provide survey participants an easy way to respond when they were not currently involved in the RRR industry. In this study, the firms which indicated they were not involved in the RRR industry were removed from the mailing list. The percentage of firms responding to the survey indicating they were not involved in the RRR is also reflected in the study results, thus attempting to not overestimate the actual impact of the industry. For example, 47% of the respondents indicated they were not involved in the RRR industry; therefore the original list of firms was decreased by 47%.

Survey data were collected on all 26 RRR business categories. However to be more consistent with the USREIS, the survey data were used only used in the analysis of 13 business categories.¹

Pilot Survey

A pilot study was conducted using two survey instruments. One of the survey instruments was a short survey, much like the final survey. The second survey instrument included an additional section of questions, including questions about the type of inputs purchased and the location from which the inputs were purchased. A copy of the pilot surveys and cover letters are contained in Appendix C. Based on the responses to the pilot study, it was determined the longer survey would result in a much lower response rate, and in addition, it would be more difficult to ensure the quality of the data contained in the long form due to the complexity of the survey questions.

One modification was made to the short survey following the pilot study to include response categories for payroll and sales. Similar categories were used for total number of employees and total sales. The USREIS study utilized the same ranges “due to the sensitive nature of the survey questions, it was anticipated that asking for response in ranges rather than exact number would increase the response rate.” (R. W. Beck, 2001) Sales and payroll information is sensitive information that businesses may not be willing to release, however with the response categories the firm may select the correct range of values rather than identify actual sales and payroll. The ranges should average out with a significant number of responses.

Survey

The questions in the final survey can be grouped into four categories. Those categories are:

¹ Compost and Miscellaneous Organics Producers; Glass Product Producers (other recycled uses); Paper-Based Product Manufactures; Pavement Mix Producers (asphalt and aggregate); Plastics Reclaimers; Rubber Product Manufacturers; Other Recycling Processors/Manufactures; Computer and Electronic Appliance Demanufacturers; Wood Reuse; Materials Exchange Services; and Other Reuse

- A qualifying question to determine if the firm was part of the RRR industry,
- Type and percentage of covered business practices in which the firm is involved,
- Economic information needed for the impact analysis, and
- Tax information, including local, state, and federal taxes paid in 2003.

The survey was mailed to a random sample of 750 firms. The survey instrument, cover letter, and a postage-paid envelope were mailed to the firms on July 27, 2004. The follow-up post card was mailed on August 5, 2004. Copies of the letter, post card, and survey instrument are located in Appendix D. If a firm had not responded to the survey, follow-up phone calls were made from August 23 to September 7. The final response rate was 22 percent. The calculation of the response rate is presented in Appendix E. The multiple contact methods made with the respondents is not conducive to accounting for non-response error. No follow-up was done to determine if non-respondent data was different from respondent data; therefore care should be taken when reporting the results.

Economic Information

The direct economic information collected from RRR firms included:

- Number of establishments (total number of physical locations each firm operates),
- Total Number of Employees,
- Total Annual Payroll (total compensation paid to employees, includes wages, benefits, bonuses, etc.),
- Total Annual Receipts (all revenue received, including receipts from sales and services), and
- Percentage of business dedicated to recycling “covered activities,”
- Business category(s) in which the firms conduct “covered activities.”

Data Verification

Returned surveys were reviewed for completeness and accuracy. Per-employee and per-establishment data were figured to determine if the data were meaningful. If it appeared the survey was filled out incorrectly, the data were not used in the final analysis. A section of the survey was left blank so firms could provide more information on their firm; all possible information, including notes and comments made by the respondent, was used to verify the responses were complete and valid.

Complied Survey Data

Data from the returned surveys were entered into an Excel worksheet. The raw data were analyzed after an error check was conducted. The survey data were used to determine the average characteristics of each of the 11 categories used for survey analysis. The averages were calculated for number of employees, total annual payroll, and total annual receipts. The identified population was divided into the 26 business categories based on descriptions found in the original sets used and internet searches. The calculated

averages for the 11 survey categories used were then used to determine the direct effect of all firms included in the business categories. The number of responses used to calculate the averages are indicated in the tables.

Existing Data

Existing data were gathered for the 13 business categories in which NAICS data was used. The individual NAICS codes used for the identified business categories are listed in Appendix F along with method used to calculate values. These calculations are similar to those used in the USREIS.

Derivation Data

The business categories in which a derivation was used include Government Staffed Residential Curbside Collection and Private Staffed Residential Curbside Collection. The complete derivations, along with data sources, are outlined in Appendix G.

ECONOMIC IMPACT

This section contains background information used to define input output models and their use in determining the economic impact of recycling. Direct, indirect, and induced effects are outlined as well as the three multipliers used in the study: sales; payroll; and employment.

Economic Impact Background

The impact of a new firm can be very important to a region's economy. The effect of the new firm can be measured using an economic impact study. Economic impact can be defined as the estimated changes in a region's employment, income, and level of business activity resulting from a certain program or project. The change in business activity level can be accounted for as the change in gross receipts or total amount of value added by the firms (Leistriz 1998).

Input Output Models

Input output models are used to estimate economic impacts on a region's current output, total amount of value-added through processing, number of jobs, employee compensation and proprietors' income due to a change in the region's business activity (Stallmann et al. 2001).

Economic Impacts and Multipliers

The creation of a new firm or the expansion of an existing firm can have a large impact on a region's economy which can be analyzed in three categories, direct, indirect, and induced effects. Direct impacts or direct effects are the changes in economic activity resulting from the production and processing of a product. (Piewthongngam et al. 2002; Stallmann et al. 2001). The actual number of employees, payroll, and sales of a firm represent the direct effects of a firm.

Indirect effects occur when the actual firm purchases goods and services from other sectors to produce its product. For example, a glass manufacturer buys used glass from a collection service; the glass manufacturer not only has its own employees but pays for the services of the employees at the collection service. If the glass manufacturer provides the collection service with enough business, the collection service may have to hire another employee to meet the demands of the glass manufacturer. These firms, supporting industries, are the industries from which the direct industries purchase inputs and such purchases by the basic industry results in increased spending or indirect effects. The increase in wages paid to employees in the direct and supporting industries are available for employees to purchase additional goods and services. The additional wages spent by

employees creates the induced effect on the region's economy (Piewthongngam et al. 2002; Stallmann et al. 2001). The direct and indirect coefficients are used to measure the induced effect. (Doeksen and Schreiner 1974). Induced effects are the sum of direct and indirect effects and indicate the total impact a firm has on the region.

Sales Multiplier

An income or sales multiplier measures the total change in the state's economy from a one-dollar change in income or sales by a given sector.

Payroll Multiplier

The payroll multiplier measures the total change in the state's economy from a one-dollar change in magnitude of a firm's payroll.

Employment Multiplier

An employment multiplier represents the change in employment in the state from a one-employee change in the number of employees in a given sector.

Type I and Type II Multipliers

Type I and Type II Missouri multipliers from IMPLAN for the business categories are listed below in Tables 3 and 4. "The Type I multiplier identifies the value of direct and indirect transactions – e.g., the output of a business category and all other output purchased from its suppliers in the region – relative to the value of only the direct transactions. The Type II multiplier identifies the value of all economic transactions (direct, indirect, and induced) stimulated in the economy by an industry under study, including the personal spending of employees throughout the supply chain whose economic activity is apportioned to the industry, relative to the value of only the direct transactions." (R. W. Beck, 2001) The multipliers differ down the columns due to the way the firms interact with each other and their location in the chain from recyclable products to final products.

Table 3

Type I Multipliers by Business Categories

	Sales	Income	Employment
<i>Recycling Collection</i>			
1. Government Staffed Residential Curbside	1.4347	1.4085	1.4826
2. Private Staffed Residential Curbside Collection	1.4347	1.4085	1.4826
<i>Recycling Processing</i>			
3. Compost and Miscellaneous Organics Producers	1.4352	2.2942	2.1488
4. Materials Recovery Facilities	1.4347	1.4085	1.4826
5. Recyclable Material Wholesalers	1.2846	1.3018	1.4251
<i>Recycling Manufacturing</i>			
6. Glass Container Manufacturing Plants	1.4274	1.5431	1.6690
7. Glass Product Producers (other recycled uses)	1.4004	1.4845	1.4869
8. Nonferrous Secondary Smelting and Refining	1.5606	2.5783	2.5451
9. Nonferrous Product Producers	1.2465	1.6201	1.6848
10. Nonferrous Foundries	1.3604	1.4197	1.4159
11. Paper and Paperboard Mills/Deinked Market	1.5576	2.3147	2.6444
12. Paper-based Product Manufacturers	1.3816	1.7440	1.7121
13. Pavement Mix Producers (asphalt and aggregate)	1.3801	1.7641	2.2008
14. Plastics Reclaimers	1.4396	2.0318	1.9014
15. Plastic Converters	1.4093	1.7943	1.8864
16. Rubber Product Manufacturers	1.3149	1.4177	1.3851
17. Steel Mills	1.4910	2.1060	2.4409
18. Iron and steel foundries	1.4166	1.4773	1.5110
19. Other recycling processors and manufacturers	1.4143	1.7920	1.8834
<i>Reuse and Remanufacturing</i>			
20. Computer and Electronic Appliance Demanufacturers	1.2818	1.2840	1.3513
21. Motor Vehicle Parts	1.2846	1.3018	1.4251
22. Retail Used Merchandise Sales	1.5433	1.6723	1.2473
23. Tire Retreaders	1.3122	1.3882	1.3706
24. Wood Reuse	1.6594	1.7047	1.4996
25. Materials Exchange Services	1.1338	1.2314	1.2266
26. Other Reuse	1.2846	1.3018	1.4251

Table 4

Type II Multipliers by Business Categories

	Sales	Income	Employment
<i>Recycling Collection</i>			
1. Government Staffed Residential Curbside	1.9062	1.8822	2.1714
2. Private Staffed Residential Curbside Collection	1.9062	1.8822	2.1714
<i>Recycling Processing</i>			
3. Compost and Miscellaneous Organics Producers	1.6866	3.0658	3.2005
4. Materials Recovery Facilities	1.9062	1.8822	2.1714
5. Recyclable Material Wholesalers	1.7746	1.7397	2.2035
<i>Recycling Manufacturing</i>			
6. Glass Container Manufacturing Plants	1.8219	2.0622	2.5783
7. Glass Product Producers (other recycled uses)	1.7992	1.9838	2.2134
8. Nonferrous Secondary Smelting and Refining	1.8877	3.4454	3.8175
9. Nonferrous Product Producers	1.5408	2.1650	2.4789
10. Nonferrous Foundries	1.8023	1.8972	2.1036
11. Paper and Paperboard Mills/Deinked Market	1.8469	3.0932	3.8775
12. Paper-based Product Manufacturers	1.7111	2.3306	2.5529
13. Pavement Mix Producers (asphalt and aggregate)	1.6822	2.3574	3.6446
14. Plastics Reclaimers	1.7098	2.7152	2.7768
15. Plastic Converters	1.7014	2.3978	2.8458
16. Rubber Product Manufacturers	1.6840	1.8502	2.0316
17. Steel Mills	1.8001	2.8143	3.7882
18. Iron and steel foundries	1.8773	1.9742	2.2731
19. Other recycling processors and manufacturers	1.7588	2.391	2.8448
<i>Reuse and Remanufacturing</i>			
20. Computer and Electronic Appliance Demanufacturers	1.7577	1.7158	2.0099
21. Motor Vehicle Parts	1.7746	1.7397	2.2035
22. Retail Used Merchandise Sales	2.0694	2.2347	1.5105
23. Tire Retreaders	1.6810	1.8551	2.0198
24. Wood Reuse	2.1322	2.2780	1.9690
25. Materials Exchange Services	1.4201	1.6456	1.7005
26. Other Reuse	1.7746	1.7397	2.2035

RESULTS OF THE STUDY

The direct effect of the RRR industries on Missouri includes 1,228 identified firms and their 28,026 employees. The firms represent \$5,122,436,000 annually in sales and \$707,307,000 in annual payroll. The direct effects of the RRR are summarized in Table 5. The Recycling Manufacturing sector provides 48% of total direct sales, 67% of direct payroll, and 64% of direct employment.

Table 5

Direct Effects of the Missouri RRR Industry

	Number of Establishments	Sales (\$1,000)	Payroll (\$1,000)	Employees
Recycling Collection	199	21,392	14,777	547
Recycling Processing	358	2,548,167	184,414	6,248
Recycling Manufacturing ¹	314	2,434,264	475,510	17,962
Reuse and Remanufacturing ²	357	118,613	32,606	3,269
Total	1,228	5,122,436	707,307	28,026

¹Three NAICS codes did not disclose data and two business categories of the survey did not provide enough data to draw conclusions.

²Two NAICS codes did not disclose data.

Results by Business Categories

The total number of establishments by business category is found in Table 6. The Recyclable Material Wholesalers category has the largest number of firms, 214. The study only identified one Glass Container Manufacturing Plant located in Missouri. For the Retail Used Merchandise Sales business category no information was provided in NAICS.

Direct, indirect, and induced sales effects are in Table 7. The total direct effects of the reporting business categories are \$5,122,436,000. There were five business categories not reporting number due to disclosure issues and two categories in which there was not enough information to draw conclusions.

Table 8 outlines the direct, indirect, and induced effects of payroll to employees involved in RRR. The total direct payroll of reported business categories is \$707,307,000 with induced effects of \$1,759,337,000. The Paper and Paperboard Mills/Deinked Market has the largest number of direct payroll to employees, \$197,175,000. The Compost and

Miscellaneous Organics Producers business category has the second largest direct payroll, \$105,366,000 and induced effects of \$323,031,000.

The distribution of employees working in the RRR industry and the indirect and induced employment effect of the industry is summarized in Table 9. The Compost and Miscellaneous Organics Producers has the largest number followed by the Nonferrous Foundries with 3,002 direct employees and 6,315 induced employees.

Table 6

Total Number of Firms by Business Category

	Total Number of Firms
<i>Recycling Collection</i>	
1. Government Staffed Residential Curbside	68
2. Private Staffed Residential Curbside Collection	131
<i>Recycling Processing</i>	
3. Compost and Miscellaneous Organics Producers	102
4. Materials Recovery Facilities	42
5. Recyclable Material Wholesalers	214
<i>Recycling Manufacturing</i>	
6. Glass Container Manufacturing Plants	1
7. Glass Product Producers (other recycled uses)	13
8. Nonferrous Secondary Smelting and Refining	5
9. Nonferrous Product Producers	3
10. Nonferrous Foundries	50
11. Paper and Paperboard Mills/Deinked Market	72
12. Paper-based Product Manufacturers	22
13. Pavement Mix Producers (asphalt and aggregate)	4
14. Plastics Reclaimers	15
15. Plastic Converters	48
16. Rubber Product Manufacturers	16
17. Steel Mills	2
18. Iron and steel foundries	23
19. Other recycling processors and manufacturers	40
<i>Reuse and Remanufacturing</i>	
20. Computer and Electronic Appliance Demanufacturers	23
21. Motor Vehicle Parts	197
22. Retail Used Merchandise Sales	(D)
23. Tire Retreaders	18
24. Wood Reuse	36
25. Materials Exchange Services	68
26. Other Reuse	15

Note: For all business categories in which survey data was used, the estimated number of firms was determined by the total number of firms in each categories determined by the research multiplied by the total percent of completed surveys involved in recycling (53%).

Table 7

Economic Impact of Sales (\$1,000) by Business Category

	Direct	Indirect	Induced
<i>Recycling Collection</i>			
1. Government Staffed Residential Curbside ¹	7,239	10,386	13,799
2. Private Staffed Residential Curbside Collection ¹	14,153	20,305	26,978
Recycling Collection Subtotal	21,392	30,691	40,777
<i>Recycling Processing</i>			
3. Compost and Miscellaneous Organics Producers ²	208,488	299,222	351,636
4. Materials Recovery Facilities ³	580	832	1,106
5. Recyclable Material Wholesalers	2,339,099	3,004,408	4,150,965
Recycling Processing Subtotal	2,548,167	3,304,462	4,503,707
<i>Recycling Manufacturing</i>			
6. Glass Container Manufacturing Plants	(D)	(D)	(D)
7. Glass Product Producers (other recycled uses) ⁴	121,394	170,000	218,412
8. Nonferrous Secondary Smelting and Refining	(D)	(D)	(D)
9. Nonferrous Product Producers	110,386	137,596	170,082
10. Nonferrous Foundries	346,912	471,939	625,239
11. Paper and Paperboard Mills/Deinked Market	1,077,368	1,678,108	1,989,791
12. Paper-based Product Manufacturers ⁵	192,500	265,958	329,387
13. Pavement Mix Producers (asphalt and aggregate) ⁶	*	*	*
14. Plastics Reclaimers ⁷	3,795	5,463	6,489
15. Plastic Converters	429,949	605,927	731,515
16. Rubber Product Manufacturers ⁸	*	*	*
17. Steel Mills	(D)	(D)	(D)
18. Iron and steel foundries	151,040	213,963	283,47
19. Other recycling processors and manufacturers ⁹	920	1,301	1,619
Recycling Manufacturing Subtotal	2,434,264	3,412,659	4,072,534
<i>Reuse and Remanufacturing</i>			
20. Computer and Electronic Appliance Demanufacturers ¹⁰	1,978	2,535	3,477
21. Motor Vehicle Parts	(D)	(D)	(D)
22. Retail Used Merchandise Sales	(D)	(D)	(D)
23. Tire Retreaders	47,551	62,396	79,933
24. Wood Reuse ¹¹	60,372	100,181	128,725
25. Materials Exchange Services ¹²	3,672	4,521	5,163
26. Other Reuse ¹³	5,040	6,474	8,944
Reuse and Remanufacturing Subtotal	118,613	176,107	226,242
Total RRR Sales	5,122,436	6,923,919	8,843,260

* Not enough information collected in the survey to draw conclusion.

¹ Based on calculations found in Appendix G.

² Based of averages (n = 12).

³ Based of averages (n = 4).

⁴ Based of averages (n = 2).

⁵ Based of averages (n = 1).

⁶ There were no responses returned in the pavement mix producers therefore no conclusions can be made.

⁷ Based of averages (n = 5).

⁸ Only one response was received for the rubber product manufactures, and only 5% of the firm was involved in rubber manufacturing therefore, was not enough information was available to draw conclusions.

⁹ Based of averages (n = 2).

¹⁰ Based of averages (n = 2).

¹¹ Based of averages (n = 7).

¹² Based of averages (n = 4).

¹³ Based of averages (n = 7).

Table 8

Economic Impact of Employee Payroll (\$1,000) by Business Category

	Direct	Indirect	Induced
<i>Recycling Collection</i>			
1. Government Staffed Residential Curbside ¹	4,998	7,040	9,407
2. Private Staffed Residential Curbside Collection ¹	9,779	13,774	18,406
Recycling Collection Subtotal	14,777	20,814	27,813
<i>Recycling Processing</i>			
3. Compost and Miscellaneous Organics Producers ²	105,366	241,731	323,031
4. Materials Recovery Facilities ³	3,570	5,028	6,719
5. Recyclable Material Wholesalers	75,478	98,257	131,309
Recycling Processing Subtotal	184,414	345,016	461,059
<i>Recycling Manufacturing</i>			
6. Glass Container Manufacturing Plants	(D)	(D)	(D)
7. Glass Product Producers (other recycled uses) ⁴	22,542	33,464	44,719
8. Nonferrous Secondary Smelting and Refining	(D)	(D)	(D)
9. Nonferrous Product Producers	16,281	26,377	35,248
10. Nonferrous Foundries	86,371	122,620	163,863
11. Paper and Paperboard Mills/Deinked Market	197,175	456,401	609,902
12. Paper-based Product Manufacturers ⁵	38,500	67,144	89,728
13. Pavement Mix Producers (asphalt and aggregate) ⁶	*	*	*
14. Plastics Reclaimers ⁷	1,125	2,286	3,055
15. Plastic Converters	73,631	132,116	176,552
16. Rubber Product Manufacturers ⁸	*	*	*
17. Steel Mills	(D)	(D)	(D)
18. Iron and steel foundries	39,445	58,272	77,872
19. Other recycling processors and manufacturers ⁹	440	788	1,052
Recycling Manufacturing Subtotal	475,510	767,352	1,201,991
<i>Reuse and Remanufacturing</i>			
20. Computer and Electronic Appliance Demanufacturers ¹⁰	1,081	1,388	1,855
21. Motor Vehicle Parts	(D)	(D)	(D)
22. Retail Used Merchandise Sales	(D)	(D)	(D)
23. Tire Retreaders	8,778	12,186	16,284
24. Wood Reuse ¹¹	20,124	34,305	45,842
25. Materials Exchange Services ¹²	748	921	1,231
26. Other Reuse ¹³	1,875	2,441	3,262
Reuse and Remanufacturing Subtotal	32,606	51,241	68,474
Total RRR Payroll	707,307	1,184,423	1,759,337

* Not enough information collected in the survey to draw conclusion.

¹ Based on calculations found in appendix F.

² Based of averages (n = 12).

³ Based of averages (n = 4).

⁴ Based of averages (n = 2).

⁵ Based of averages (n = 1).

⁶ There were no responses returned in the pavement mix producers therefore no conclusions can be made.

⁷ Based of averages (n = 5).

⁸ Only one response was received for the rubber product manufactures, and only 5% of the firm was involved in rubber manufacturing therefore, was not enough information was available to draw conclusions.

⁹ Based of averages (n = 2).

¹⁰ Based of averages (n = 2).

¹¹ Based of averages (n = 7).

¹² Based of averages (n = 4).

¹³ Based of averages (n = 7).

Table 9

Economic Impact of Employment by Business Category			
	Direct	Indirect	Induced
<i>Recycling Collection</i>			
1. Government Staffed Residential Curbside ¹	185	274	402
2. Private Staffed Residential Curbside Collection ¹	362	537	786
Recycling Collection Subtotal	547	811	1,188
<i>Recycling Processing</i>			
3. Compost and Miscellaneous Organics Producers ²	3,468	7,452	11,099
4. Materials Recovery Facilities ³	294	436	638
5. Recyclable Material Wholesalers	2,486	3,542	5,478
Recycling Processing Subtotal	6,248	11,430	17,215
<i>Recycling Manufacturing</i>			
6. Glass Container Manufacturing Plants	375 ¹⁴	626	1,342
7. Glass Product Producers (other recycled uses) ⁴	1,196	1,757	2,647
8. Nonferrous Secondary Smelting and Refining	750 ¹⁴	1,909	2,863
9. Nonferrous Product Producers	607	1,023	1,505
10. Nonferrous Foundries	3,002	4,251	6,315
11. Paper and Paperboard Mills/Deinked Market	6,005	15,880	23,284
12. Paper-based Product Manufacturers ⁵	836	1,431	2,134
13. Pavement Mix Producers (asphalt and aggregate) ⁶	*	*	*
14. Plastics Reclaimers ⁷	60	114	167
15. Plastic Converters	2,855	5,386	8,125
16. Rubber Product Manufacturers ⁸	*	*	*
17. Steel Mills	750 ¹⁴	1,831	2,841
18. Iron and steel foundries	1,446	2,185	3,287
19. Other recycling processors and manufacturers ⁹	80	151	228
Recycling Manufacturing Subtotal	17,962	35,113	54,738
<i>Reuse and Remanufacturing</i>			
20. Computer and Electronic Appliance Demanufacturers ¹⁰	46	62	92
21. Motor Vehicle Parts	1,750 ¹⁴	2,494	3,856
22. Retail Used Merchandise Sales	(D)	(D)	(D)
23. Tire Retreaders	385	528	778
24. Wood Reuse ¹¹	900	1,350	1,772
25. Materials Exchange Services ¹²	68	83	116
26. Other Reuse ¹³	120	171	264
Reuse and Remanufacturing Subtotal	3,269	4,688	6,878
Total RRR Employees	28,026	52,042	80,019

* Not enough information collected in the survey to draw conclusion.

¹ Based on calculations found in Appendix G.

² Based of averages (n = 12).

³ Based of averages (n = 4).

⁴ Based of averages (n = 2).

⁵ Based of averages (n = 1).

⁶ There were no responses returned in the pavement mix producers therefore no conclusions can be made.

⁷ Based of averages (n = 5).

⁸ Only one response was received for the rubber product manufactures, and only 5% of the firm was involved in rubber manufacturing therefore, was not enough information was available to draw conclusions.

⁹ Based of averages (n = 2).

¹⁰ Based of averages (n = 2).

¹¹ Based of averages (n = 7).

¹² Based of averages (n = 4).

¹³ Based of averages (n = 7).

¹⁴ Based on average employee range from NAICS.

Results by Industry Sector

The following tables outline results by industry sector. In Table 10 the number of Recycling Processing, Recycling Manufacturing, and Reuse and Remanufacturing firms are relatively similar across industry sector.

Table 10

Total Number of Firms by Industry Sector

	Total Number of Firms
Recycling Collection	199
Recycling Processing	358
Recycling Manufacturing	314
Reuse and Remanufacturing ¹	357
Total	1,228

¹One NAICS code did not disclose data.

Table 11 shows the total amount of annual sales by industry sector. The Recycling Processing direct sales are \$2,548,167,000 followed closely by the Recycling Manufacturing industry with \$2,434,264,000. Recycling Collection represents the sector with the smallest amount of sales with \$21,392,000 in direct sales. The total effect, or induced effect, of RRR industry sales in the state of Missouri is \$8,843,260,000.

Table 11

Economic Impact of Sales (\$1,000) by Industry Sector

	Direct	Indirect	Induced
Recycling Collection	21,392	30,691	40,777
Recycling Processing	2,548,167	3,304,462	4,503,707
Recycling Manufacturing ¹	2,434,264	3,412,659	4,072,534
Reuse and Remanufacturing ²	118,613	176,107	226,242
Total	5,122,436	6,923,919	8,843,260

¹Three NAICS codes did not disclose data and two business categories of the survey did not provide enough data to draw conclusions.

²Two NAICS codes did not disclose data.

Total payroll for RRR employees is found in Table 12. The largest amount of benefit to employees is in the Recycling Manufacturing sector. The total payroll for Recycling Manufacturing is more than two and a half times that of the Recycling Processing sector and more than 32 times the compensation paid to Recycling Collection employees. The

total direct impact of payroll to RRR employees is \$707,307,000 with a total effect of \$1,759,337,000.

Table 12

Economic Impact of Payroll (\$1,000) by Industry Sector

	Direct	Indirect	Induced
Recycling Collection	14,777	20,814	27,813
Recycling Processing	184,414	345,016	461,059
Recycling Manufacturing ¹	475,510	767,352	1,201,991
Reuse and Remanufacturing ²	32,606	51,241	68,474
Total	707,307	1,184,423	1,759,337

¹ Three NAICS codes did not disclose data and two business categories of the survey did not provide enough data to draw conclusions.

² Two NAICS codes did not disclose data.

There are a total of 28,026 employees involved in the RRR industry, as outline in Table 13. The Recycling Manufacturing sector employs more than half of the total, 17,962. The Recycling Processing employs the second highest total with 6,248. The total effect, or inducted effect, of the 28,026 direct employees is 80,019 employees.

Table 13

Economic Impact of Employment by Industry Sector

	Direct	Indirect	Induced
Recycling Collection	547	811	1,188
Recycling Processing	6,248	11,430	17,215
Recycling Manufacturing ¹	17,962	35,113	54,738
Reuse and Remanufacturing ²	3,269	4,688	6,878
Total	28,026	52,042	80,019

¹ Three NAICS codes did not disclose data and two business categories of the survey did not provide enough data to draw conclusions.

² Two NAICS codes did not disclose data.

Table 14 summarizes direct, indirect, and induced effects by industry sector. Recycling Processing and Reuse and Remanufacturing sectors have the largest numbers of establishments, however the Recycling Manufacturing sector provides the most benefit to the state. The Recycling Manufacturing sector provides 48% of total direct sales, 67% of direct payroll, and 64% of direct employment.

Table 14

Direct, Indirect, and Induced Effects of the RRR Industry on the State of Missouri

	Number of Establishments	Sales (\$1,000)	Payroll (\$1,000)	Employees
<i>Recycling Collection</i>				
Direct Effect	199	21,392	14,777	547
Indirect Effect		30,691	20,814	811
Induced Effect		40,777	27,813	1,188
<i>Recycling Processing</i>				
Direct Effect	358	2,548,167	184,414	6,248
Indirect Effect		3,304,462	345,016	11,430
Induced Effect		4,503,707	461,059	17,215
<i>Recycling Manufacturing</i> ¹				
Direct Effect	314	2,434,264	475,510	17,962
Indirect Effect		3,412,659	767,352	35,113
Induced Effect		4,072,534	1,201,991	54,738
<i>Reuse and Remanufacturing</i> ²				
Direct Effect	357	118,613	32,606	3,269
Indirect Effect		176,107	51,241	4,688
Induced Effect		226,242	68,474	6,878
Total				
Direct Effect	1,228	5,122,436	707,307	28,026
Indirect Effect		6,923,919	1,184,423	52,042
Induced Effect		8,843,260	1,759,337	80,019

¹ Three NAICS codes did not disclose data and two business categories of the survey did not provide enough data to draw conclusions.

² Two NAICS codes did not disclose data.

Comparison of Missouri Industries

Table 15 contains a comparison of the direct effects of various industries within Missouri, based upon the 1997 NAICS data. The sum of direct effects for all 1997 Missouri NAICS industries is presented at the top of the Table. These figures include all industry direct effects, including the RRR industry. There are a total of 133,402 business

establishments in the state of Missouri that fall into 19 two digit NAICS industry codes.² The state’s RRR establishments have total sales of \$5,122,436,000, payroll of \$707,307,000, and 28,026 paid employees. Detailed information is included for five industries for comparison purposes.

Table 15

Summary of Direct Impacts of Various Industries on the State of Missouri

	Establishments	Sales (\$1,000)	Payroll (\$1,000)	Employees
Missouri Total	133,402	336,337,051 ¹	57,465,049	2,158,557
Construction	15,020	19,016,286	3,978,052	130,555
Accommodation and Food Service	11,150	6,780,812	1,933,340	203,849
Manufacturing	7,497	93,115,478	11,647,050	371,448
Real Estate and Rental and Leasing	5,550	3,991,137	698,146	31,301
Utilities	342	6,172,065	838,053	16,685
RRR Industry ²	1,228	5,122,436	707,307	28,026

¹Data were not available for the finance and insurance industry.

²Based on study results.

Direct Effects Found in Comparison to Other Statewide Studies

R.W. Beck has conducted a number of statewide recycling economic information studies. Table 16 provides a comparison of the direct impact results of the R. W. Beck studies to the results found in this study. California has the largest number of RRR firms, 5,324. Ohio employs the largest number of people in the RRR industry, as well the greatest amount of sales (\$22,514,778,000) and the largest payroll (\$3,602,743,000). Missouri ranks 10th in population among this group of 13 states, and 10th in the number of establishments, 8th in sales, 9th in both payroll, and 8th in number of employees.

² Mining; Utilities; Construction; Manufacturing; Wholesale Trade; Retail Trade; Transportation and Warehousing; Information; Finance and Insurance; Real Estate and Rental and Leasing; Professional, Scientific, and Technical Services; Management of Companies and Enterprises; Administrative and Support and Waste Management and Remediation Services; Educational Services; Health Care and Social Assistance; Arts, Entertainment, and Recreation; Accommodation and Food Service; Other Services (except Public Administration); and Auxiliaries, except Corporate, Subsidiary, and Regional Managing Offices

Table 16

Comparison of Statewide RRR Industries

	Establishments	Sales (\$1,000)	Payroll (\$1,000)	Employees
Missouri	1,228	5,122,436	707,307	28,026
California	5,324	14,182,174	2,249,894	84,245
Delaware	171	469,746	56,040	2,055
Florida	3,683	4,374,479	765,176	32,138
Illinois	2,412	12,267,184	1,849,637	56,249
Indiana	1,709	18,908,934	3,086,333	74,970
Massachusetts	1,437	3,580,518	557,648	19,445
Nebraska	417	683,132	109,192	4,323
New Jersey	1,982	5,869,095	850,574	26,929
New York	4,257	9,014,119	1,327,529	43,614
Ohio	3,177	22,514,778	3,602,743	98,302
Pennsylvania	3,247	18,398,776	2,886,264	81,322
Vermont	247	404,288	58,172	1,955

Other state totals from the USREIS.

The Recycling Manufacturing Industry makes up a large proportion of the entire RRR among these 13 states. Table 17 summarizes the direct impacts of the Recycling Manufacturing Industry in these states. Ohio has the largest Recycling Manufacturing Industry of the states listed; Vermont has the smallest number of Recycling Manufacturing establishments and the fewest employees. Missouri ranks 7th in establishments, 8th in sales, 8th in payroll, and 7th in employees.

Table 17

 Comparison of Statewide Recycling Manufacturing Industries

	Establishments	Sales (\$1,000)	Payroll (\$1,000)	Employees
Missouri	314	2,434,264	475,510	17,962
California	795	6,889,668	1,278,569	39,449
Delaware	30	340,349	38,514	1,075
Florida	261	1,978,021	344,548	10,288
Illinois	425	8,399,036	1,431,314	39,580
Indiana	386	16,887,198	2,829,494	63,269
Massachusetts	271	2,313,885	354,288	11,457
Nebraska	59	431,472	71,233	2,132
New Jersey	275	3,405,695	488,956	14,269
New York	396	5,493,192	799,431	22,688
Ohio	725	19,018,463	3,142,042	77,659
Pennsylvania	569	15,510,983	2,487,170	64,106
Vermont	24	338,525	48,358	1,386

 Other state totals from the USREIS.

RECOMMENDATIONS FOR FUTURE STUDIES

Recommendations for future studies are:

- Work more with the regional Solid Waste Management Districts to ensure all RRR firms located in the respective districts are included in the complete list of possible firms involved in the RRR industry;
- Increase the sample to which the survey was mailed to ensure several responses are collected from each business category and conclusions can be made. This goal could be accomplished by over-sampling the categories not represented in this study;
- Conduct a more in-depth economic analysis of the industries, which could include where inputs are purchased and where end products are sold using a survey instrument much like the longer pilot survey; and
- Conduct a similar study in 3 – 5 years to see how the RRR is changing in the state of Missouri.

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APPENDIX A – Business Categories Descriptions

Industry Segment	Business Categories in Sector	Typical SIC Code Assignments	Typical NAIC Code Assignments
<i>Recycling Collection</i>	1. Government Staffed Residential Curbside Collection Programs staffed by municipal, state or other government agencies which provide curbside, dropoff or other recycling collection services. Does not include programs focused on education, market development or other activities not directly supporting collection programs. Does not include municipal programs staffed by private contractors.	4212 Local Trucking Without Storage	562111 Solid Waste Collection (without disposal)
	2. Private Staffed Residential Curbside Collection Private sector establishments which provide recycling collection services to residential waste generators, sometimes under contract to municipal or state government agencies. The primary activity of many of these establishments is waste hauling.	4212 Local Trucking Without Storage	562111 Solid Waste Collection (without disposal)
<i>Recycling Processing</i>	3. Compost and Miscellaneous Organics Producers Establishments which produce compost, mulch, bark, and other soil amendment or landscaping products from source separated yard trimmings, discarded wood and food, biosolids and other organic feedstocks. This category also includes vermiculture.	2875 Fertilizers (mixing only)	325314 Fertilizers (mixing only)
	4. Materials Recovery Facilities Establishments which accept mixed and/or source separated recyclables, typically from municipal curbside and drop-off collection programs. Activities include sorting, baling, grinding, densifying and/or brokering recyclables for wholesale distribution. May also segregate recyclables from mixed solid waste. This category is intended to be defined consistently with the new NAIC category for materials recovery facilities.	4953 Refuse Systems	56292 Material Recovery Facilities
	5. Recyclable Material Wholesalers Establishments which process recycled materials by sorting, grading, densifying, removing contaminants and otherwise preparing the materials for shipment to manufacturing facilities for use in industrial production. Examples include paper stock dealers and scrap metal processors. These establishments may also provide recycling collection services. This category is intended to be defined consistently with the new NAIC category for recyclable material wholesalers.	5093 Scrap & Waste Material Wholesalers	42193 Recyclable Material Wholesalers
<i>Recycling Manufacturing</i>	6. Glass Container Manufacturing Plants Establishments which produce finished glass containers for shipment to bottlers, using recycled glass cullet as a feedstock. May also undertake beneficiation activities on site.	3221 Glass Containers	327213 Glass Containers

<i>Industry Segment</i>	Business Categories in Sector	Typical SIC Code Assignments	Typical NAIC Code Assignments
<i>Recycling Manufacturing cont.</i>	7. Glass Product Producers (other recycled uses) Establishments which produce products other than containers, using recycled glass as a feedstock. Examples include fiberglass, decorative tiles, glassware, and construction blocks.	3229 Pressed and Blown Glass and Glassware	327212 Pressed and Blown Glass and Glassware
	8. Nonferrous Secondary Smelting and Refining Mills Establishments involved in the recovery and alloying of nonferrous metals. Activities include grading, sorting, detinning, refining, and other processes. Produce intermediate products such as ingot. May also include fabrication of basic products. Note that primary smelters of nonferrous metals, excluding aluminum and copper, process scrap in addition to virgin materials. Primary aluminum and copper smelters do not process scrap.	3341 Secondary smelting and refining of nonferrous metals	331314, 331423, 331492 Miscellaneous metals Secondary Nonferrous Smelting, Refining and Alloying.
		3339 Primary smelting and refining of nonferrous metals, except copper and aluminum	
	9. Nonferrous Product Producers Establishments which produce a wide range of intermediate products through extrusion processes, primarily from billet manufactured in smelting operations. Many of these plants may also operate in-house casting operations which process unrefined nonferrous scrap.	3351 - 3356 Miscellaneous Nonferrous Products	331421, 331315, 331315, 331316, 331319 Miscellaneous Nonferrous Products
		10. Nonferrous Foundries Establishments which produce castings and die-castings of various non ferrous metals and alloys. Note that many manufacturers of specific end-products, e.g., automobiles, may operate foundries and purchase scrap.	3363 - 3369 Nonferrous Foundries
	11. Paper and Paperboard Mills/Deinked Market Pulp Producers Establishments that produce first stage intermediate paper and paper board products (e.g., paper rolls) using recovered paper or deinked market pulp as a feedstock. Also includes establishments which deink recovered paper and produce market pulp for sale to paper and paperboard mills.	2621 Paper Mills	322121 Paper Mills (Except newsprint)
2631 Paperboard Mills		322122 Newsprint Mills 32213 Paperboard Mills	
12. Paper-based Product Manufacturers Establishments which produce paper products other than traditional paper and paperboard products, using discarded paper as a feedstock. Examples include cellulose insulation, molded fiber products, construction board, hydro-seeding mulch or animal bedding.	2679 Miscellaneous Converted Paper and Paperboard Products	322299 Other Converted Paper Product Manufacturing (egg cartons, molded pulp)	

Industry Segment	Business Categories in Sector	Typical SIC Code Assignments	Typical NAIC Code Assignments
<i>Recycling Manufacturing cont.</i>	13. Pavement Mix Producers (asphalt and aggregate) Establishments which produce asphalt paving mix and aggregate for use in road construction using recycled pavement, asphalt, rubber modified asphalt and/or glass, in addition to virgin materials.	2951 Asphalt paving mixtures and blocks	324121 Asphalt paving mixtures and blocks
	14. Plastics Reclaimers Establishments which produce plastic pellets or granulated plastic suitable for use by plastics product manufacturers. Activities include separating, washing, grinding, flaking and/or pelletizing. This category also includes establishments which manufacture intermediate products directly from unprocessed recycled plastic, such as plastic lumber products.	3087 Custom Compounding of Purchased Plastics Resins	325991 Custom Compounding of Purchased Plastics Resins
	15. Plastic Converters Establishments which produce intermediate plastic products (e.g., molded products and components, sheet and fiber) using recycled pellets or granulated plastic as a feedstock.	3081 – 3083, 3086 Miscellaneous Plastics Products	3261 Plastic Product Manufacturing
	16. Rubber Product Manufacturers Establishments which produce first-stage intermediate products or end products using crumb rubber as a feedstock.	3069 Miscellaneous fabricated rubber products	3262 Rubber Product Manufacturing
		3011 Tires and inner tubes	
		3021 Rubber and plastics footwear	
		3052 Rubber & plastics hose & belting	
17. Steel Mills Basic oxygen furnaces (BOF) producing raw steel in various forms using a mix of scrap and molten iron made in blast furnaces from scrap and raw materials (iron ore, coke, limestone) and also electric arc furnaces (EAF) using scrap. Products from EAF mills are primarily slabs, billets or rebar. Products from BOF mills are primarily flat or rolled products. Activities include grading scrap, detinning, refining, and product fabrication. Additional fabrication and assembly of final stage products may occur at these facilities.	3053 Gaskets, packing and sealing devices	331111 Iron and Steel Mills	
	3312 Steel works, Blast Furnaces and Rolling Mills		

Industry Segment	Business Categories in Sector	Typical SIC Code Assignments	Typical NAIC Code Assignments
<i>Recycling Manufacturing cont.</i>	18. Iron and steel foundries Establishments which produce a wide range of cast steel products using unrefined scrap and steel ingot produced in steel mills. Activities may include grading scrap, refining and casting.	3321 - 3325 Iron and Steel Foundries	331511 – 331513 Iron and Steel Foundries
	19. Other recycling processors and manufacturers Other recycling processors and manufacturers, not elsewhere classified. May include used oil refiners, household hazardous waste processors, agricultural facilities or landscapers using ash or paper mill sludge, engineering applications of tires, and other users of materials not elsewhere classified.	Varied.	Varied.
	20. Computer and Electronic Appliance Demanufacturers Establishments which sort, classify, grade and remanufacture used electronic appliances, primarily computers. Remanufacture may encompass entire appliances or components. These establishments may also recycle materials not suitable for remanufacture.	5065 Electronic Parts, NEC 7278 Computer Maintenance and Repair	411690 Other Electronic Parts and Equipment Wholesale 811212 Computer & Office Machine Repair and Maintenance
	21. Motor Vehicle Parts Establishments which clean, sort, inspect and remanufacture used motor vehicle parts.	5015 Wholesale Used Motor Vehicle Parts	42114 Motor Vehicle Parts (Used Wholesale)
<i>Reuse and Remanufacturing</i>	22. Retail Used Merchandise Sales Establishments which operate retail sales facilities dedicated to reused products. Activities may include providing drop-off or pick-up collection services for used products; cleaning, repairing and otherwise preparing products for resale. Includes “thrift” stores, reusable product depots, reuse centers and product-specific stores such as used clothing and used sporting goods, not elsewhere classified.	42114 5932 Used Merchandise Stores (retail)	45331 Used Merchandise Stores (excluding pawn shops)
	23. Tire Retreaders Establishments which sort, clean, buff and remanufacture used tires by adding new tread. These establishments produce crumb rubber as a by-product.	7534 Tire Retreading and Repair Shops	326212 Tire Retreading
	24. Wood Reuse Establishments which produce graded lumber and/or finished goods by cleaning, grading, and otherwise processing used wood. Includes establishments which purchase used, damaged pallets and remanufacture for reuse. Does not include establishments whose primary product is fuel.	2448 Wood Pallets and Skids 2499 Wood Products, NEC	32192 Wood Container and Pallet Manufacturing 321999 Wood Products, NEC

Industry Segment	Business Categories in Sector	Typical SIC Code Assignments	Typical NAIC Code Assignments
<i>Reuse and Remanufacturing cont.</i>	25. Materials Exchange Services Establishments which provide listings and otherwise facilitate the reuse of products and materials, primarily by commercial and industrial establishments.	7389 Business Services NEC	54199 All Other Professional, Scientific, and Technical Services
	26. Other Reuse Establishments, not elsewhere classified, which purchase used equipment or merchandise and remanufacture, clean and otherwise prepare the used products for distribution.	5082-5084 Wholesale Machinery, Equipment, and Supplies	42181-42183 Wholesale Machinery, Equipment, and Supplies

APPENDIX B – Letter mailed to District Planners

March 12, 2004

Dear ,

We are writing to ask for your assistance with the Missouri Recycling Economic Information Study. This study has been commissioned and is being funded by the Environmental Improvement and Energy Resources Authority and the research is being conducted by the University of Missouri. The purpose of this study will be to help gauge the number of firms that are involved in recycling activities and their role in Missouri's economy. Once completed, this information will be used to help promote awareness of the recycling and reuse industry and serve as a reference tool for legislators who must evaluate the recycling industry.

Currently we are working on compiling a database of all recycling-related businesses or entities. The enclosed document outlines the definition of the recycling and reuse industry that is being utilized in this study along with examples. We know there are various definitions of the recycling industry, but we feel that the definitions included in this letter will provide us with a starting point for discussion of the economic impacts.

Included in this letter is a copy of all of the firms that we have been able to identify within your Solid Waste Management District. Please take a minute to review the firms we have identified in your district. If you know of any firms we have missed please make a note of the firms on the included form and any contact information that you may have and return it to us using the postage paid envelope. If you feel that any of the firms that we have included do not match the definition that we have established please let us know.

Each of the firms identified as part of the recycling industry in Missouri will receive a mail survey. The survey will include questions on the number of employees and their payroll, goods and services purchased, and where the goods and services were purchased. The study will be conducted in a confidential manner. Specific information on any one business will never be released to the public or shared with any other entity.

Thanks you for taking time from your busy schedule to help us in this effort. Without your assistance, it would be impossible to acquire this much needed-information. If you have any questions or suggestions regarding the study, please feel free to contact Morgan Mundell by phone at 573-882-4550 or by e-mail at mundellmm@missouri.edu or Ann Ulmer by phone at 573-884-5023 or by e-mail at ulmera@missouri.edu.

Sincerely,

Morgan Mundell
Assistant Director
Community Policy Analysis Center

Ann Ulmer
Research Analyst
Institute of Public Policy

Missouri Recycling Economic Information Study

Please review the enclosed list of recycling/reuse businesses in your district. If you know of any additions that need to be made to the list, simply fill in the information below. If you are unable to provide us with all the information requested below, please provide all available information so we will be able to contact them. When you are completed with the list, mail this page(s) using the postage paid envelope to the address at the bottom of the page. **Make additional copies of this sheet if needed.**

Your Information	
Name _____	Phone Number (____) _____
SWMD Letter _____	

Additional Businesses	
Business Name _____	Phone Number (____) _____
Address _____	
City _____	State, Zip _____
Business Name _____	Phone Number (____) _____
Address _____	
City _____	State, Zip _____
Business Name _____	Phone Number (____) _____
Address _____	
City _____	State, Zip _____
Business Name _____	Phone Number (____) _____
Address _____	
City _____	State, Zip _____

Additional Businesses	
Business Name _____	Phone Number () _____
Address _____	
City _____	State, Zip _____
Business Name _____	Phone Number () _____
Address _____	
City _____	State, Zip _____
Business Name _____	Phone Number () _____
Address _____	
City _____	State, Zip _____
Business Name _____	Phone Number () _____
Address _____	
City _____	State, Zip _____
Business Name _____	Phone Number () _____
Address _____	
City _____	State, Zip _____
Business Name _____	Phone Number () _____
Address _____	
City _____	State, Zip _____

APPENDIX C – Pilot Study Documents

Short Survey and Cover Letter

Dear Recycling Coordinator:

We need your help! Recycling saves natural resources and reduces energy consumption, but it is also an important economic factor in the state's economy. We are involved in a study designed to obtain valuable information that will be used to inform the public about the economic importance of the recycling industry in Missouri. Your help is critical to the success of this project

This study was commissioned and is being funded by the Environmental Improvement and Energy Resources Authority and is being conducted by the University of Missouri. The survey should take less than 5 minutes to complete. Be assured that your responses will be kept confidential, and that your participation in this survey is voluntary. Specific information about any business will never be released to the public or shared with any other entity; only summary information will be reported. The number stamped on the front of the survey is to help us keep your responses confidential and to avoid unnecessary mailings. If you would prefer not to answer a particular question, simply leave it blank and continue to the next question.

The survey consists of 7 questions. The first question identifies your involvement in the Missouri recycling industry. If you are not part of the industry, question one is the only question in which we ask you to respond. The remaining six questions deal with the types of recycling that your business is active in and economic data about your business. If you have any additional comments on the study, please write in the space provided on the back of the survey.

Thank you for taking time from your busy schedule to complete this survey. Without your assistance, it would be impossible to acquire this much-needed information. If you have any questions or suggestions regarding the study, please feel free to contact David Valentine by phone at 573-884-5475 or by e-mail at valentined@missouri.edu or Ann Ulmer by phone at 573-884-5023 or by e-mail at ulmera@missouri.edu. For additional information regarding human participation in research, contact the University of Missouri Institutional Review Board Office at 573-882-9585.

Sincerely,

David Valentine
Senior Policy Analyst
Institute of Public Policy

Ann Ulmer
Research Analyst
Institute of Public Policy

Missouri Recycling Economic Information Study



Commissioned by the
Environmental Improvement and
Energy Resources Authority
Conducted by the
Institute of Public Policy
University of Missouri – Columbia

Please complete a separate form for each business location. Make photocopies as necessary. This information will be used to create an input-output model that be used to develop an economic picture of the recycling industry in Missouri.*

1. Does your firm or organization sell or purchase recycled material on a regular basis in Missouri? *(Please circle the correct response)*

YES

NO

If "NO" please stop and return this form in the enclosed envelope.

If "YES" please proceed to the following questions.

2. Please indicate the percentage of business practices in the applicable categories by writing in the percentage to the left of the category. (For example, if a quarter of your business is dedicated to organic processing place "25" to the left of the "Compost/Organic processing" category below.) It is possible for a firm to be engaged in two types of recycling. It is also possible for a firm to only dedicate a small percentage of its total time to recycling; therefore the answer may not add up to 100% unless the entire business is dedicated to recycling.

Recycling Collection

_____ Government-staffed collection

_____ Private-staffed collection

Recycling Processing and Manufacturing

_____ Compost/organic processing

_____ Fiberglass insulation producer

_____ Glass container manufacturing

_____ Glass product producer (other recycled uses)

_____ Household hazardous waste processor

_____ Materials recovery facility (commingled materials)

_____ Nonferrous product producer

_____ Nonferrous foundry

_____ Nonferrous smelting or refining mill

_____ Oil processor

_____ Paper, paperboard, or market pulp mill

_____ Paper-based product manufacturing (i.e. insulation, bedding)

_____ Pavement mix producer - asphalt or aggregate

_____ Plastics converter

_____ Plastics reclaimer

_____ Recyclable materials processor (i.e. paper, metal)

_____ Rubber product manufacturing

_____ Steel or iron manufacturing

_____ Steel mill

* You must be 18 years of age or older to complete this survey.

Reuse & Remanufacturing

- Computer / electronic appliance remanufacturing
 - Equipment or toner cartridge remanufacturer
 - Motor vehicle part manufacturer
 - Retail used merchandise sales
 - Tire retreader
 - Wood reuse or pallet rebuilder
-

Support Business

- Broker
 - Materials exchange services
 - Recycling and reuse equipment manufacturer
 - Transporter
-

Other

- Other recycling processor / manufacturer
 - Other reuse / remanufacturer
 - Other – None of the above, please specify below
-

7. Please indicate the **total** amount paid in taxes in 2003 for each of the following categories:

Federal \$ _____

State \$ _____

Local \$ _____

Please use the following space to describe any other recycling activities and to provide any additional comments you may have.

41

3. Please indicate the **total** number of full-time employees (work 40 hours per week) at this location in 2003.

4. Please indicate the **total** number of part-time employees (work less than 40 hours per week) at this location in 2003.

5. Please indicate the **total** annual payroll at this location in 2003.

\$ _____

6. Please indicate the **total** receipts at this location in 2003.

\$ _____

Thank you for your time and assistance!
Please return the questionnaire in the enclosed self-addressed, postage-paid envelop.

This survey is part of an effort of the Environmental Improvement and Energy Resources Authority and the Missouri Department of Natural Resources to illustrate the economic impact the recycling industry plays in our state. If you have any questions about this survey, please contact David Valentine at 573-884-5475 or Ann Ulmer at 573-884-3381.

Long Survey and Cover Letter

Dear Recycling Coordinator:

We need your help! Recycling saves natural resources and reduces energy consumption, but it is also an important economic factor in the state's economy. We are involved in a study designed to obtain valuable information that will be used to inform the public about the economic importance of the recycling industry in Missouri. Your help is critical to the success of this project

This study was commissioned and is being funded by the Environmental Improvement and Energy Resources Authority and is being conducted by the University of Missouri. The survey should take less than an hour to complete. Be assured that your responses will be kept confidential, and that your participation in this survey is voluntary. Specific information about any business will never be released to the public or shared with any other entity; only summary information will be reported. The number stamped on the front of the survey is to help us keep your responses confidential and to avoid unnecessary mailings. If you would prefer not to answer a particular question, simply leave it blank and continue to the next question.

The survey consists of 7 questions plus questions about cost factors. The first question identifies your involvement in the Missouri recycling industry. If you are not part of the industry, question one is the only question in which we ask you to respond. The remaining six questions deal with the types of recycling that your business is active in and economic data about your business. The input portion of the survey identifies your possible business costs in order to get a picture of the economic impact of recycling in Missouri. If you have any additional comments on the study, please write in the space provided on the back of the survey.

Thank you for taking time from your busy schedule to complete this survey. Without your assistance, it would be impossible to acquire this much-needed information. If you have any questions or suggestions regarding the study, please feel free to contact David Valentine by phone at 573-884-5475 or by e-mail at valentined@missouri.edu or Ann Ulmer by phone at 573-884-5023 or by e-mail at ulmera@missouri.edu. For additional information regarding human participation in research, contact the University of Missouri Institutional Review Board Office at 573-882-9585.

Sincerely,

David Valentine
Senior Policy Analyst
Institute of Public Policy

Ann Ulmer
Research Analyst
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Missouri Recycling Economic Information Study



Commissioned by the
Environmental Improvement and
Energy Resources Authority
Conducted by the
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University of Missouri – Columbia

Please complete a separate form for each business location. Make photocopies as necessary. This information will be used to create an input-output model that be used to develop an economic picture of the recycling industry in Missouri.*

1. Does your firm or organization sell or purchase recycled material on a regular basis in Missouri? *(Please circle the correct response)*

YES

NO

If "NO" please stop and return this form in the enclosed envelope.

If "YES" please proceed to the following questions.

2. Please indicate the percentage of business practices in the applicable categories by writing in the percentage to the left of the category. (For example, if a quarter of your business is dedicated to organic processing place "25" to the left of the "Compost/Organic processing" category below.) It is possible for a firm to be engaged in two types of recycling. It is also possible for a firm to only dedicate a small percentage of its total time to recycling; therefore the answer may not add up to 100% unless the entire business is dedicated to recycling.

Recycling Collection

_____ Government-staffed collection
_____ Private-staffed collection

Recycling Processing and Manufacturing

_____ Compost/organic processing
_____ Fiberglass insulation producer
_____ Glass container manufacturing
_____ Glass product producer (other recycled uses)
_____ Household hazardous waste processor
_____ Materials recovery facility (commingled materials)
_____ Nonferrous product producer
_____ Nonferrous foundry
_____ Nonferrous smelting or refining mill
_____ Oil processor
_____ Paper, paperboard, or market pulp mill
_____ Paper-based product manufacturing (i.e. insulation, bedding)
_____ Pavement mix producer - asphalt or aggregate
_____ Plastics converter
_____ Plastics reclaimer
_____ Recyclable materials processor (i.e. paper, metal)
_____ Rubber product manufacturing
_____ Steel or iron manufacturing
_____ Steel mill

* You must be 18 years of age or older to complete this survey.

Reuse & Remanufacturing	
_____	Computer / electronic appliance remanufacturing
_____	Equipment or toner cartridge remanufacturer
_____	Motor vehicle part manufacturer
_____	Retail used merchandise sales
_____	Tire retreader
_____	Wood reuse or pallet rebuilder
Support Business	
_____	Broker
_____	Materials exchange services
_____	Recycling and reuse equipment manufacturer
_____	Transporter
Other	
_____	Other recycling processor / manufacturer
_____	Other reuse / remanufacturer
_____	Other – None of the above, please specify below

3. Please indicate the **total** number of full-time employees (work 40 hours per week) at this location in 2003.

4. Please indicate the **total** number of part-time employees (work less than 40 hours per week) at this location in 2003.

5. Please indicate the **total** annual payroll at this location in 2003.

\$ _____

6. Please indicate the **total** receipts at this location in 2003.

\$ _____

7. Please indicate the **total** amount paid in taxes in 2003 for each of the following categories:

Federal \$ _____

State \$ _____

Local \$ _____

The Input/Expense Categories should identify inputs that you have into your business. An input is any good or service that you put into your business in order to produce a final product or service. There are several categories listed below and a section for you to write in all other inputs categories that are not included.

The following questions ask what you provide the costs of goods and services used by your firm in calendar year 2003. Where the data are not available, please make an estimate. The value of the input or cost to the business should only appear in one category. If the expense appears to fall into two categories, please place it in the category in which it best fits to or write it in as any other at the end of this section.

Operating Expenses

Input/Expense Category	Cost of the Input
_____	_____

Advertising Expenses

Newspaper Advertising _____

Radio/TV Advertising _____

Packaging Supplies	
Cardboard boxes	_____
Metal can, box, or other container	_____
Plastic packaging material (including film and sheet)	_____
Wood containers or pallets	_____
Repair and Maintenance	
Building	_____
Commercial Machinery	_____
Electronic Equipment	_____
Vehicle	_____
Transportation	
Railroad	_____
Trucking	_____
Utilities	
Electricity	_____
Natural Gas	_____
Sewer	_____
Water	_____
Other Services	
Accounting/Bookkeeping	_____

Banking Services and Fees (including interest payments)	_____
Commercial Printing	_____
Computer Services	_____
Directory or Database Publishers (i.e. Yellow Pages, Recycling Directories)	_____
Employment Services	_____
Insurance	_____
Legal Services	_____
Other financial services (includes clearing checks and credit card transactions)	_____
Outside Management and Consulting Services	_____
Telephone	_____
Warehousing and Storage Costs	_____
Other Costs	
Automotive Parts	_____
Environmental Clean-up	_____
Janitorial Supplies	_____
Purchasing of Vehicles	_____
Office Supplies	_____
Wholesale trade (include all products purchased as wholesale prices, i.e. Sam's Club)	_____

How often does equipment need to be replaced (5 – 10 years) and what is the replacement cost? Please list major equipment used, life of equipment, replacement cost:

Equipment	Life Expectancy in years	Replacement Cost

Please list all other major costs that were not included in the rest of the survey.

Expense Category	Total Value

Please use the following space to describe any other recycling activities and to provide any additional comments you may have.

**Thank you for your time and assistance!
Please return the questionnaire in the enclosed
self-addressed, postage-paid envelop.**

This survey is part of an effort of the Environmental Improvement and Energy Resources Authority and the Missouri Department of Natural Resources to illustrate the economic impact the recycling industry plays in our state. If you have any questions about this survey, please contact David Valentine at 573-884-5475 or Ann Ulmer at 573-884-5023.

APPENDIX D – Final Survey Documents

Dear Recycling Coordinator:

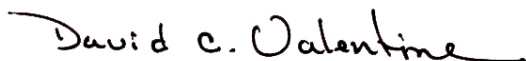
We need your help! Recycling saves natural resources and reduces energy consumption, but it is also an important economic factor in the state's economy. We are involved in a study designed to obtain valuable information that will be used to inform the public about the economic importance of the recycling industry in Missouri. Your help is critical to the success of this project

This study was commissioned and is being funded by the Environmental Improvement and Energy Resources Authority and is being conducted by the University of Missouri. The survey should take less than 5 minutes to complete. Be assured that your responses will be kept confidential, and that your participation in this survey is voluntary. Specific information about any business will never be released to the public or shared with any other entity; only summary information will be reported. The number stamped on the front of the survey is to help us keep your responses confidential and to avoid unnecessary mailings. If you would prefer not to answer a particular question, simply leave it blank and continue to the next question.

The survey consists of 6 questions. The first question identifies your involvement in the Missouri recycling industry. If you are not part of the industry, question one is the only question in which we ask you to respond. The remaining five questions deal with the types of recycling that your business is active in and economic data about your business. If you have any additional comments on the study, please write in the space provided on the back of the survey.

Thank you for taking time from your busy schedule to complete this survey. Without your assistance, it would be impossible to acquire this much-needed information. If you have any questions or suggestions regarding the study, please feel free to contact David Valentine by phone at 573-884-5475 or by e-mail at valentined@missouri.edu or Ann Ulmer by phone at 573-884-5023 or by e-mail at ulmera@missouri.edu. For additional information regarding human participation in research, contact the University of Missouri Institutional Review Board Office at 573-882-9585.

Sincerely,



David Valentine
Senior Policy Analyst
Institute of Public Policy



Ann Ulmer ¹⁰⁷
Research Analyst
Institute of Public Policy

Missouri Recycling Economic Information Study



Commissioned by the
Environmental Improvement and
Energy Resources Authority
Conducted by the
Institute of Public Policy
University of Missouri – Columbia

Please complete a separate form for each business location. Make photocopies as necessary. This information will be used to create an input-output model that be used to develop an economic picture of the recycling industry in Missouri.*

1. Does your firm or organization sell or purchase recycled material on a regular basis in Missouri? *(Please circle the correct response)*

YES

NO

If "NO" please stop and return this form in the enclosed envelope.

If "YES" please proceed to the following questions.

2. Please indicate the percentage of covered business practices in each of the following applicable categories. The answer may not add up to 100% unless the entire business is dedicated to recycling.

Covered business practices:

- Transforming scrap materials or products into a recycled raw material
- Transforming recycled raw materials into a first intermediate product (e.g. sheet, fiber, roll)
- Transforming recycled raw materials directly into a finished product
- Preparing used products for reuse
- Manufacturing equipment for the recycling or reuse industries

Covered activities do not include converting a first intermediate product to finished products or preparing material for fuel use.

Recycling Collection

% Government-staffed collection
 Private-staffed collection

Recycling Processing and Manufacturing

% Compost/organic processing
 Fiberglass insulation producer
 Glass container manufacturing
 Glass product producer (other recycled uses)
 Household hazardous waste processor
 Materials recovery facility (commingled materials)
 Nonferrous product producer
 Nonferrous foundry
 Nonferrous smelting or refining mill
 Oil processor
 Paper, paperboard, or market pulp mill

* You must be 18 years of age or older to complete this survey.

_____ Paper-based product manufacturing (i.e. insulation, bedding)
 _____ Pavement mix producer – asphalt or aggregate
 _____ Plastics converter
 _____ Plastics reclaimer
 _____ Recyclable materials processor (i.e. paper, metal)
 _____ Rubber product manufacturing
 _____ Steel or iron manufacturing
 _____ Steel mill

Reuse & Remanufacturing

_____ % Computer / electronic appliance remanufacturing
 _____ Equipment or toner cartridge remanufacturer
 _____ Motor vehicle part manufacturer
 _____ Retail used merchandise sales
 _____ Tire retreader
 _____ Wood reuse or pallet rebuilder

Support Business

_____ % Broker
 _____ Materials exchange services
 _____ Recycling and reuse equipment manufacturer
 _____ Transporter

Other

_____ % Other recycling processor / manufacturer
 _____ Other reuse / remanufacturer
 _____ Other – None of the above, please specify below

3. Total number of employees:

0 – 9
 10 – 24
 25 – 49
 50 – 99
 100 – 199
 200 – 299
 300 – 399
 400 – 499
 500 – 1,000

_____ Please fill in if
 greater than 1,000

4. Total Annual Payroll 2003⁽¹⁾

\$0 – \$49,999
 \$50,000 – \$99,999
 \$100,000 – \$149,999
 \$150,000 – \$499,999
 \$500,000 – \$999,999
 \$1,000,000 – \$2,499,999
 \$2,500,000 – \$4,999,999
 \$5,000,000 – \$9,999,999
 \$10,000,000 – \$19,999,999
 \$20,000,000 – \$30,000,000

_____ Please fill in if
 greater than \$30,000,000

⁽¹⁾Payroll includes total salary, hourly pay, bonuses, commissions, sick-leave pay, free meals, and benefits received by employees.

5. Total Annual Receipts 2003⁽²⁾

\$0 – \$99,999
 \$100,000 – \$249,999
 \$250,000 – \$499,999
 \$500,000 – \$999,999
 \$1,000,000 – \$2,499,999
 \$2,500,000 – \$4,999,999
 \$5,000,000 – \$7,499,999
 \$7,500,000 – \$9,999,999
 \$10,000,000 – \$19,999,999
 \$20,000,000 – \$49,999,999
 \$50,000,000 – \$74,999,999
 \$75,000,000 – \$100,000,000

_____ Please fill in if
 greater than \$100,000,000

6. Total Annual Taxes 2003

Local \$ _____

State \$ _____

Federal \$ _____

⁽²⁾ Receipts include revenue of all forms (sales, fees, rents, Commissions, interest, dividends) minus all local, state, and federal tax revenue collected.

Please use the following space to describe any other recycling activities and to provide any additional comments you may have.

**Thank you for your time and assistance!
 Please return the questionnaire in the enclosed
 self-addressed, postage-paid envelope.**

This survey is part of an effort of the Environmental Improvement and Energy Resources Authority and the Missouri Department of Natural Resources to illustrate the economic impact the recycling industry plays in our state. If you have any questions about this survey, please contact David Valentine at 573-884-5475 or Ann Ulmer at 573-884-5023.

Follow-up Postcard

A few days ago, you should have received a survey from the Institute of Public Policy at the University of Missouri on the impact of recycling in Missouri. If you have not taken the time to complete the survey, we ask that you take a few minutes to fill it out and return it in the postage-paid envelope. Your response is very important because only a small number of firms have been selected to help us. Please be assured that your survey information will be kept strictly confidential. For more information please call 573-884-5475 or 573-884-5023.

Thank you for your assistance!

David Valentine
Senior Policy Analyst
Institute of Public Policy

Ann Ulmer
Research Analyst
Institute of Public Policy

APPENDIX E – Response Rate Calculation

Response Rate

Dillman 1978 identifies response rate calculation as:

$$\text{Response rate} = \frac{(107) \text{ number returned}}{(750) \text{ number in sample} - ((95) \text{ noneligible} + (164) \text{ nonreachable})} \times 100$$

An example a noneligible contact would be if the population were taken from registered voters and 15 out of the sample were not registered then they would be considered noneligible. In this study firms were considered noneligible if they were not involved in the recycling industry. Also if after repeated attempts have been made to reach a member of the sample and no contact can be made then that individual would be considered nonreachable.

APPENDIX F – NAICS Codes and Calculations Used for Existing Data

Business Sector	NAICS Code(s)	Calculation Method
5. Recyclable Material Wholesalers	42193	No adjustment was made to NAICS data.
6. Glass Container Manufacturing Plants	327213	Employment, payroll, and receipts were adjusted to 90% for the percent of covered activities.
8. Nonferrous Secondary Smelting and Refining Mills	331314 331423 331492	Employment, payroll, and receipts were adjusted to 95% for the percent of covered activities.
9. Nonferrous Product Producers	331315 331316 331319 331421	Employment, payroll, and receipts were adjusted by 50%, percentage of establishments assumed to be utilizing recycled materials, then by 95% for the percent of covered activities.
10. Nonferrous Foundries	331521 331524 331525 331518	Employment, payroll, and receipts were adjusted to 90% for the percent of covered activities.
11. Paper, Paperboard, and Deinked Market Pulp Mills	32221	No adjustment was made to NAICS data.
15. Plastics Converters	3261	Establishments, employment, payroll, and receipts were adjusted to 5.7%, industry-wide recycled content percentage, and divided by 35%, the average recycled content of products containing recycled materials.
17. Steel Mills	331111	Employment, payroll, and receipts were adjusted to 95% for the percent of covered activities.
18. Iron and Steel Foundries	331511 331513	Employment, payroll, and receipts were adjusted to 95% for the percent of covered activities.
21. Motor Vehicle Parts (used)	42114	No adjustment was made to NAICS data.
22. Retail Used Merchandise Sales	453310	No adjustment was made to NAICS data.
23. Tire Retreaders	326212	No adjustment was made to NAICS data.

APPENDIX G – Calculation for Government and Private Collection

Equations used to Determine Government and Private Staffed Collection

	Equation
Number of establishments	1) $K * D$
Recycling Collection Employees	2) $((A / (B * C * F)) * D * E) * (1 + G) * (1 + H)$
Yard Waste Collection Employees	3) $((A / (B * L * F)) * D * M * N * O) * (1 + G) * (1 + H)$
Total Curbside Recycling and Yard Waste Collection Employees	4) Calculation 2+ Calculation 3
Annual Payroll	5) Calculation 4*I
Receipts	6) $(A / B) * D * J * 12$ months/year

Data used in Equations for Government and Private Staffed Collection

Data Label	Description	Value	Source
A	Population with curbside collection	2,200,000	BioCycle (11/2000) ¹
B	Persons per household	2.48	U.S. Census (2000)
C	Homes collected per truck per day	900	R. W. Beck Estimate
D	Percent of homes collected by government staffed collection	34%	R. W. Beck Privatization Study
E	Average crew per truck	1.5	R. W. Beck Estimate
F	Collection days per cycle	5	Assumes once per week collection
G	Additional percent supervisory	10%	R. W. Beck Estimate
H	Additional percent absenteeism, recycling coordinator, etc.	5%	R. W. Beck Estimate
I	Average payroll per employee	\$27,014 ²	1997 U.S. Census
J	Recycling collection cost per household per month	\$2.00	R. W. Beck Estimate
K	Number of curbside programs	199	BioCycle (11/2000) ¹
Information for Yard Waste Collection			
L	Homes collected per truck per day	1,000	R. W. Beck Estimate
M	Average crew per truck	2	R. W. Beck Estimate
N	Percent of households with yard waste collection	75%	Estimate based on BioCycle (11/2000) ¹
O	Percent of year collection takes	66%	R. W. Beck Estimate

¹ Complete data not available in BioCycle 12/2001 or 1/2004.

² Calculated as average payroll for 1997 NAICS 562111 Solid waste collection.

 Printed on Recycled Paper 