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Results of a National Survey of Biobased Product Companies

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Summary

Iowa State University conducted a convenience survey of biobased product companies in 2008, 2010, and again in 2012 to better understand some of the basic characteristics of companies that produce end-use biobased products and intermediate materials. The companies included in the 2012 survey were selected from a database of 3,467 companies populated by Iowa State as part of their support of the BioPreferred program. This program is part of an effort by the USDA to satisfy portions of the Farm Security and Rural Investment Act of 2002 and the Food, Conservation, and Energy Act of 2008. Companies in the database produce and distribute more than 100 types of products including bath products, candles and wax melts, facial care products, intermediate feedstocks, multipurpose cleaners, gasoline fuel additives, graffiti and grease removers, laundry products, disposable tableware, hydraulic fluids, sorbents, and animal repellants.

Companies responding to all three surveys were very diverse, ranging from large multinational corporations to small start-ups. About one-third of the respondents had five or fewer employees. Slightly more than one-third had been in business for less than ten years, and nearly half had been selling biobased products for less than ten years. Nearly eighty percent of the companies were located in a metropolitan area, with about forty percent in cities with a population of less than 20,000.

The majority of the products the survey respondents sold were categorized in the chemical sector, with the greatest sub-group in the soap, toilet preparation, and other cleaning categories. Just less than half of all respondents only sold biobased products; the other companies sold both biobased and nonbiobased products. More than half of the companies stated that biobased sales composed 80 percent or more of total sales. Some of the products cost less than alternative nonbiobased products, but about 50 percent of the respondents stated their products cost an additional 10 percent or more.

Introduction

The Food, Conservation, and Energy Act of 2008 (FCEA) reauthorized and expanded provisions related to the federal biobased procurement and labeling statute originally established by Section 9002 of the Farm Security and Rural Investment Act of 2002 (FSRIA) [1, 2]. The statute includes provisions to encourage the procurement of biobased products by federal agencies and a voluntary biobased-labeling program. The U.S. Department of Agriculture (USDA) refers to the programs collectively as BioPreferred.

As defined by the FCEA, "biobased products" are products determined by the U.S. Secretary of Agriculture to be commercial or industrial goods (other than food or feed) that are composed in whole or in significant part of biological products, including renewable domestic[1] agricultural materials and forestry materials or intermediate ingredients or feedstocks.

The goals of the BioPreferred program are to lessen U.S. dependence on foreign oil to improve security and decrease the trade deficit, promote economic development by creating new jobs in rural communities and new markets for farm commodities, and improve the environment. These might occur from substitutions of petroleum-based products with biobased equivalents, by incorporating improvements over petroleum-based products, or by the development of entirely new products.

Federal agencies are required to give preference to BioPreferred-designated biobased products when the biobased product is reasonably available, reasonably priced, and comparable in performance. The development of a list of items (or generic groupings of biobased products) for preferred procurement is a core element of the BioPreferred program. Once an item is designated, every manufacturer/vendor producing and marketing products that fit within that designation can claim preferred procurement status for their products when marketing to federal agencies.

For the purposes of this study, the definition of a biobased product was further constrained to new-use products. Mature-market products (e.g., cotton shirts) are not included in the current analysis since many do not consider these types of products as part of a new bioeconomy. Items like cotton shirts were developed in the marketplace because of basic consumer demand for the product and not as a mechanism to reduce U.S. dependency on oil, help rural economies, or improve the environment.

As defined by the USDA, mature markets generally refer to items sold prior to 1972 [2]. Some companies that sold products that were available prior to 1972 are still included in the BioPreferred database and were included in the survey for two reasons. First, the database used for the survey includes companies that have not yet been analyzed in-depth by the USDA to determine when the products were initially sold and whether or not they should receive preferred preference under the BioPreferred program. The number of companies that fall into this category is thought to be fairly small since the products that were analyzed first by the USDA included those items that were sold by a significant number of companies.

[1] In practice, the USDA has eliminated the "domestic" qualifier associated with agricultural materials to comply with World Trade Organization regulations.

Second, the USDA still considers some products sold prior to 1972 as acceptable for preferred procurement because information gathered indicated that these products did not constitute a significant portion of the market and therefore would still qualify for preferred procurement.

End-use biobased products are defined as items sold directly to end-use consumers (point of purchase) or business-to-business sales. Business-to-business sales might include transactions where only minor modifications to the product are made (e.g., repackaging) or wholesale distribution of end-use products. End-use biobased products include all products that are not categorized as a biofuel or biochemical.

In this report, biochemicals refer to nonfuel chemicals made from biobased feedstocks that are predominantly considered to be new uses. What remains within the definition used here are commodity chemicals or intermediates that use a biomass feedstock as opposed to a petrochemical feedstock. Some of these biochemicals could also be classified as end-use products (e.g., biobased 1, 3-propanediol). The recent Farm Bill specifically refers to intermediate ingredients that "are or can be used to produce items that will be subject to the preference" targeted by the BioPreferred program. These may be commercial or industrial products [1].

Since the definition of biobased products is not easily specified nor universally understood, the following definition was developed for use in the survey conducted in this work: "A biobased product is a commercial or industrial product other than food or feed that is made from biologically based materials, such as plant or animal products, and that traditionally has been made from other kinds of materials. This includes products like chemicals that are plant based rather than petroleum based, or like clothing made from corn or hemp. Biobased products are sometimes referred to as 'green' products."

In 2012, Iowa State University had identified more than 27,484 biobased products produced or sold by more than 3,467 manufacturers and distributors. These numbers represent a significant increase over the available products and companies used in the 2010 survey [14]; this may be due in part to the release of several regulatory rules released by the BioPreferred program, including designation rounds four, five, six, seven, and eight, more large companies in the database, some companies might have reported bio products other than a new use, along with the implementation of the BioPreferred labeling program.

Survey Methodology

In 2012 a survey of manufacturers and distributors of biobased products was conducted.

A questionnaire was developed that covered a variety of topics associated with the size of the companies and constraints to growth. The survey was purposely kept short in an attempt to achieve a high response rate.

A telephone survey was used to maintain a consistent focus on biobased products, per the definition. Interviewers were able to clarify the definition when needed and to probe regarding whether or not the company was actually involved in the biobased products industry.

There is currently no available listing of all companies involved in the biobased products industry. As a result, the sample for this project was a convenience sample[2] developed from the available list of BioPreffered participating companies, by Iowa State University through support of the USDA BioPreferred program. The sample consisted of a list of 3,003[3] companies that identified themselves in promotional materials or on their websites as either manufacturing or distributing biobased products. The sample included 1,157 companies that had never been included in previous Iowa State University Biobased Product Surveys, [13, 14]. The sample consisted of primarily U.S companies. If a company was composed of two or more establishments, only a single establishment was included—this was typically the company headquarters.

Both the 2008 and 2010 surveys included only companies in predominantly English-speaking countries because of a potential language barrier between the interviewers and the company personnel. Specifically, companies in the United States, Canada, Australia, and the United Kingdom were interviewed. This time 16 companies from China and 69 companies from Europe and the rest of the world were included in the survey.

Advance letters were sent to the sampled companies prior to data collection to explain the purpose of the research and to notify them that a research interviewer would be contacting them to conduct an interview. Approximately 150 of those letters were returned as undeliverable. Additional efforts were made to locate new addresses.

Attempts were made to call all sampled companies with an available telephone number. When no contact name was available, attempts were made to locate someone in the firm who was knowledgeable about biobased product lines. Anywhere from eight to fifteen unsuccessful call attempts were made before companies were removed from the calling queue.

Of the original 3,003 businesses in the sample, 686 were classified as (1) not eligible for a variety of reasons, (2) no personal contact could be made with the company, or (3) a working telephone number was not available.

There were 375 businesses deemed ineligible. These included businesses that were verified as closed or merged with other firms, exclusively involved in research and development, planning to manufacture in the future but currently in the developmental stages, or duplicate listings. A few of the businesses manufactured biologically based products that were excluded from the study by definition, either because all of their products are food, feed, or pharmaceuticals or because all of their products are mature products like wooden pallets, wood flooring, or standard compost. The largest portion of ineligible businesses simply stated that they do not manufacture or distribute any biobased products, based on the study definition.

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[2] Convenint sampling is a type of nonprobability sampling in which people are sampled simply because they are "convenient" sources of data for researchers-Mike Bttagila [15]. For a more detailed explanation of convenience sampling one can refer to [16, 17].

[3] The CIRAS data base had 3467 companies. Iowa State University's Survey and Behavioral Research Services (SBRS) removed 543 companies from this data base due to various reasons namely no contact information, out of business or request of removal etc, in addition 79 new companies were added. Taking this into account the sample size reduces to 3003.

There was no personal contact with 214 of these cases—only answering machines or ringing numbers. They were removed after a maximum number of calls was made.

There were 97 businesses that did not have a working telephone number available. Some of these businesses may have closed or merged with other companies, but their actual status was unknown. Some were operating businesses but no phone numbers or company employees were available to the public.

A sample of 2,317 companies remained, 77 percent of the base 3,003 businesses.

There were an additional 742 companies where personal contact was made but a survey was not completed. Some refused to complete an interview (319), a portion of these because company policy prohibited them from completing surveys. The remaining 423 involved some personal conversation with an employee. They did not actively refuse to participate, but no interview could be conducted within a maximum number of call attempts within the data collection period.

A total of 1,559 distinct interviews were completed with businesses. This is 60 percent of the companies where personal contact was made and the company was deemed to be a manufacturer or distributer of a biobased product as defined earlier. The number of distinct interviews conducted was 429 greater than what was achieved in the 2010 survey.

The company interviews were held from February 1 through May 22, 2012. Standard interviewing protocols were followed. Interviews were monitored at random intervals by supervisory staff to ensure proper protocols were being followed. Interviews lasted an average of 18 minutes. Since a convenience sample was used, the data was not weighted.

Business Summary

Of the total number of companies responding to the survey, 71 percent primarily considered themselves a manufacturer, 28 percent were primarily a wholesaler or retailer, and 1 percent classified themselves as something different. Of all respondents, 78 percent stated they manufactured a biobased product. Nearly 56 percent of the companies also manufactured or distributed a nonbiobased product. These results did not significantly differ from those recorded in 2010.

Biobased Products

The respondents' biobased products were categorized into one of three broad types—end use, intermediates, and fuels. The makeup of the respondents is displayed in Figure 1. The total in the chart adds up to more than 100 percent because some companies sold products that fall into more than one category.

The majority of the respondents sold end-use biobased products; many fewer companies sold intermediates. This is not surprising since there generally are fewer companies that produce intermediates than those that buy commodity feedstocks to produce a product. Companies that produce intermediate chemicals tend to be larger and more established, whereas many

companies that sell end-use biobased products are very small and have been in existence for a shorter period of time. In addition, Iowa State researchers began the search for companies that produce intermediate feedstocks after the search for end-use products began. Therefore, the survey sample likely included a lower fraction of the total number of companies that produce intermediates.

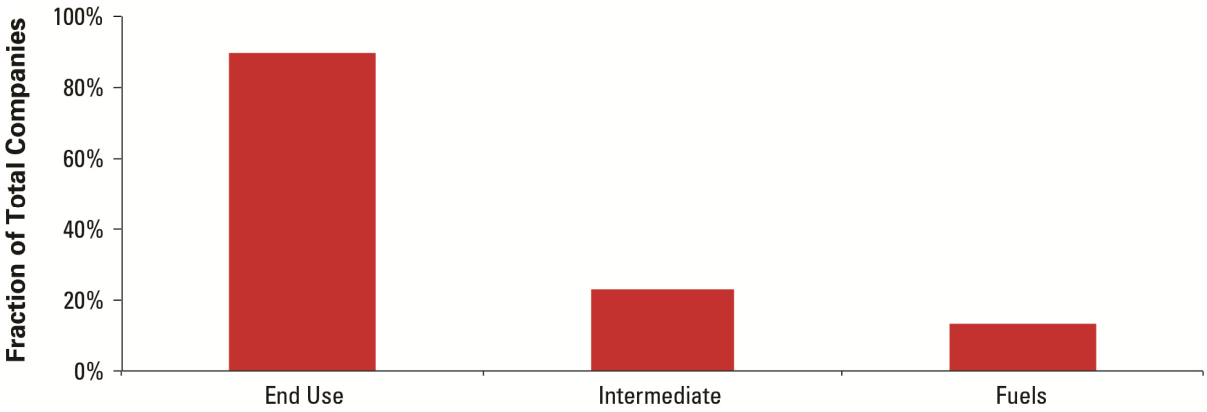

Figure 1. Products sold by biobased products companies.

Just over 13 percent of the respondents produced fuels, which is fewer than what might be expected given the number of ethanol and biodiesel plants in the United States [3, 4, 5]. One reason the number of respondents is low is because of how the survey list was generated. The company list did not include all of the biofuel companies, since the list was generated based on the FSRIA product definition. Specifically, companies were only included if they sold fuels targeted as a fuel-additive since nonfuel products were the primary focus of the legislation. Other legislation is focused on the growth of the biofuels industry targeted to the transportation sector.

The median size of the companies that stated they produced end-use products was 10 employees; the median size of the companies that produced intermediates was 24 employees; and the median size of the companies that produced fuels was 37 employees. There was little change from the 2010 survey.

The companies were asked what primary product they sold and the corresponding three-digit North American Industry Classification System (NAICS) category [6]. Sixty percent of the total responses were categorized as being in the chemical industry (NAICS category 325) (see Figure 2). The top eight NAICS categories of the respondents are displayed in the figure. These top eight three-digit categories encompassed 80 percent of all companies that responded to the survey.

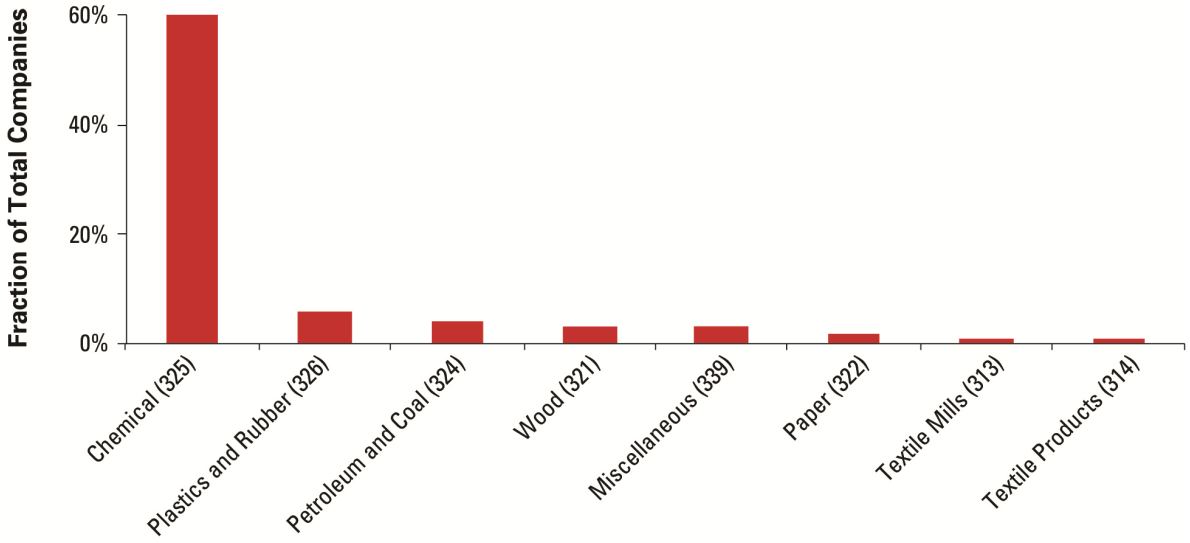

Figure 2. Top NAICS categories of survey respondents.

More than half of the survey respondents provided three-digit NAICS information on their products. The remaining companies were asked additional questions in an attempt to understand their three-digit NAICS codes. A fraction of these provided enough additional information so that the authors were able to further classify those products to a four-digit code. The primary subcategories of the 359 chemical companies where a four-digit code could be ascertained are displayed in Figure 3. The product descriptions associated with these four-digit NAICS codes are listed in Table 1.

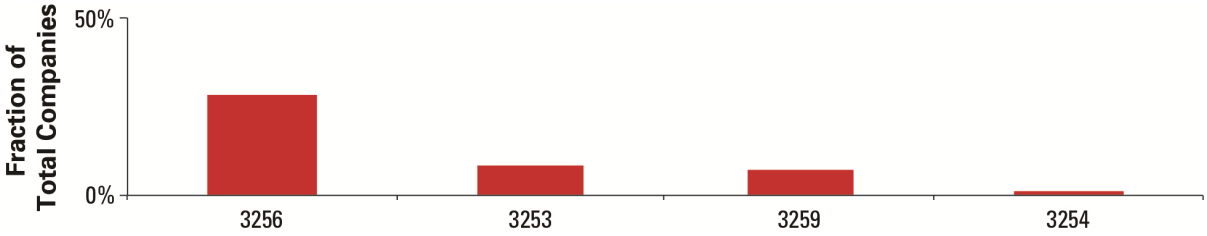

Figure 3. Products sold by chemical companies—NAICS 325.

Table 1. Four-digit NAICS code descriptions.

4-Digit NAICS	Description
3256	Soap, cleaning compound, and toilet preparation
3253	Pesticide, fertilizer, and other agricultural chemicals
3259	Other chemical products and preparation
3254	Pharmaceuticals and medicines

Company Location

Of the 1,559 distinct companies responding to the survey, 92 percent were located in the United States, 4 percent in Canada, and the remaining in Australia and the United Kingdom.

The locations of the 1,428 U.S. respondents to the survey are displayed in Figure 4. The region definitions are the same as the four census regions used by the Bureau of Census. For companies with multiple establishments, only the data submitted by the establishment that completed the survey is included in these results.

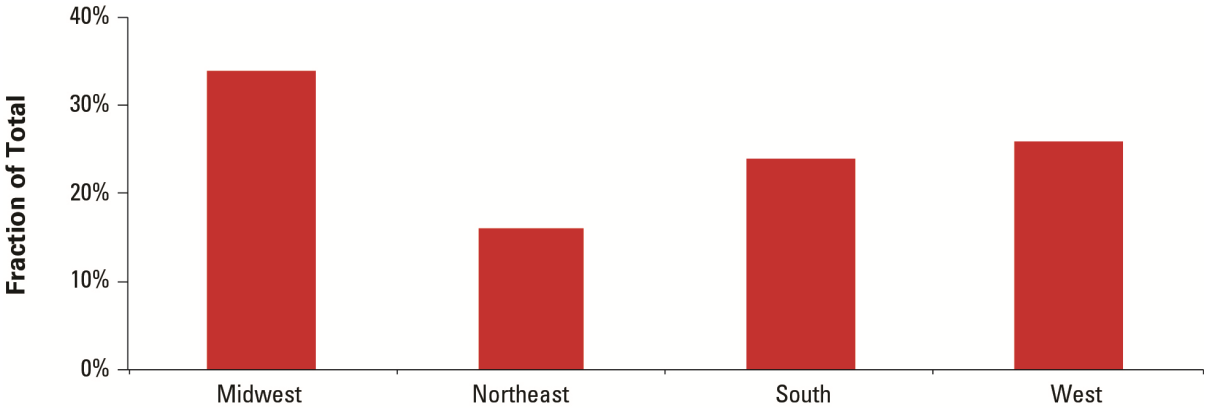

Figure 4. Location of U.S. biobased products survey respondents.

The ten states with the greatest number of respondents are displayed in Figure 5. These ten states encompass 53 percent of all the U.S. respondents.

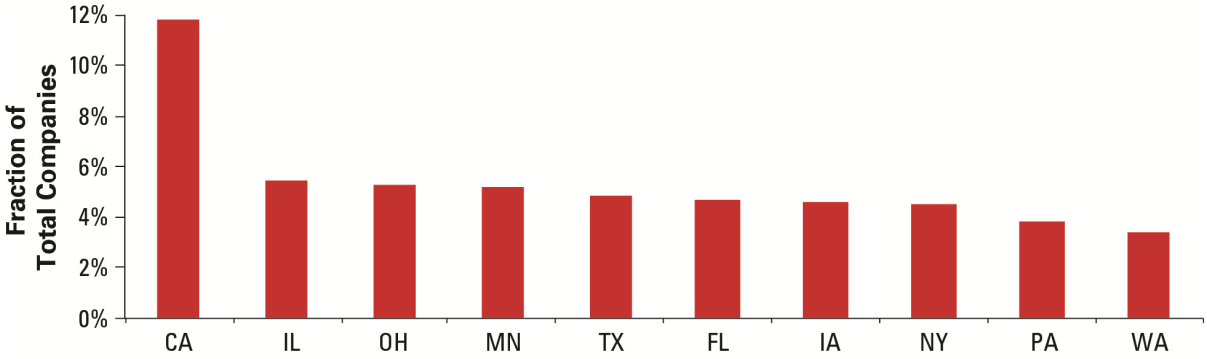

Figure 5. Top 10 states responding to the survey.

The locations of the respondents were classified in two separate ways—by a rural-urban classification and by the size of the town or city where the company was located. The RUCA (Rural-Urban Commuting Area Codes) is a designation mechanism that uses the Bureau of Census Urbanized Area and Urban Cluster definitions and commuting information to classify census tracts [7]. The ZIP Code RUCA approximation was used to categorize each biobased product company.

Figure 6 displays the locations of the U.S. survey respondents by grouped RUCA classifications. Specifically, metropolitan includes RUCAs 1–3, micropolitan 4–6, small town 7–9, and rural 10. As evidenced by the results, the vast majority of the biobased product companies are classified as metropolitan. This means the companies are located in a county with a city of 50,000 or more inhabitants or they are located in a county where 10 percent or more of the inhabitants commute to an urbanized area.

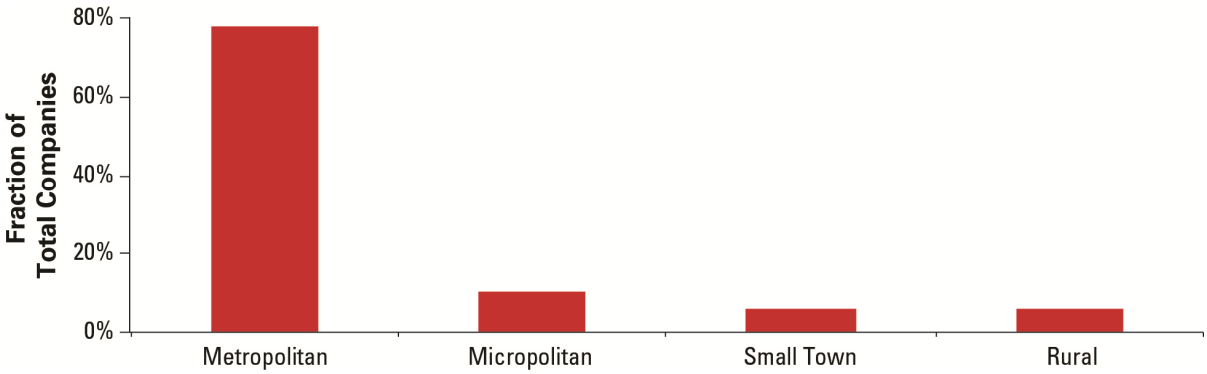

Figure 6. Location designation of U.S. biobased products survey respondents—RUCA classification.

There are strengths and weaknesses of any definition. For example, a company located in Nevada, Iowa (population 6,807), is considered a metropolitan company because of the proximity to Ames (population 59,042). Since so much of the U.S. population is classified as living within metropolitan areas, a different definition of rural and urban was investigated.

A second analysis of the respondents was conducted based on the size of the town or city where the company was located. Three broad classifications were used: cities with 50,000 or more inhabitants, cities with 20,000–49,999 inhabitants, and cities with fewer than 20,000 inhabitants. Figure 7 displays the locations of the respondents by city size.

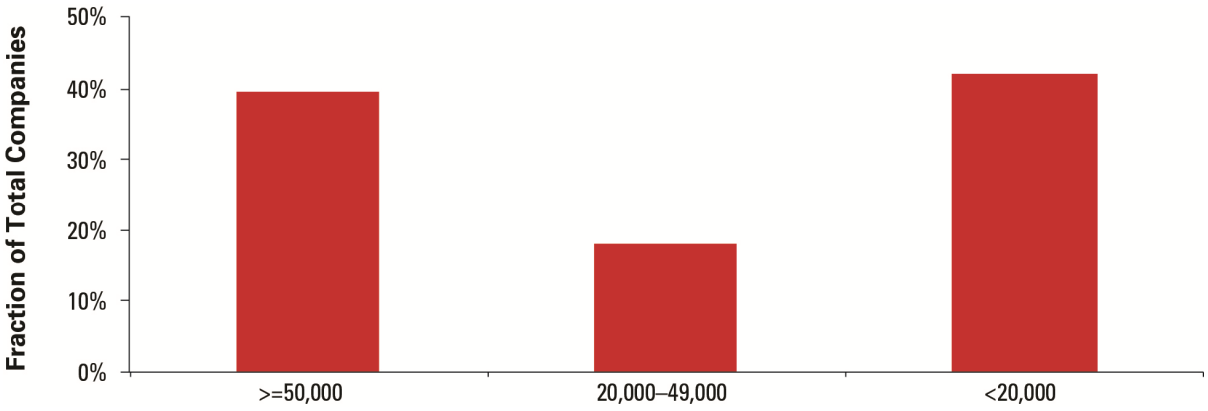

Figure 7. Location designation of U.S. biobased products survey respondents—city size.

A city-size approach has weaknesses as well. For example, a company located in Clive, Iowa (population 15,858), is designated to be within a small population city even though it is located seven miles, center-to-center, from Des Moines (population 206,599).

Company Age

Of all surveyed companies, 1,451 provided information on the age of the company, the length of time selling biobased products, the total number of employees, and the number of employees involved with biobased products. Figure 8 displays information on the length of time this subset of respondents had been in business. About one-third had been in business for ten years or less. About 60 percent had been in business for less than twenty years.

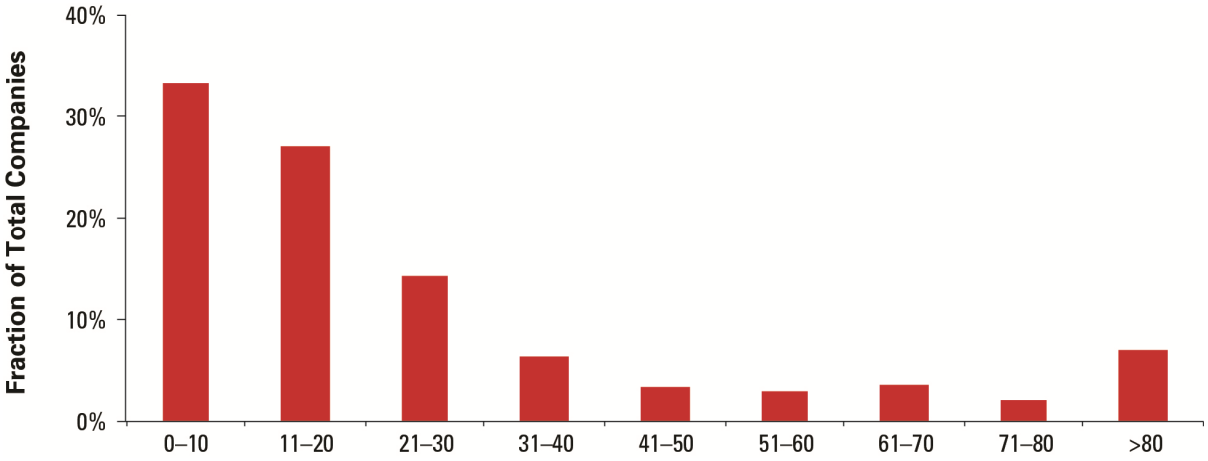

Figure 8. Age of biobased product companies (years).

Figure 9 displays the length of time the respondents had been producing or distributing biobased products. Just over fifty percent of the companies had been selling biobased products for less than ten years, just over three quarters for less than twenty years. Only 6 percent had been selling a biobased product for more than 50 years, though 16 percent of the companies had been in business for that length of time.

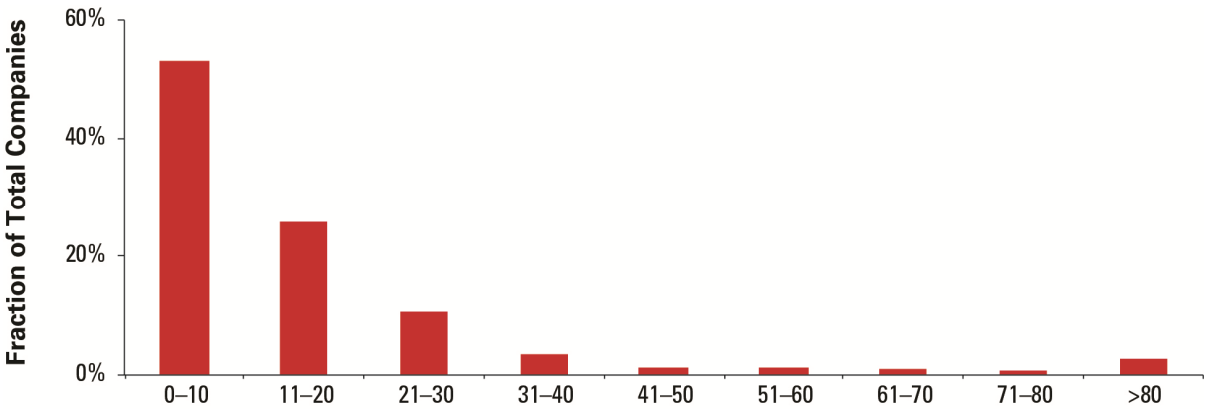

Figure 9. Length of time selling biobased products (years).

It is not surprising to find such a small number of companies selling biobased products for more than 50 years. As discussed earlier, the BioPreferred database was developed with a focus on new-use biobased products.

Company Size

The total number of people employed in the biobased products industry is the most common question the authors receive. The answer to this question is not straightforward because a common definition of biobased products does not exist, the total number of biobased companies is not yet known, and a convenience sample was used in this survey.

The BioPreferred database, which was used as the basis of the current survey, includes companies with products the authors believe are new-use products, as opposed to mature-market products. As such, survey results will not include employment information from biobased product companies only selling mature biobased products. It will also miss the number of employees at new-use biobased product companies that have not yet been located. Finally, it will not include the employees at the companies that did not complete the survey or did not answer this question when they completed the survey.

There is also no way of knowing whether the number of biobased product employees reported in the survey includes employees producing/distributing new-use or mature products. Approximately 40 percent of the companies in the BioPreferred database produce one product, which is a new-use product. For large companies producing many biobased products, the authors have observed that many produced new-use and mature biobased products. In addition a portion of the responding companies also indicated they were involved with the biofuels industry, which may account for some of the reported jobs. If these companies reported all their biobased employees, the results will overpredict the number of biobased employees working on new-use biobased products.

It may be possible to get a lower estimate of new-use biobased product employees by removing the number of biobased product employees in the larger companies. All respondents reported a total of 280,411 biobased product employees. There were 51,308 biobased product employees working in companies with fewer than 1,000 employees.

Compared with the 2010 survey, we see that there has been a substantial increase in the number of biobased employees.

The size of the companies providing a number of both biobased and nonbiobased employees is displayed in Figure 10, where the fraction of total companies responding is displayed for both total employment and biobased product employment. Almost thirty percent had five or fewer. Almost sixty percent had twenty employees or fewer.

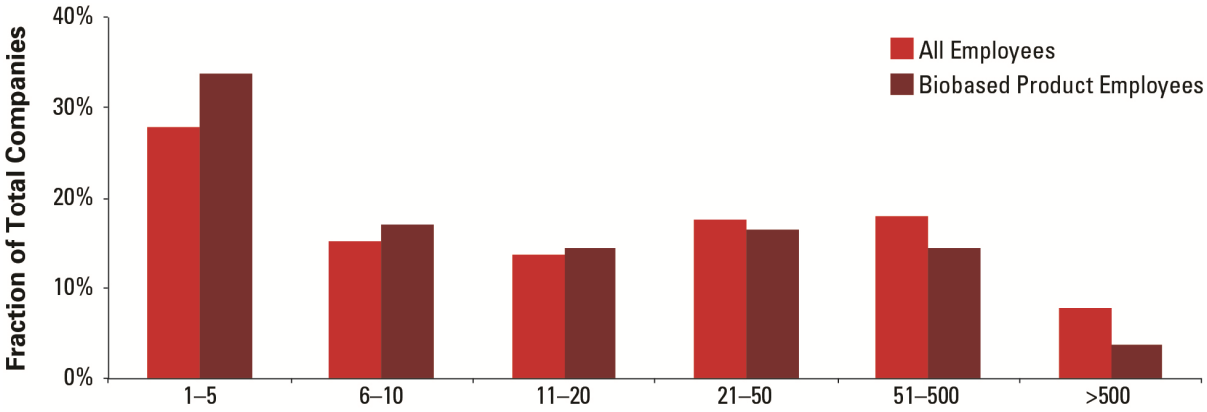

Figure 10. Number of employees at biobased product companies.

The companies were also asked how many of their employees, including support staff, contributed to the production or distribution of biobased products (see Figure 10). About one-third of the companies had five employees or fewer working with biobased products. Fewer than 4 percent of the respondents to this question stated they have 500 or more employees working on biobased products.

Of the 1,483 companies that gave a number of biobased employees, 92 percent were in companies that primarily considered themselves a manufacturer. The remaining companies were wholesalers, retailers, product developers, or something else.

Of all surveyed companies, 1,451 provided information on the age of the company, the length of time selling biobased products, the total number of employees, and the number of employees involved with biobased products. The number of companies (by fraction of total) and the size of companies, as well as how these vary with the length of time they have been in business, is displayed in Figure 11. As expected, the median size of the companies and the number of employees working on biobased products tend to increase as the company age increases.

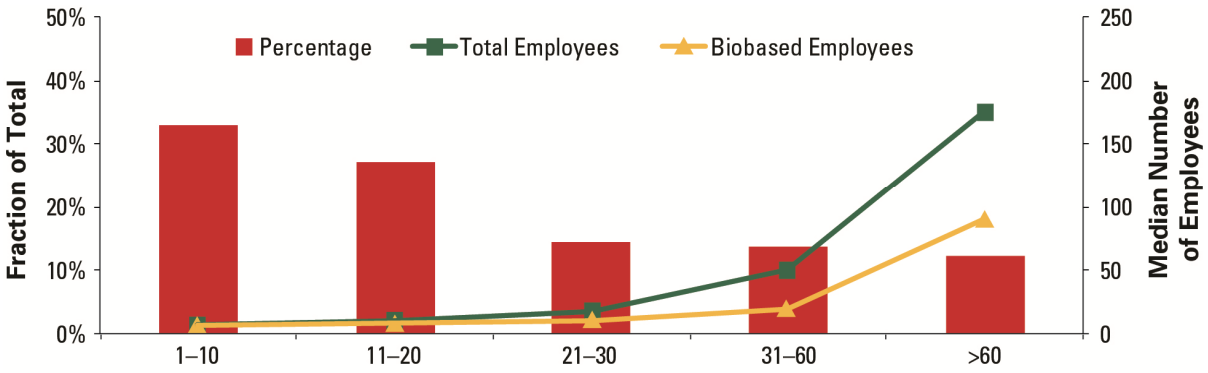

Figure 11. Variation of employment size with company age (years).

As part of the 2010 and 2012 surveys, investigators included four additional research questions in an attempt to help quantify the potential economic impact of the biobased products industry as it relates to job creation and quality. Respondents were asked to estimate the percentage of biobased employees in managerial, technical, production, clerical, or sales jobs. Nearly 1,500 survey respondents provided answers to the number of biobased employees and the percentages attributed to each job category. Figure 12 displays a distribution of the number of biobased employees associated with each job type.

Figure 12. Variation of biobased employees with job classifications.

Two questions were focused on benefits associated with biobased jobs. Slightly more than two-thirds of the companies responding indicated that health care insurance was being made available to their employees. More than half of responding companies indicated they have some type of pension plan or 401K for their employees.

In addition to the impact of biobased products on jobs within companies, respondents were also asked if they had used any outside technical support or consultant services. Nearly 60 percent of the 1,558 companies responding to this question were engaging outside resources. There was no difference between companies in rural versus metropolitan areas in their use of consulting services.

Biobased Sales

Figure 13 displays the fraction of the companies' total sales attributed to biobased products. Nearly three-fifths of the respondents stated that 80 percent or more of their sales came from biobased products. Conversely, 31 percent of the companies reported less than 40 percent of their sales were from biobased product lines.

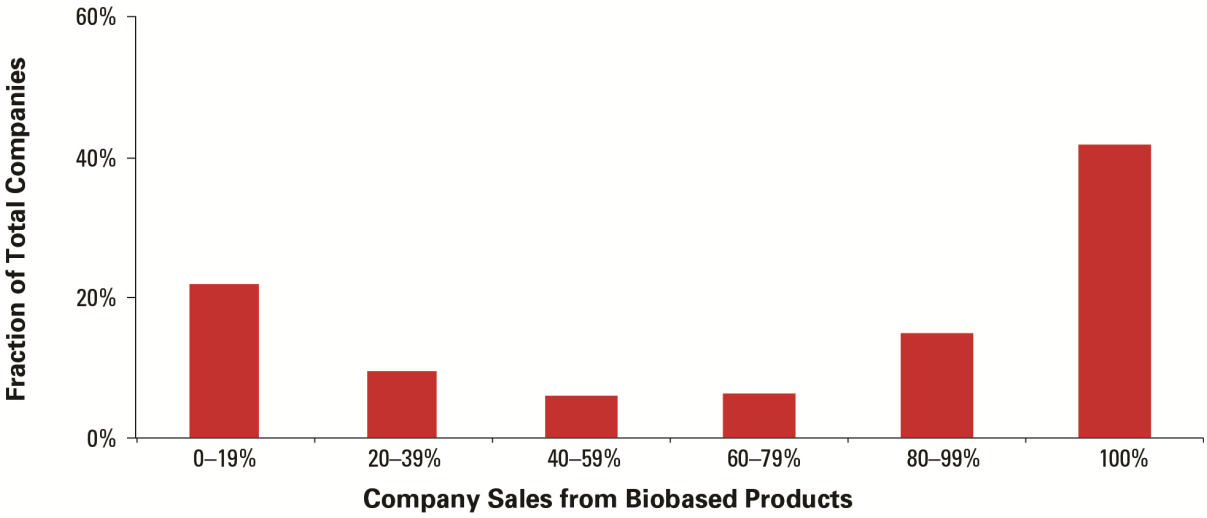

Figure 13. Company sales from biobased products.

Fraction of sales from biobased products, total employment, and employment associated with biobased products were provided by 1,361 of the survey respondents. The variation in the median number of biobased employees with company dependency on biobased product sales is displayed in Figure 14.

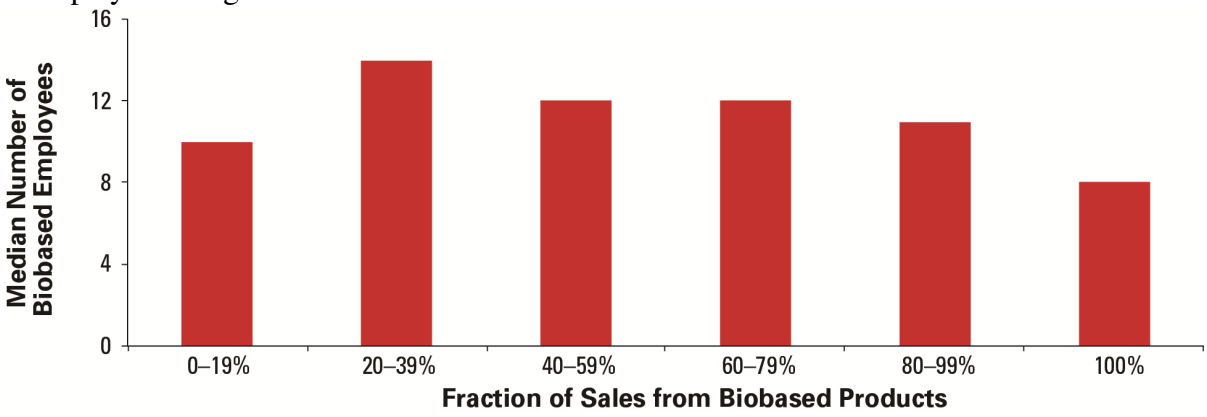

Figure 14. Size variation with sales focus.

Of all the companies surveyed, 1,557 responded as to how they market or sell their biobased product. The respondents' methods for selling biobased products were categorized into one of three broad types—business-to business (B-to-B), direct to the final customer, or through a distributor. The companies that reported direct sales included companies that sold through a storefront, over the web, at public events, etc. The makeup of the respondents is displayed in Figure 15. The total in the chart adds up to more than 100 percent because some companies

sold products through multiple channels. The variation with fraction of sales was virtually unchanged from the 2010 survey.

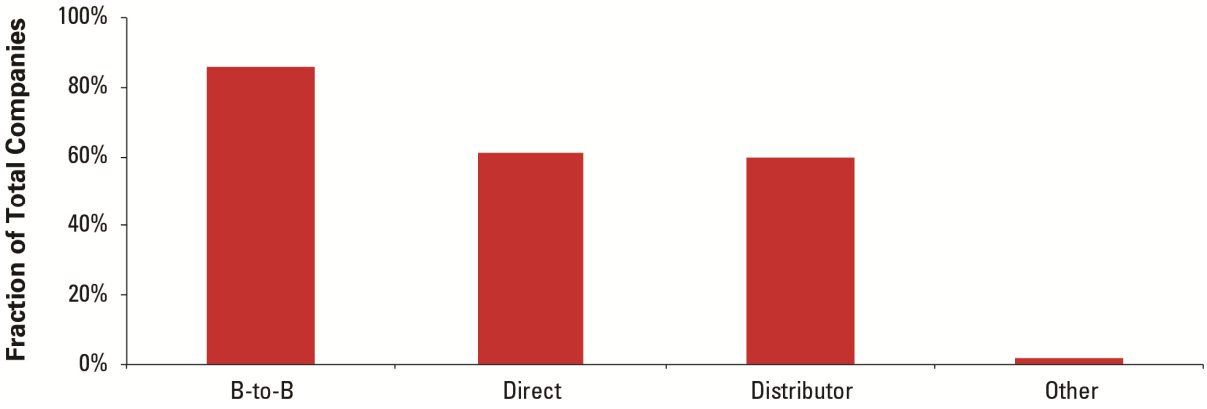

Figure 15. Methods used by companies to sell their products.

The respondents were asked to compare the price range of their primary biobased product to the nonbiobased alternative. As seen in Figure 16, about one-third of the companies sold their primary biobased product at about the same cost (plus or minus 10 percent) as a nonbiobased product. The variation with price range was virtually unchanged in comparison to 2010 survey.

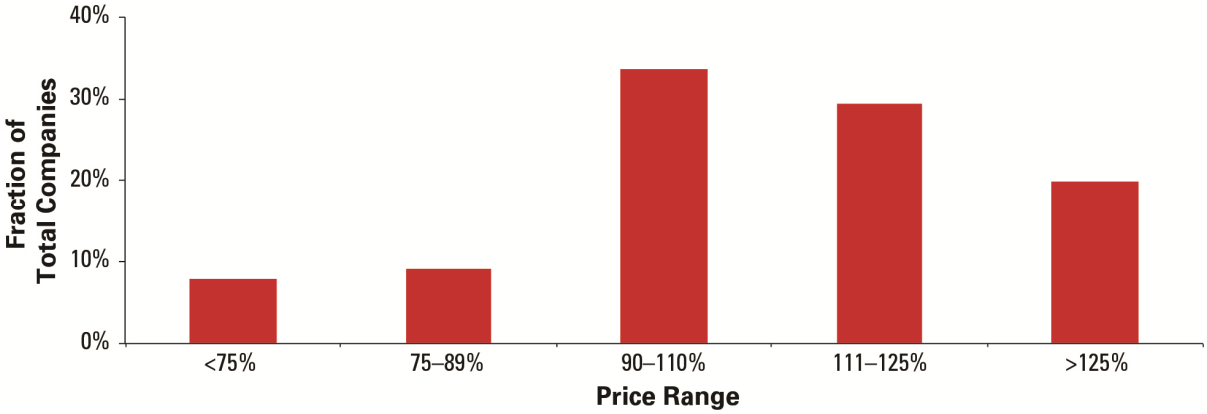

Figure 16. Price of biobased products compared with conventional products.

The companies were asked the reasons why customers buy their biobased products over non-biobased products. Information was provided by 1,041 respondents. Respondents were asked to indicate which of six categories were important to their buisnesses and were allowed to select all appropriate. Environmental benefit and performance were the top reasons given, with about ninety percent of the companies responding in the affirmative for each. The responses are displayed in Figure 17.

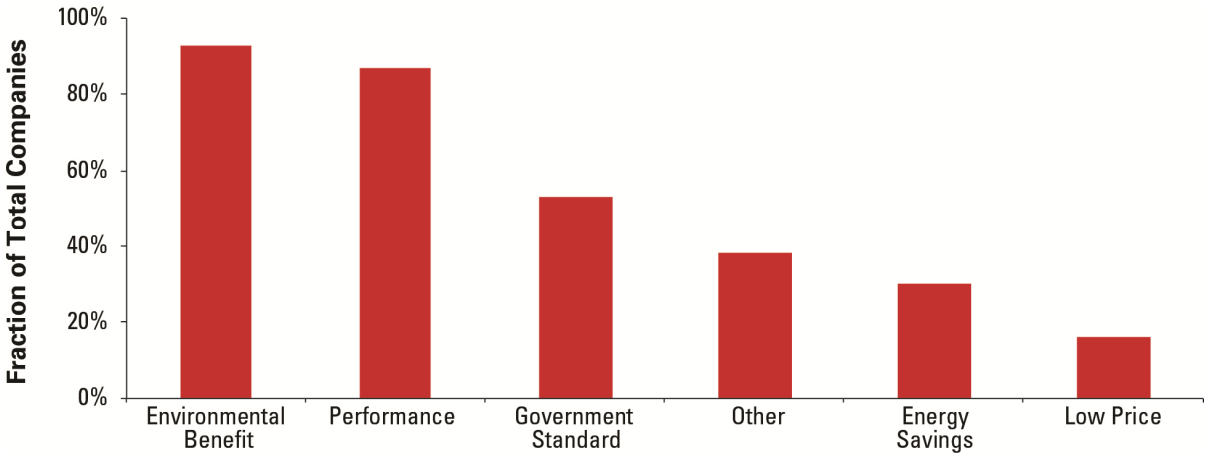

Figure 17. Top reasons companies give why customers buy biobased products.

Limitations to Growth

Figure 18 displays the level of importance given to various items that were limiting the growth of the companies. The average rating for each of the limiting factors was below three on a one-to-five scale. In contrast to 2010 results, in the 2012 survey results raw material costs had the greatest change in relative importance, moving from seventh to second place in importance.

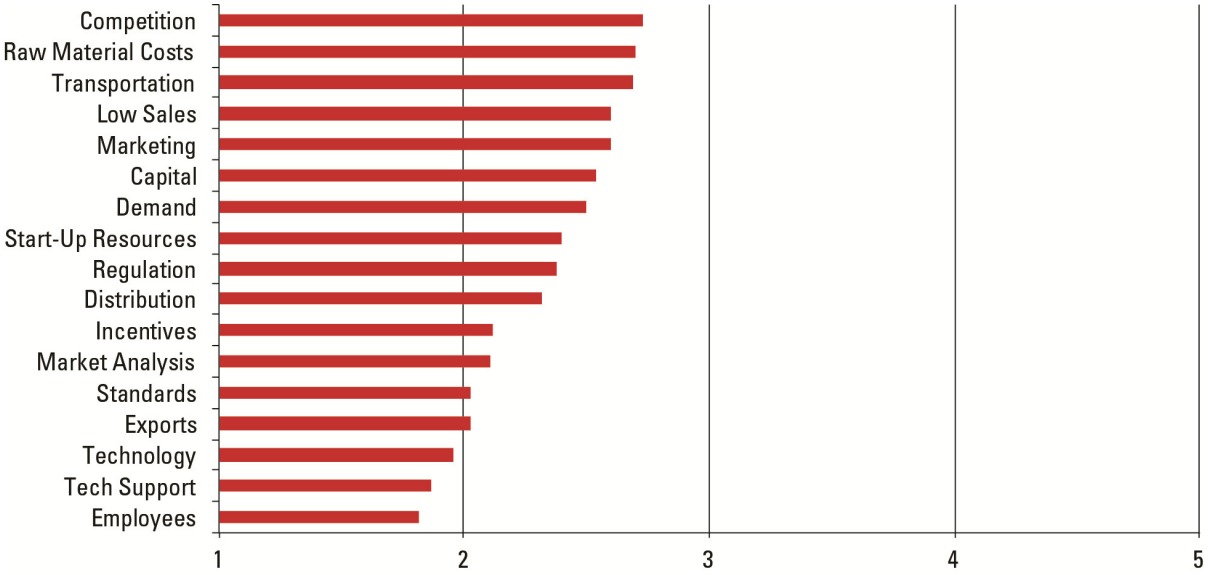

Figure 18. Factors limiting the growth of biobased products companies.

After the basic data were summarized, a more in-depth analysis was completed to see if there were any characteristics that surfaced between different types of companies.

Characteristics—High/Low Price of Products

The responses were analyzed to determine if there were any distinguishing features between companies that primarily sold products at a high price compared to the alternative (>110 percent) and those companies that primarily had lower-priced products (<90 percent).

Compared to companies that primarily sold higher-priced biobased products, companies that sold at a low price had been in business for a slightly shorter time. No significant difference was noted between the two groups in the median number of years they were selling biobased products.

The typical low-price company had a slightly higher fraction of their overall sales from biobased products. The fraction of companies that reported biobased sales to be growing was similar for both groups. There was a considerable difference in the fraction of companies that reported overall sales to be growing. For high-price companies, 43 percent reported sales growth, whereas for low-price companies it was 30 percent.

The median number of biobased employees at the low-price companies was 20 compared with a median of 8 employees for the high-price companies.

Not surprisingly, 74 percent of the companies that were selling at lower prices than the alternatives gave low price as a reason their products were purchased versus less than 1 percent of the companies selling at higher prices. Companies selling at lower prices also cited government standards and product performance as reasons why their products were purchased. There was little difference between the two groups in regard to environmental benefits or performance standards.

None of the factors limiting growth were ranked high, regardless of whether the company sold high - or low-priced products. The top three factors that impede growth for the high-priced firms were cost of raw materials, competition from similar firms, and low sales. On the other hand, for low-priced firms the obstacles were availability of financial capital, competition from similar firms, and uncertain demand.

Characteristics—Small/Large Companies

The responses were analyzed to determine if there were any distinguishing features between small companies and large companies. Small companies were defined as those with 50 or fewer employees and large companies as those with more than 50 employees. The median size of the group of small companies was 8 employees versus 200 employees for the large companies. The median number of biobased employees for the small companies was 7 employees versus 150 for the large companies.

The average time in business of the group of small companies was 21 years compared to 54 years for the large companies. The average length of time the small companies had been selling biobased products was 13 years compared to 32 years for the large companies.

The typical small company had a higher fraction of their overall sales from biobased products. The fraction of companies that reported biobased sales growth was similar for both

groups, about 70 percent. The fraction of companies that reported overall sales to be growing was greater for large companies (57 percent), than for small companies (35 percent).

No significant difference was noted between the two groups in the fraction of companies that sold at a low price and those that sold at a high price.

There was little difference between the two groups in regard to reasons given for why their products were purchased. A higher fraction of the large companies gave standards as a reason.

None of the factors limiting growth were ranked high, regardless of size. The top three factors that impede growth for large firms were cost of raw materials, competition from similar firms, and transportation. For small firms the factors were availability of financial capital, marketing, and transportation.

Characteristics—Metro/Nonmetro Company Location

The responses were analyzed to determine if there were any distinguishing features between companies in metro areas versus nonmetro areas, according to the RUCA classification. Metro companies with a ZIP code in an area with a RUCA less than four were defined as metro. Companies with a RUCA greater or equal to four (micropolitan, small town, rural) were defined as nonmetro.

The average time in business of the group of metro companies was 25 years compared to 17 years for the nonmetro companies. The average length of time the metro companies were selling biobased products was 17 years compared to 15 years for the nonmetro group.

The typical nonmetro company had a slightly lower fraction of their overall sales from biobased products. The fraction of biobased sales growth was similar for both groups. The fraction of companies that reported overall sales to be growing was 43 percent for metro companies and 30 percent for nonmetro companies.

There was a difference between the two groups regarding sales price compared to the alternative. Only 13 percent of companies in the metro group sold products classified as low price (<90 percent of alternative). This compares with 28 percent of nonmetro companies. Of the metro companies, 47 percent stated their products were high priced (>110 percent of alternative). This compares to 39 percent of nonmetro companies.

No significant difference was noted between the two groups in the median number of employees or the median number of employees involved with biobased products.

There was little difference between the two groups in reasons given for why their products are purchased. A higher fraction of the nonmetro companies gave low price as a reason, which aligns with the data on price comparison to alternatives.

None of the factors limiting growth were ranked very high regardless of location. The top three factors that impede growth for both metro and non-metro companies alike were competition from similar firms, cost of raw materials, and transportation.

Conclusions and Recommendations

The biofuels sector has received considerable attention from federal and state legislators and the media, and the industry has seen substantial growth over the past decade. On the other hand, the end-use biobased products sector has received much less attention, partly because information about the sector is limited. This work provides a snapshot of the industry in 2012, resulting from a survey of more than 3,000 companies, of which 1,559 responded.

Companies responding to the survey were very diverse, ranging from large multinational companies to small start-ups. About one-third of the respondents had five or fewer employees. One-third had been in business for less than ten years, and slightly over half had been selling biobased products for less than ten years. Nearly eighty percent of the companies were located in a metropolitan area.

Nearly half of the respondents only sold biobased products; the other half sold both biobased and nonbiobased products. Nearly sixty percent of the companies stated that biobased products made up eighty percent or more of their sales. Some of the products cost less than alternative nonbiobased products, but nearly half of the respondents stated their products cost more than ten percent higher than traditional products. As indicated by survey respondents, environmental benefit and product performance were the top reasons given as to why customers buy their biobased products.

Since a convenience sample was used in this pilot study, definitive, detailed conclusions should be avoided. That said, since such a high fraction of companies where contact was made completed the survey (59 percent), recognizing that the biobased product companies in the sample were the result of a nearly nine-year effort to locate biobased product companies, and because of the authors' personal knowledge of the industry, it is felt that the results accurately describe high-level characteristics of the industry from an industry perspective.

As a more accurate compilation of the companies in the industry becomes available and additional companies are removed from the BioPreferred database that do not meet the definition of new-use biobased products, more accurate analysis techniques can be explored. Improvements to the survey tool can also be incorporated. For instance, a more accurate description of who would or would not be considered a biobased employee should be developed. Also, since it is difficult for a single person to accurately respond to a wide variety of questions, sending a copy of the survey with definitions in advance of the phone interviews might improve accuracy and completeness.

The BioPreferred program was developed to help improve biobased products companies' access to federal markets [2]. Since that time, a variety of state programs have been developed to further enhance markets [8, 9, 10, 11, 12]. Future surveys might incorporate questions to attempt to ascertain the effectiveness of these various programs.

As more detailed analyses of the biobased products sector are completed and disseminated, it is hoped that a better understanding of the industry will lead to the development of improved policies and economic development strategies, enhanced awareness of the industry by procurement officials, and a subsequent growth in the industry.

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