Market Mapping for Danish Biosolutions Providers in the US

MINISTRY OF FOREIGN AFFAIRS OF DENMARK
The Trade Council

TEKNOLOGISK INSTITUT

Market Mapping for Danish Biosolutions Providers in the US

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Foreword

Global food systems are facing major challenges in the coming decades. A continued growth in population and climate change will require that we produce more nutritious and healthy food with significantly less resources.

Biotechnological discoveries play an important role across the value chain both as an enabler and as an accelerator to create the food systems of tomorrow. This is what we refer to as Biosolutions.
In Denmark, we have a strong tradition for biotechnological discoveries that transforms both small and large parts of entire productions. The story starts when Emil Christian Hansen isolated brewer's yeast at the Carlsberg Laboratories in 1883. In 2022, export of bio-based products accounted for 35 billion DKK and enzymes was the fourth most valuable export good, only surpassed by pork, dairy and aquaculture. Enzymes was the second to most valuable export from Denmark to the US in 2022 with 1.2 billion DKK.[1]

We have a strong tradition for collaboration – and see it as key to solving the challenges ahead of all of us globally. In the US we try to gather the eco-system in a Food and Bio Forum[2], a consortium for Danish providers of biosolutions supported by the Danish Agriculture and Food Council, the Danish Chamber of Commerce and the Danish Confederation of Industry. The US is a particularly interesting market for biosolutions. An increasing political focus is being aimed at the sector with both the Inflation Reduction Act and the Executive Order on Biomanufacturing. The general purpose of these initiatives is to bring more production capability and jobs to the US. The potential to draw investments and job creation alongside biosolutions business makes it a good case in the US market.

This report looks at biotechnology that can be applied across all parts in the value chain of the food and agricultural production: From the soil, to the plants, to the processing and production, and through the final food products we put on the table.

The Trade Council strives to assist and support Danish companies in global markets, and we hope that this tool can be another means to opening up the American market for Danish providers of biosolutions.

Mikkel Dam Schwartz
MINISTER COUNSELOR, FOOD, AGRICULTURE AND FISHERIES

Embassy of Denmark in the U.S.

1 Udenrigshandel (lf.dk)
2 Dansk bioteknologi på det amerikanske marked (thetradecouncil.dk)

Market Mapping for Danish Biosolutions providers in the US

Danish companies have a lot to offer the American market when it comes to biosolutions. The Danish sector for Biosolutions can meet many the demands from a range of industrial sectors in the United States.

This is the general take away from the present report that describes the Danish biosolutions sector in terms of enterprise sizes, and affiliation to other business sectors and export intensity, along with an analysis of the market they address and the value they offer to clients and business partners.

The Danish biosolutions sector has been subject to a lot of attention in recent years, due to the emerging potential for the sector and the competitiveness of the Danish enterprises within this field.

Copenhagen Economics estimates that the global biosolutions market for the manufacturing industry, agriculture, and the sector for transportation could surge from € 240 billion in 2020 to € 640 billion in 2030.[1] The same report states that the Danish biosolutions industry contributed € 1.8 Billion to the Danish GDP and supported around 6800 jobs in Denmark in 2020, and that they could grow their global sales towards more than € 14 billion in 2030.

Because of the emerging global market and a considerable Danish stronghold within the field of biosolutions, several subgroups of the Biosolutions sectors have been identified as branching into different sectors. Among other sectors, biosolutions can contribute to food ingredients, agriculture, environmental technologies, and manufacturing.[2]

It is evident that the Danish biosolutions sector consists of several technologies and application areas. The scope of this report is narrowed down to focus on biosolutions that fall within food and agriculture. This scope is aligned with a recent analysis of the market potential of Biosolutions within the American food and agriculture sectors.[3] [4]

[1] Copenhagen Economics, 2022: The Potentials of Bio Solutions. Climate and Sustainability Potentials, Barriers to Growth, and Danish Strongholds
[2] Iris Group, 2021: Biosolutions i Danmark. Analyse af bioøkonomiens potentialer og vækstbetingelser
[3] Rambøll. 2022: Assessment of the Market Potential for Deployment of Bio-Solutions within the U.S Food and Agriculture Sectors
[4] In this research the category agriculture also covers the remaining part of the primary sector, thus including also forestry and fishery. The heading agriculture has been chosen as the vast majority of Biosolutions in Danish firms are related to the agricultural sector.

This report is divided into two parts
The first part is an introduction to the Danish biosolution sector. Initially, company representatives were identified and interviewed. . The interviews were conducted in order to map the companies' engagement in the market in the US: What US demand are the Danish stakeholders interested in? Some of the respondents already have experience with the US market, and for others it is still an open opportunity. The second part of the report is a profile of the companies in the US within food and agriculture. The profiles were made after screening more than 20,000 food and agriculture companies headquartered in the US with more than 10 employees. In the screening they were matched against keywords about them and their products that the Danish companies mentioned as important in the interview.

This report is an overall analysis and presentation of the findings. The main product of the analysis is an interactive, online database of US companies within food and agriculture.

In line with the preliminary research, this report uses a slightly adjusted definition of Biosolution companies that caters to either the sector for food and ingredients or the agricultural sector:

The working definition of biosolutions in this report is biotechnological solutions to resource efficiency challenges in the food and agriculture sector. This study focuses on biosolutions within agriculture and food or feed production, meaning solutions that control, apply, or utilize biological processes or bio-based components for the benefit of agriculture or in food or feed production. Examples include the use of enzymes, proteins, biological plant protection products, biofertilizers, microbes, bacteria, functional food ingredients, natural ingredients or fermentation technology or equipment for any of the before mentioned. Using biotechnology to optimize existing production methods or creating new types of food or feed is inherently green.

The Danish sector for biosolutions – a portrait

Through a secondary research study, The Danish technological Institute has identified Danish companies working with biosolutions for either the food industry or the agricultural sector. This exercise resulted in the identification of 157 companies with relevant biosolutions, where some are affiliates of the same company. Altogether 146 companies have been identified in Danish business registers. The companies are based all over Denmark with the main clustering in the capital region of Copenhagen and along the eastern part of Jutland (ranging from Aarhus to Kolding).

Currently, the sector cannot be mapped through the traditional statistical classifications, as the sector branches into several subcategories of the national statistical classification of economic activities.[5] Therefore, the identification took its point of view in the lists of companies gathered by recent mappings an analysis of the sector,[6] which was expanded through research in relevant databases and with the help of the Trade Council of Denmark to North America.

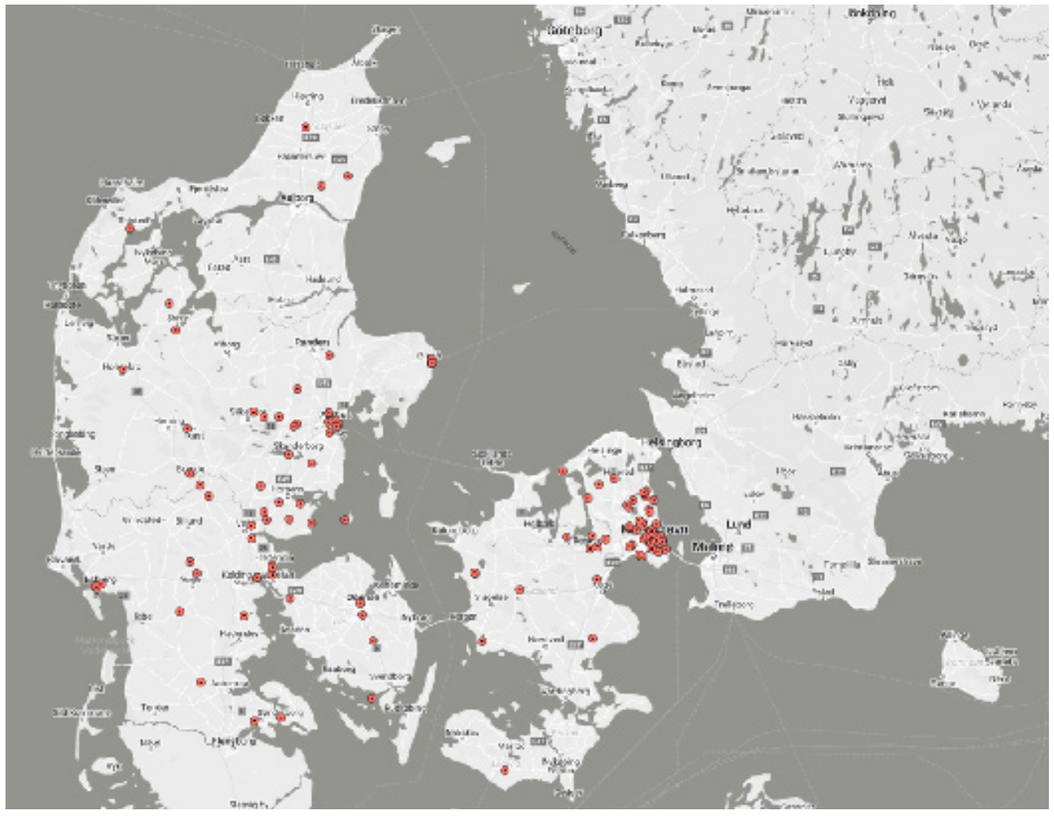


Figure 1 Map of Danish biosolution companies

Map of Danish companies with blosolutions
Visit the map at www.rebrand.ly/za0vcwb Password: teknologi

[5] Statistics Denmark: Dansk Branchekode DB07, v3:2014
[6] Iris Group, 2021: Biosolutions i Danmark. Analyse af bioøkonomiens potentialer og vækstbetingelser og HBS Economics, 2021: Økonomisk, klima- og miljømæssigt fodaftryk af biosolutions i Danmark

The 146 companies have been mapped against the Experian Business database. The analysis reveals a very diverse representation across traditional statistical classifications sector codes. 27 percent of the companies are primarily active within food and agriculture, but other industries within chemical and pharma occupy 10 percent, and equipment, and recycling is also represented with 9 percent. Another concentration of companies is within technical services and research, which activates another 33 percent of the companies, which is very illustrative of the weight of technology in biosolutions. The third largest sector for biosolutions companies is retail and trading that occupies 16 percent.

13 percent of the companies have more than 200 employees which is a significant overrepresentation of large companies compared to the Danish business demography overall where less than 1 percent have more than 200 employees. 47 percent of the companies have less than 10 employees.

Most of the companies have Danish ownership but for 17 percent the mother company is foreign, and only one of the mother companies is from the US (FMC Corp with 6500 employees worldwide). 24 percenthave affiliates outside Denmark, and at least 5 percent have affiliates in the US.

To understand the customers of the Danish biosolution companies, representatives form a number of Danish biosolutions providers were asked (in a CATI-based survey) about their expectations of the market demand for their product. The objective of the survey was primarily to harvest keywords that could be used when mapping US businesses within agriculture and food. Representatives from 27 companies responded to the telephone interview, which was sufficient for the harvesting of keywords, 25 answered all questions.

Company representatives were also asked a few questions about their business and their relation to the US market. The Companies were randomly sampled to insures statistical representativity of the results. We have no reason to believe that the results are biased. However, when studying the figures below based on the survey be aware that with 25 respondents, results are (at best) indicative for the sector. Keep in mind that one response equals 4 percent of the sample.
The majority of the interviewed Danish biosolution companies work with products based on biological processes (77 percent), while a smaller part (23 percent) produces and sells machinery or other types of equipment for handling biological processes.

Export incentive companies. As known from past research[7], the Danish sector for biosolutions is amongst the best performing business sectors in Denmark in terms of internationalization, as almost 80 percent of the sector's revenue comes from exports. Almost half of the respondents from the survey (48 percent) have more than 30 percent turnover comming from export, while only 20 percent of the companies have no export at all. This is contrary to the general picture of internationalization in Danish companies, where usually only a small part, around 4 to 5 percent, has any export at all.[8]

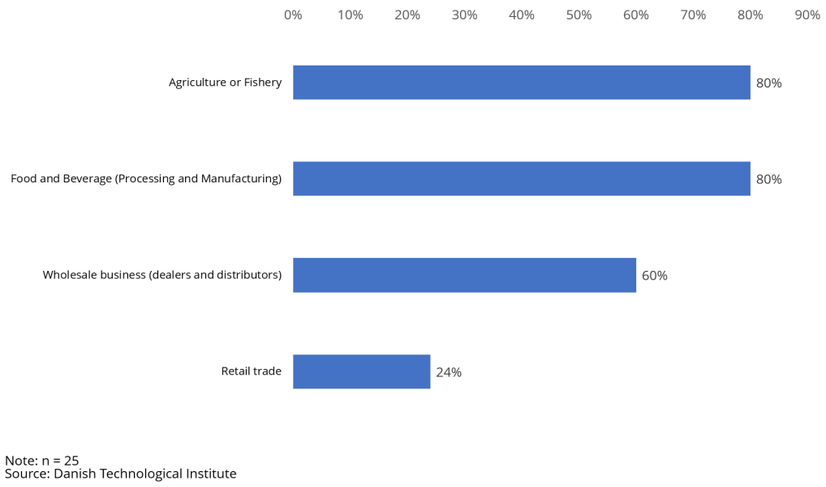
The United States is the most frequent export market for Danish companies in general.[9] Every fifth biosolutions company exports to the US market. In the interviews 76 percent of the companies with export do not export their solutions to the American market. 12 percent have a turnover of more than 30 percent in the US, and 8 percent have some exports to the US (but for less than 30 percent of their turnover).

[7] Copenhagen Economics, 2022: The Potentials of Bio Solutions. Climate and Sustainability Potentials, Barriers to Growth, and Danish Strongholds
[8] Dansk Industri, 2022: Flere eksportvirksomheder vil løfte velstanden
[9] Danmarks Statistik, 2022: Hvor stor er dansk eksport og hvem er vores samhandelspartnere?

Clients of Danish biosolution companies are mainly in agriculture / fishery and food and beverage production

To gain a better understanding of the clientele of the Danish biosolutions companies and the potential in the American market for the sector, Danish Technological Institute analyzed the target sectors of the companies.

Figure 2 shows that the majority (80 percent) of the companies have clients or industry partners within the primary sector (agriculture and fishery) and processing and manufacturing of food and beverages. Meanwhile, only 24 percent of the companies have clients or partners within retail trade.



Note: n = 25
Source: Danish Technological Institute

Figure 2 Sectors of Clients and Industry Partners of Danish Biosolution Firms

Digging deeper into the clients and partners of the Danish Biosolution companies from the primary sector paints a more detailed picture of the industries where Danish biosolutions are in demand.

Figure 3, top figure, shows that companies working with cattle or cultivation of field crops are the most common clients and partners within agriculture for the Danish biosolutions companies. 44 percent of the respondents reply that they have clients or partners within these industries.

Fishing / aquaculture and pigs are also industries that large shares of Danish biosolutions companies cater to (40 percent each). Further, Figure 3 (bottom figure) also shows the segments of clients and industry partners for biosolutions companies within food and beverage. 44 percent target dairies, and right behind with 40 percent is bakeries, slaughter plants and processed food production. Vegetables and especially frozen goods attract less attention from Danish biosolutions companies.

This analysis has highlighted some of the most relevant industries and business sectors of the Danish sector for biosolutions. The wide variety of industries for which biosolutions are relevant highlights the great potential for the Danish companies on the large American market.

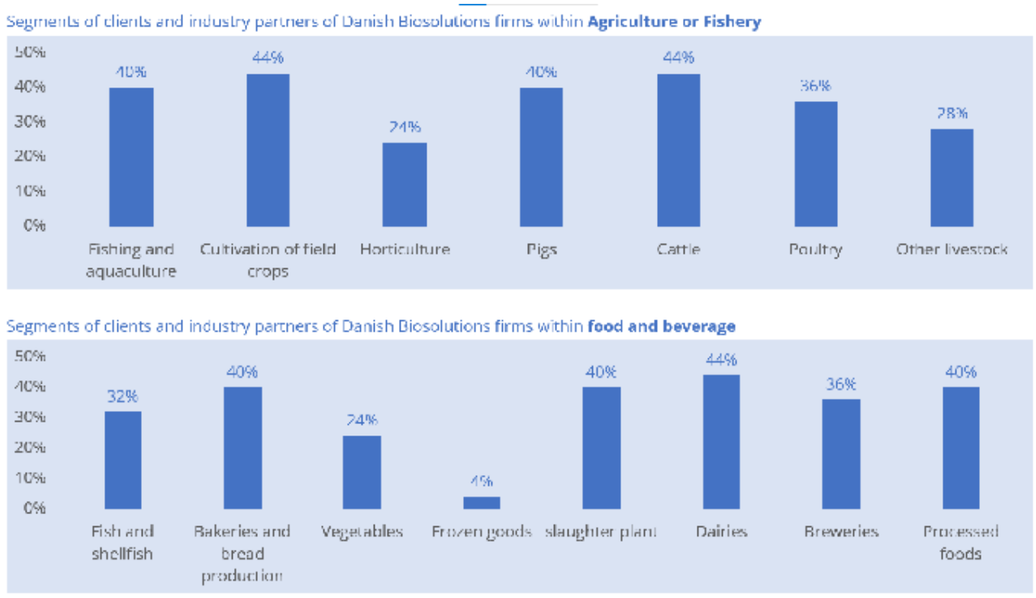


Figure 3 Segments of clients and partners for Danish biosolution firms (N = 25)

Keywords from the Danish biosolutions companies for the US market

The interviewed companies were asked to provide keywords to describe or characterize the market segment in the US that they already, or hope to, sell to. The 88 keywords mentioned by the 25 biosolutions companies are listed below with only a little editing to remove duplicates. Keywords were given in Danish and translated to English (US). In addition to the keywords, synonyms were identified to extend the list. The final list had almost 240 keywords.

These keywords were used to analyze text scraped from the websites of US companies within the agriculture, fisheries, food and beverage production industries. Scraping websites, also known as web scraping or data scraping, is the process of extracting data or information from websites. In our case, it involves extracting and cleaning text from a company website and detecting whether the listed keywords appear on the website and, finally, structure this information in a searchable database The data and methods section explains the process in more detail.

1. Additional growth of fish and avoidance of illness
2. Agriculture/farming, clean drinking water for animals
3. Almond extract, beer, soft drink / soda
4. Amylose, diabetes, bioplastic
5. Bakeries and food manufacturer
6. Bakery, processing of foods and foodstuffs
7. Bakery, slaughterhouse, plant-based ground meat / vegetarian minced.
8. Beer flavor, ingredients for flavor, shelf life and color
9. Better climate profile on products and lower carbon footprint
10. Beverages
11. Bioenergy, green development
12. Biogas plant and production of substrates
13. Biogas, environmental technology
14. Biogas, substrates, and organic fertilizer
15. Bioplastic
16. Bioplastic, sustainable foods / foodstuff, and sustainable fish feed
17. Bread, candy, products for cats and dogs, crackers/ biscuits/cookies, chocolate
18. cleaning and cleansing of water (water treatment)
19. Contribution margin and quality insurance
20. Cultivation of plants
21. Cultivator of plants, growing of vegetables and green house owners
22. Dairy products, food, and beverages
23. Dairy, dairy substitutes and meat substitutes
24. Development of energy and production of fertilizer
25. Electrolysis, hydrochloric acid, biofilm
26. Energy and foods / foodstuff
27. ensuring clean drinking water
28. Enzymes that contribute to making processes work by separating proteins and fat/ fatty substances.
29. Extracts of herbs / herbal extract, fermented, ecology / organics.
30. Feed / fodder, meat, bread
31. Feed, proteins, and alternative proteins
32. Feedstuff / Feeding stuff for animals - typically fish farming and pigs.
33. Fish
34. Food and beverages, personal care, pharmaceutical industry, drugs industry
35. Foods, foodstuffs, biomaterial
36. Greater value of product, better health, and quality
37. Health products
38. Ingredients for foods / foodstuff
39. Manufacturing of malt or brew, enzyme-based food processes
40. Manufacturing of milk and dairy products
41. measuring of critical enzymes
42. Meat, feed / fodder, bread
43. Milk and dairy products
44. Milk production and carbon neutral cooling
45. Milk, pigs for slaughtering, chicken, eggs, fish
46. Milk, pigs, chicken / poultry, egg, fish
47. Natural products without synthetic coloring and vegan products
48. No need for pesticides to avoid fungus, positive environmental effect through lower carbon footprint.
49. Optimizing of biological processes
50. Packaging, foods/foodstuffs, feed / fodder
51. Personal care, household products, medicine / drugs
52. Pig breeding, calf breeding
53. Pig, veal, and health products
54. Plant based foods / foodstuff and beverages.
55. Plant nutrients, process optimization, fertilizer
56. Pleasure of quenching the thirst
57. Production of enzymes, food, and beverages
58. Production of fish, fish farming
59. Production of foods / foodstuffs, plant-based meat, plant based beverages.
60. Production of healthy feed/fodder and foods/ foodstuffs
61. Production of pigs and veal, dietary supplements / food supplements / diet supplements
62. Products for horticulture / plant cultivation / plant production, vegetables
63. Propagation and production of seed corn
64. Protein enrichment, green lifestyle, meat replacements (e.g., Plant-based forcemeat/ minced meat)
65. Protein products and fish oil
66. Proteins, ingredients for foods, raw materials leftovers, cut offs from pigs, poultry, salmon etc.
67. Quality insurance
68. Reduction of price, keeping qualities and more healthy
69. Replacement of protein sources like soya and fish meal
70. Resource optimization
71. Retail, hotels, and restaurants
72. Sea farming, marine farming, aquaculture, fish farming, trout farming
73. Seed corn, propagation of seeds and trade with
74. Seed production (barley, corn etc.)
75. Seeds / grains / cereal and corn / maize / sweet corn
76. Seeds, barley, wheat, oat, maize / corn / sweet corn
77. Separation and isolation of proteins
78. Separation and productions of proteins
79. Stability, texture, quality, shelf life
80. Stabilization of digestion and maintenance of iron in the blood
81. Trawler, agriculture, poultry
82. Value increasing of cuts of pig meat, poultry, and salmon. Work up of proteins that can be brought back to foods/foodstuffs.
83. Vegan and eco-friendly/ environmentally friendly, Natural coloring, dyestuff, coloring agents
84. Waste treatment / management, compost, energy
85. Waste treatment / management, food waste and biogas
86. Waste treatment / management, plant cultivation, compost, energy production
87. Well-being and health
88. Whey, protein, isolate

The US market for biosolutions: an overview

The mapping of the potential market in the US identified companies with HQ in the US with agriculture and fisheries as well as food and feed production and beverages. A total of 21,434 companies with 10 or more employees were identified. For the methodology, see the method section in the back.

The geographical position of the companies is shown on the map below. It is worth noticing that even though there are numerous companies in the farming states of the US (Minnesota, Iowa, Illinois) and a little less in the less populated prairie states (Idaho, Wyoming, North Dakota, South Dakota, Nebraska, and Kansas), most companies are concentrated where the population is concentrated, which is mainly along the coastal areas and the major cities. Also, worth noticing is the concentration of companies in areas known for high tech development such as the Bay Area surrounding San Francisco and Los Angeles in California, around Chicago and, not least, in area from Boston, over New York down to Washington. These are areas with high population density as well as knowledge intensive industries.

If the number of companies is related to the size of the population, West Virginia has 0.2 companies per 10,000 inhabitants, while the District of Columbia has 2 companies per 10,000 inhabitants (A factor of 10x compared to West Virginia). Vermont, Oregon, California, and Colorado all have more than one company per 10,000 inhabitants

Headquarters are placed on the map by city. New York City is leading with 697 companies, and 150 more companies if Brooklyn is added to the count. Los Angeles is next on the list with 348 companies, closely followed by San Francisco (340), Chicago (326), Seattle (234), Denver (228), Austin (188), San Diego (187), Miami (180) and Dallas (169). Altogether 14 percent of the companies are located within the top-ten cities.

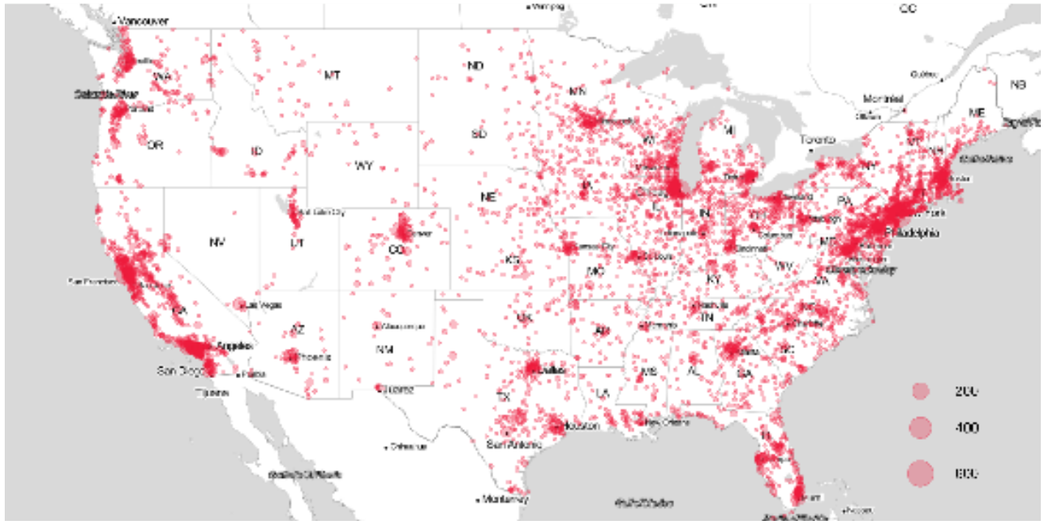


Figure 4 Map of 21.434 firms in the US with relevance for Danish biosolutions

Figure 5 shows how the companies are distributed in terms of number of employees. The results show that most of the companies included in the analysis are relatively small, with more than half having between 11 and 50 employees. Only a small percentage of the companies (just above six percent) have more than 1000 employees..

Figure 6 shows how the companies are distributed in terms of revenue. This data naturally correlates closely with the number of employees. It is common in many markets that most companies are small and few are large. Still, the fact that most companies in the market are small may suggest that there is a relatively high degree of competition and fragmentation in the market.
However, the presence of many small companies could also indicate that there is a significant demand for products or services, which could present an opportunity for a foreign company to enter the market and compete by offering unique or differentiated solutions. Additionally, small companies may be more flexible and responsive to new ideas, which could make them more receptive to partnering with a foreign company with innovative products or services.

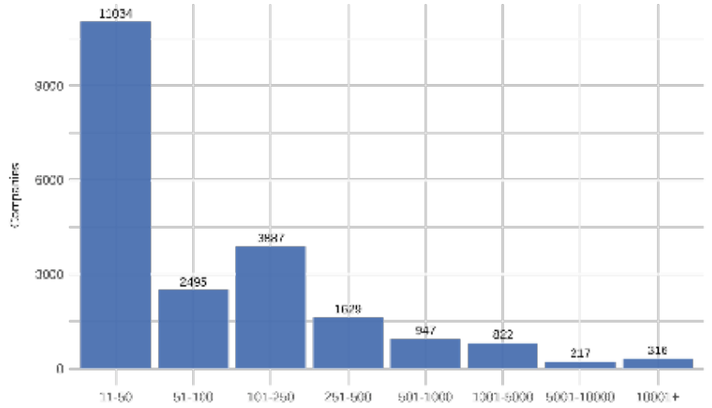


Figure 5. Distribution in terms of number of employees

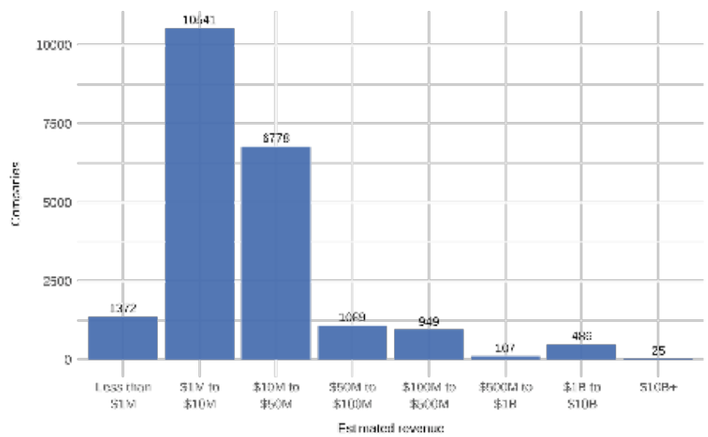


Figure 6. Distribution in terms of revenue

Types of company profiles

Food and agriculture companies have diverse product focuses and production methods. Some companies may specialize in food production, while others may concentrate on specific technologies, agriculture, fishing, beverage production, or packaging, among others. Understanding the different profiles of these companies is important for identifying potential markets and customers and developing effective strategies.

The main product of this project is an interactive, online database of over 21,000 US food and agriculture companies, which enables users to conduct customized searches to find companies with specific profiles.

There are several ways to conduct a targeted search. Users can select from 21 pre-defined profiles created by a topic modeling algorithm (machine learning) and filter by company size (employees), revenue, and geographical location. Additionally, users can select one or more relevant keywords from a list of 163 options. Only companies that match ALL selected keywords will appear in the search results. A company is assigned a keyword if it appears on its website. By combining all filters, the search becomes highly targeted.
If the predefined profiles are less relevant, users can focus on creating a unique combination of keywords to identify the particular companies of interest.

The following briefly introduces how to customize a search for a specific company profile. Read the user guide for a more thorough description. Afterwards each of the 21 profiles generated by machine learning are presented to provide an overview of the most common company types in the database.

Customizing a company profile: how to search the online database

If you want to find food manufacturing companies with less than 500 employees who use fermentation to create proteins, you can use our web application to create a targeted search. Fermentation is a helpful method for producing large amounts of protein quickly and efficiently. Microorganisms used in fermentation processes, such as bacteria and yeast, can produce proteins that are scares or ineffective to derive from traditional methods.

To start, choose the "Product Development and Manufacturing" profile in the web application. This category has companies that specialize in making food products. But it has many food manufacturing companies of all sizes. If you want to narrow down your search results to smaller companies, deselect companies with more than 500 employees. Finally, to find manufacturing companies that use fermentation and protein, add the keywords "fermentation" and "protein" to your search query. This way, your search results will show only smaller food manufacturing companies that mention both words on their website. The search will identify 25 US companies that match the search query.

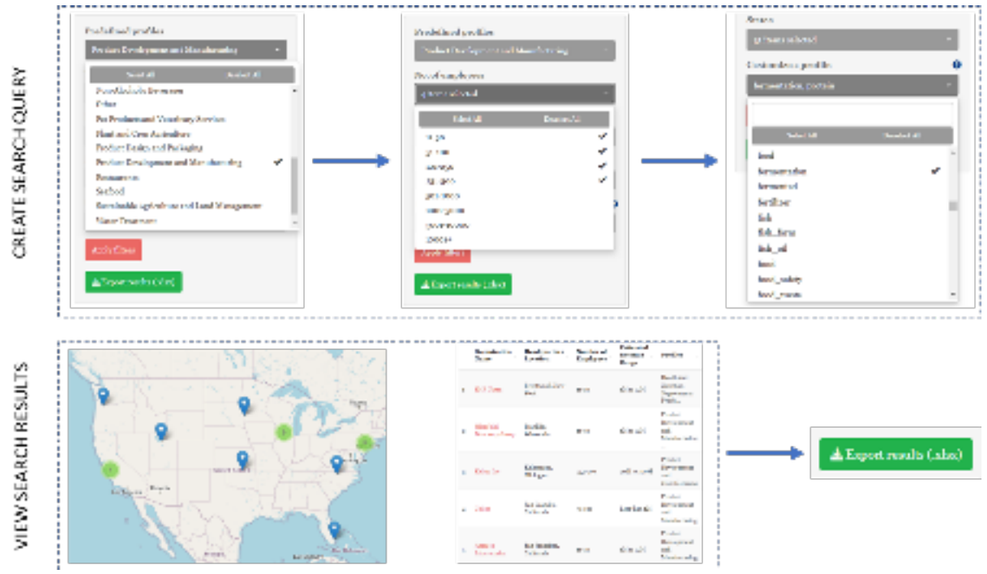


Figure 7. Illustration of how to use the web application

21 profiles generated by Machine Learning

As mentioned, we have identified 21 different types of food and agriculture companies based on the content of their websites. Users of the web application can use these predefined profiles for their search queries. These profiles are created based on a machine learning technique called topic modeling that analyze the words and phrases used on the companies websites.

Topic modeling is a machine learning technique that can automatically identify themes or topics that underlie a collection of text documents. In the context of food and agriculture companies, topic modeling can help to uncover the key themes and topics that are most prevalent on the websites of these companies.

This method depends on text scraped from the company website to correctly classify the company profile. Therefore, it is not perfect. Most are correctly classified but some are not.

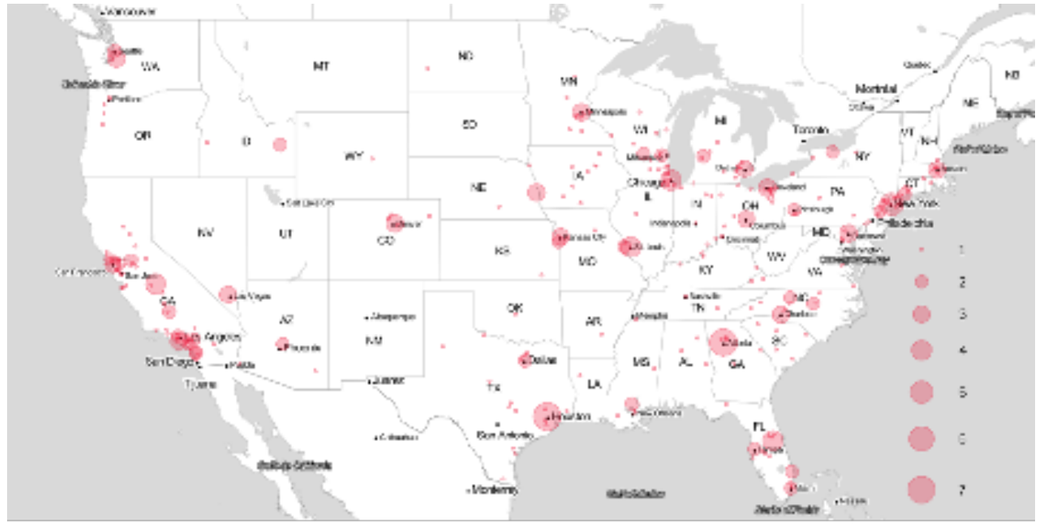
Some of the company profiles uncovered by our method are irrelevant for Danish biosolutions companies. These have to do with family farms, hotels, casinos, supermarkets, food logistics, magazines, etc. Hotels and casinos, which there are a lot of, offer food and are therefore also categorized as food and agriculture companies. These companies are in our analysis categorized as 'Other'. 7419 companies are in the 'Other' category, leaving 13897 companies classified under at least one of the 21 relevant profiles.

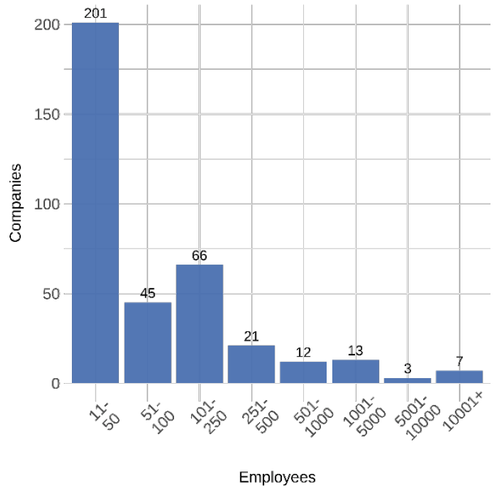
The graph below shows how the remaining companies are distributed among the 21 identified profiles. The top three are restaurants, business solutions and services, and companies within non-alcoholic beverages. The rest of this section provides a description of each profile with statistics on how the companies within each profile are distributed geographically and in terms of company size (number of employees and revenue).

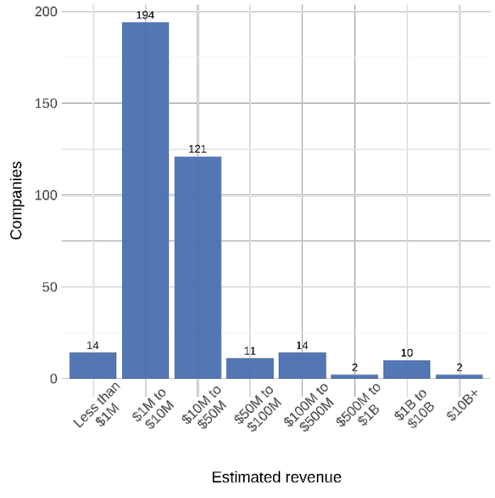
Figure 8. Distribution of the 21 profiles

Agricultural and Food Technology

Companies in this category use technology to improve the efficiency, sustainability, or safety of agricultural production, food processing, or distribution. Solutions can help address challenges related to climate change, water scarcity, soil degradation, and food waste, as well as improve food safety, traceability, and quality.

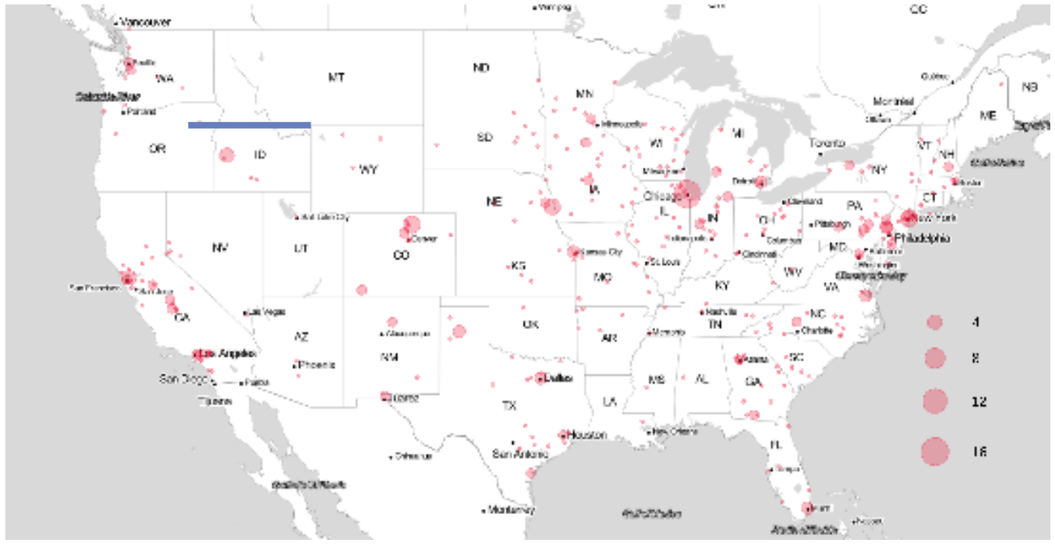






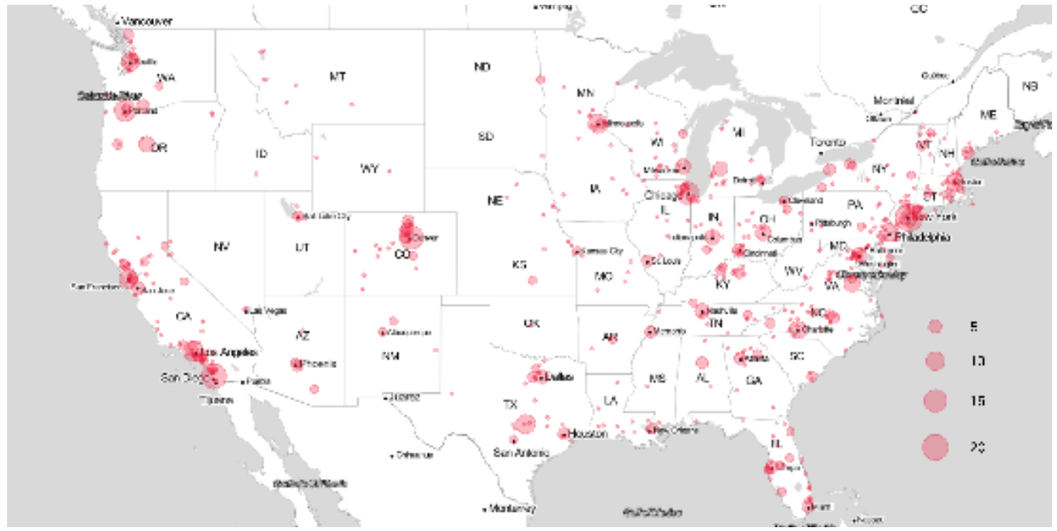
Animal Farming

This is the industry that involves the raising, feeding, slaughtering, and processing of animals for human consumption or other uses. It includes various types of animal products such as meat, eggs, and dairy products. Some common animals raised for food are cattle, pigs, chickens and turkeys. Some animal products are processed into other foods such as hot dogs, yoghurt and sausages



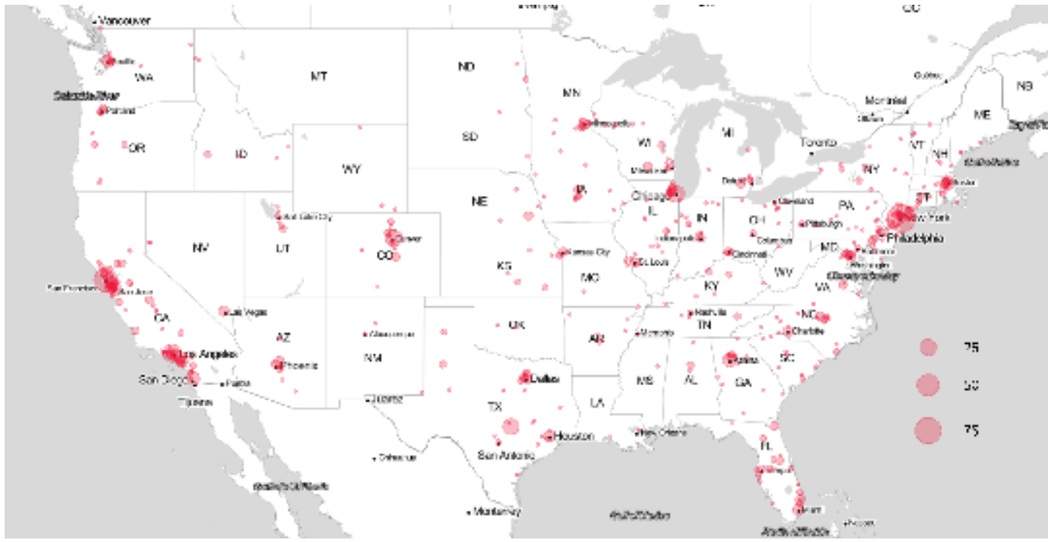
Breweries

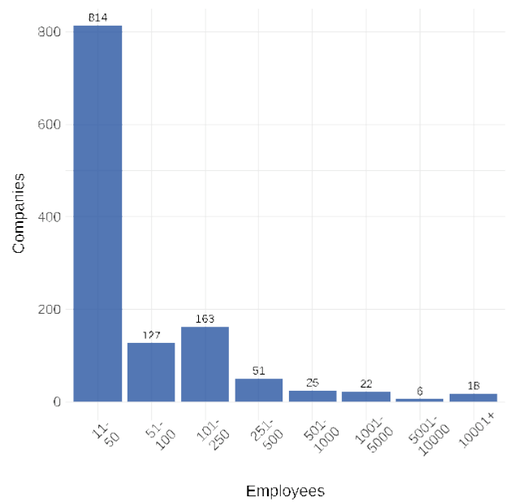
The companies falling under these keywords are primarily focused on the production, distribution, and sale of beer and other alcoholic and non-alcoholic beverages. Craft beer breweries are a key category within this group, offering different beer styles made with ingredients such as hops and malt. These companies may also produce and sell spirits, ciders, and other beverages. They may have their own taprooms or tasting rooms, as well as partnerships with bars and restaurants to offer their products.

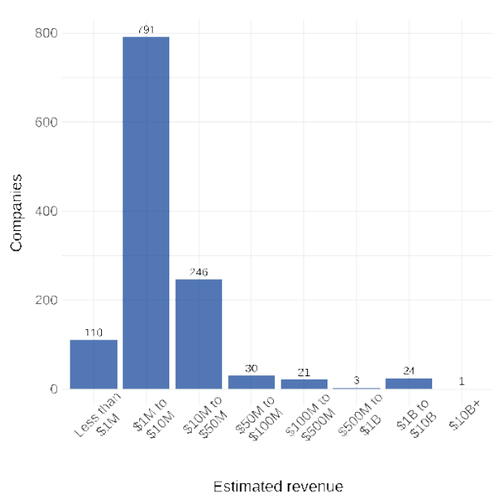


Business Solutions and Services

This category of companies offers custom business solutions and services that are tailored to meet the specific needs of individual clients within the food and agriculture sectors. These companies provide a wide range of services, including data management, market research, business process outsourcing, customer relationship management, software development, and platform integration. They may also offer solutions for improving operational efficiency and reducing costs.

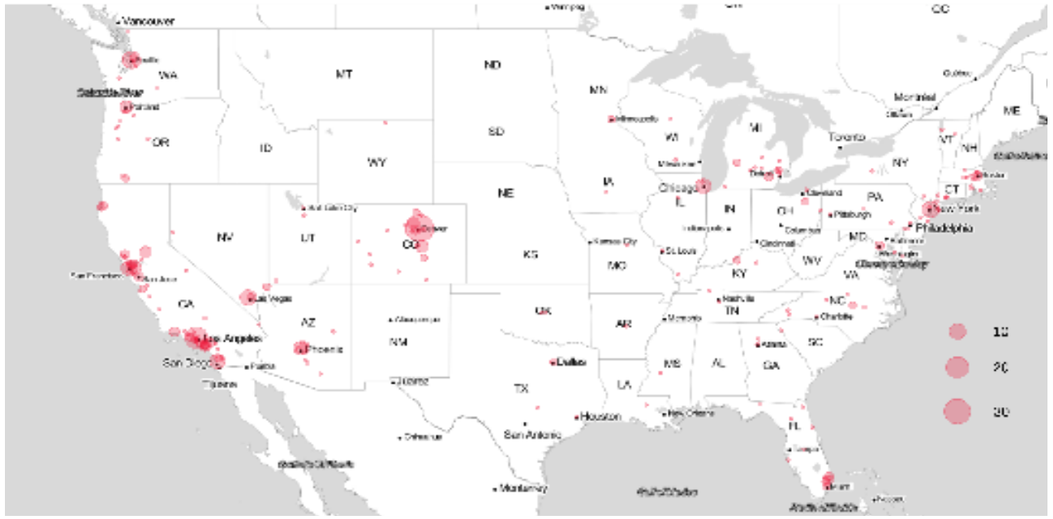


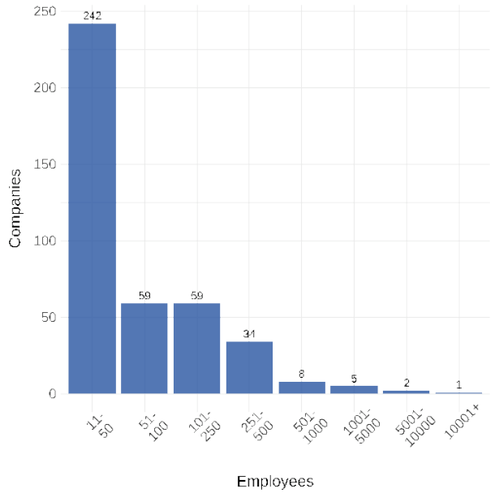


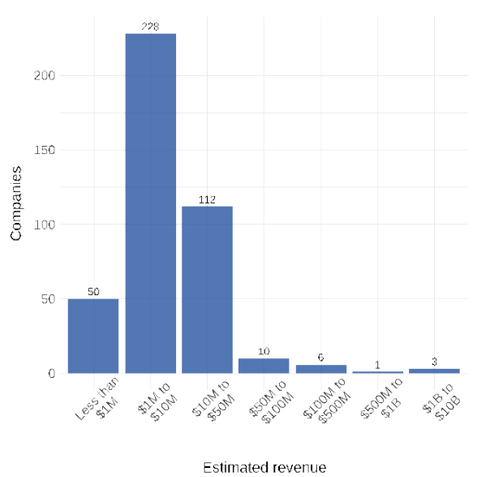


Cannabis and CBD companies

This category includes companies that are involved in the production, distribution, and sale of cannabis and CBD products. Cannabis refers to marijuana and hemp, while CBD is derived from hemp plants. These companies may offer a range of products, including flower, oil, vape cartridges, and edibles. Some companies in this category may also focus on the medicinal properties of cannabis, offering products specifically designed for therapeutic use. Additionally, companies in this category may operate dispensaries, where customers can purchase cannabis and CBD products in a retail setting. Some companies may also offer seed-to-sale tracking software or verification services to ensure the safety and legality of their products.

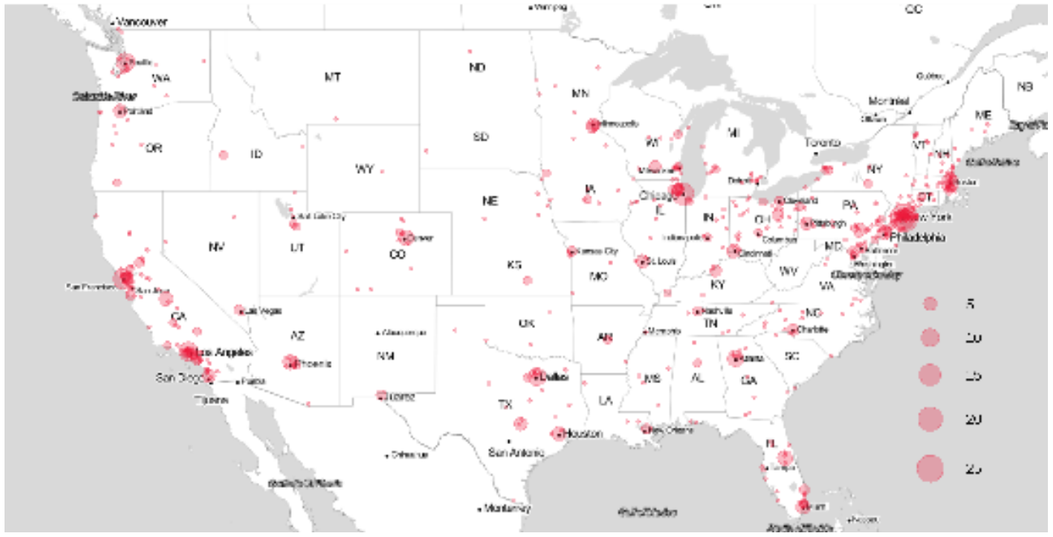


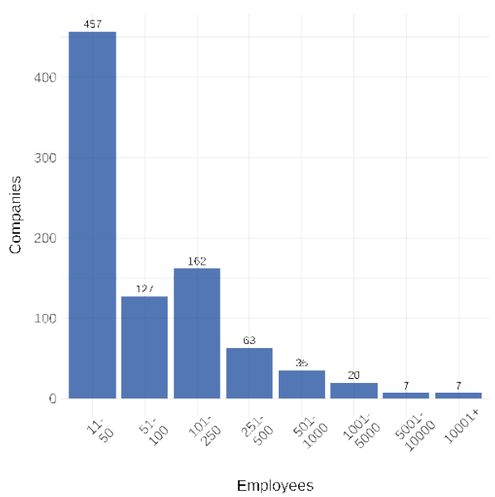


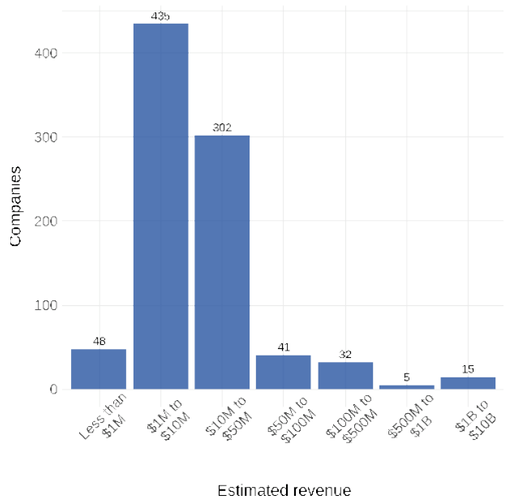


Chocolate and Confectionery

This industry involves the production and processing of drinking milk and dairy products, including cheese, yogurt, whey protein, and other dairy-based foods. The industry also includes dairy farming, which involves the breeding and raising of dairy cows to produce milk. The dairy industry uses enzymes, cheese cultures, stabilizers, and other additives to create various dairy products with different textures and flavors. The industry also in-volves the use of bacteria to ferment and culture dairy products. In addi-tion, the industry may use soy as a milk alternative for lactose-intolerant consumers. Finally, the dairy industry is concerned with the nutrition of dairy products, including vitamins and fat content, and may provide feed and other supplements to cows to ensure milk quality and quantity

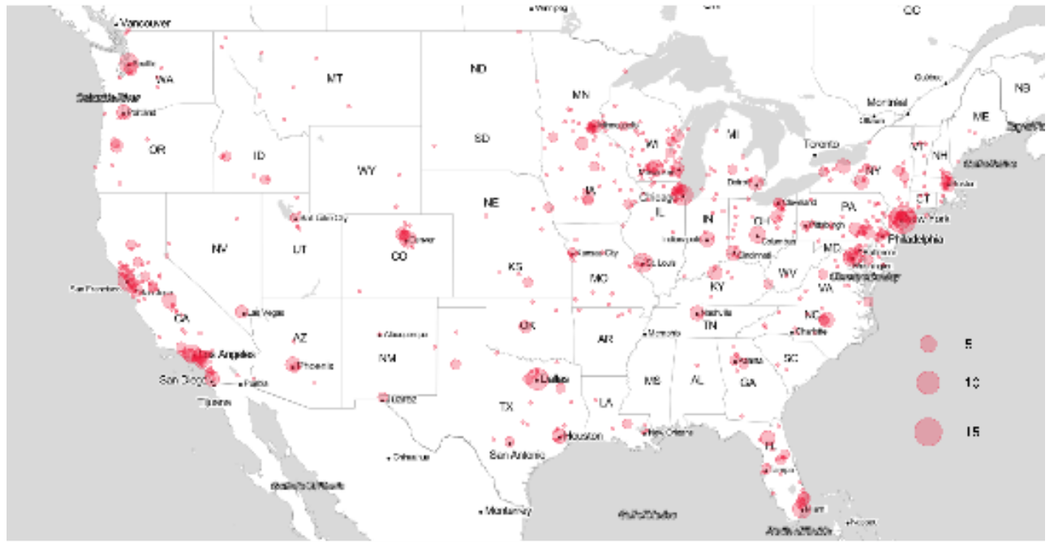


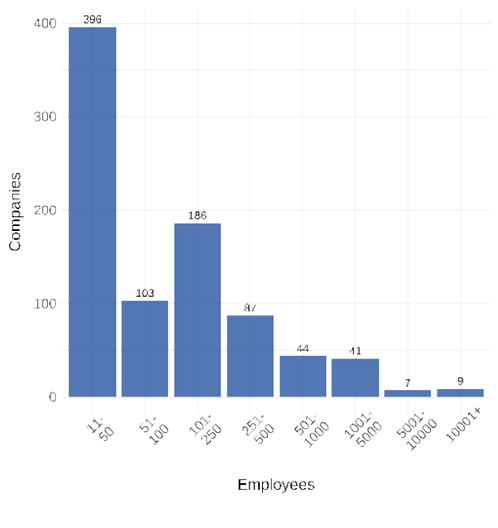


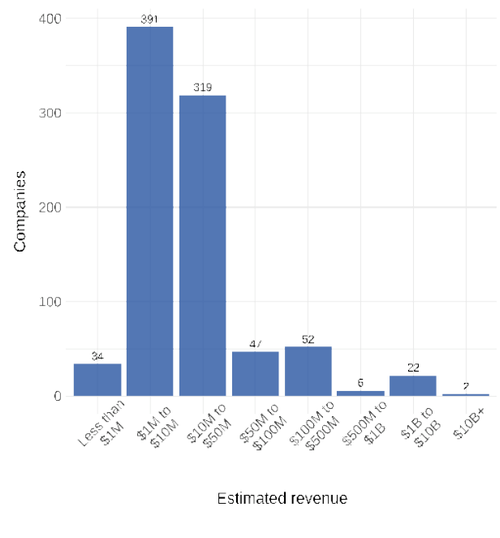


Dairy Products

This industry involves the production and processing of milk and dairy products, including cheese, yogurt, whey protein, and other dairy-based foods. The industry also includes dairy farming, which involves the breeding and raising of dairy cows to produce milk. The dairy industry uses enzymes, cheese cultures, stabilizers, and other additives to create various dairy products with different textures and flavors. The industry also involves the use of bacteria to ferment and culture dairy products. In addition, the industry may use soy as a milk alternative for lactose-intolerant consumers. Finally, the dairy industry is concerned with the nutrition of dairy products, including vitamins and fat content, and may provide feed and other supplements to cows to ensure milk quality and quantity.

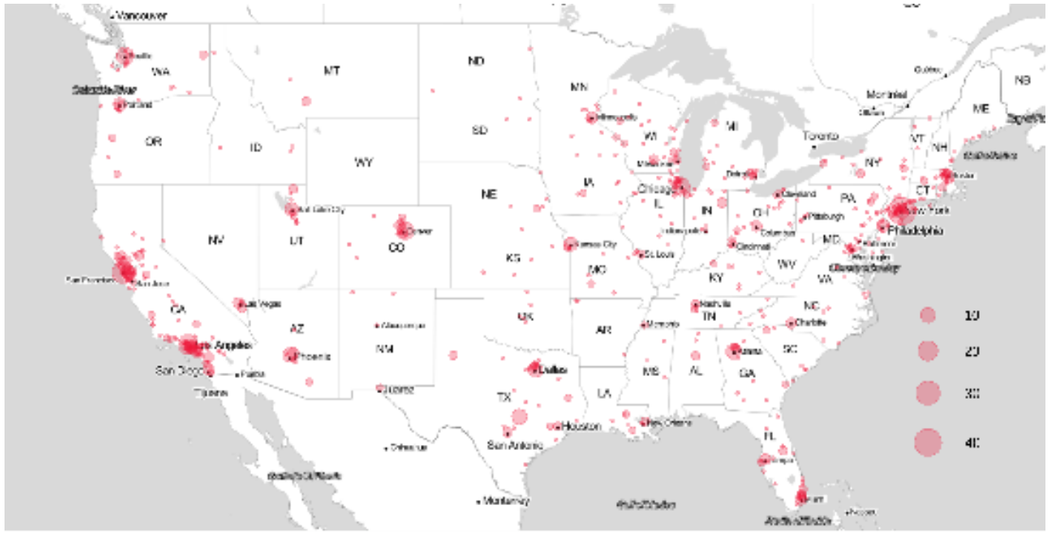


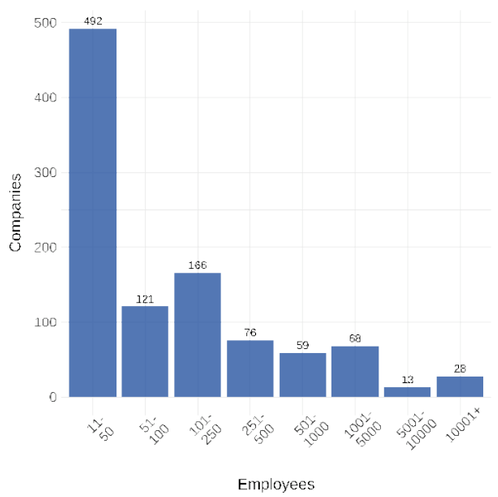


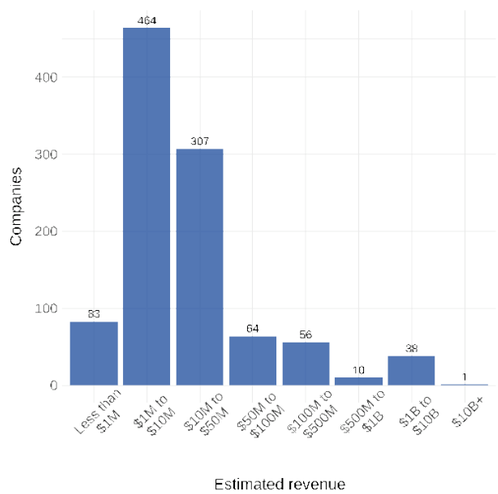


E-commerce

This category of companies specializes in e-commerce and retail services that offer a range of options for ordering, purchasing, and delivering products. They provide customized solutions that meet the needs of their customers, including flexible delivery options, gift cards, and rewards programs. These companies operate online stores and offer a wide range of products at competitive prices.

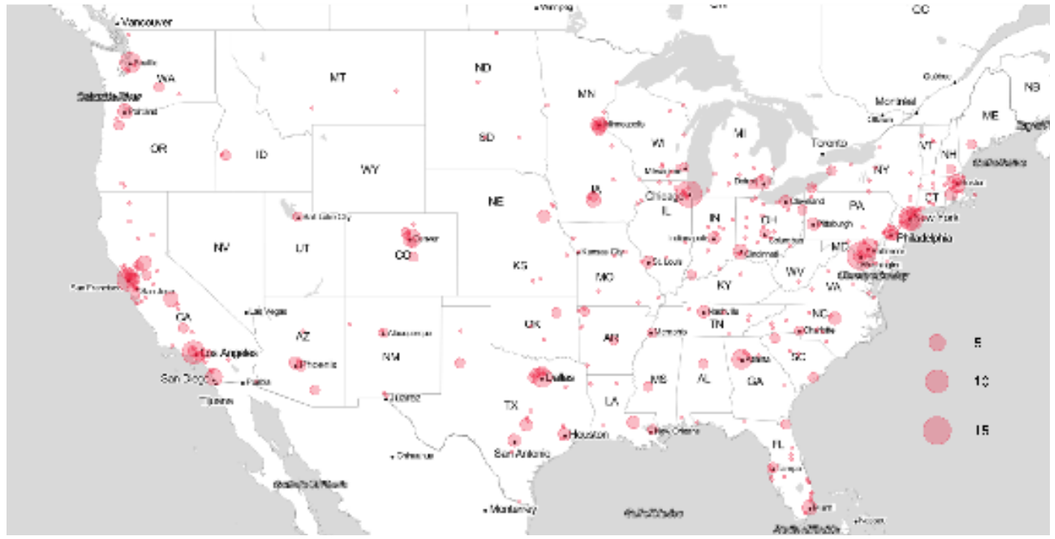


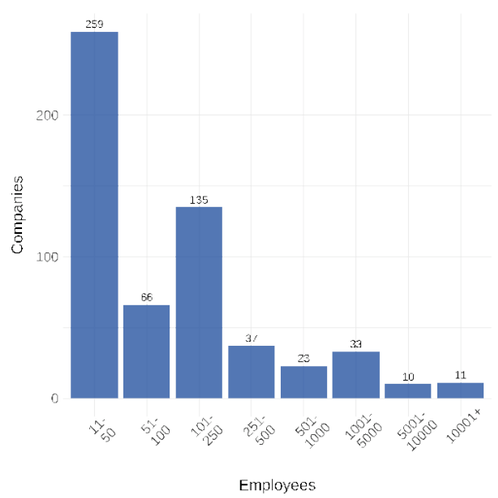


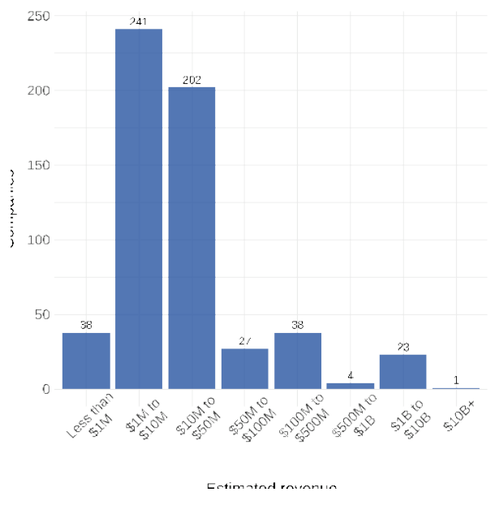


Food and Community Service

This category of companies provides a range of services and programs related to food and community support. These companies prioritize community outreach and providing access to healthy, nutritious food for families, children, and individuals in need. Examples are non-profit organizations such as food banks and food cooperatives.

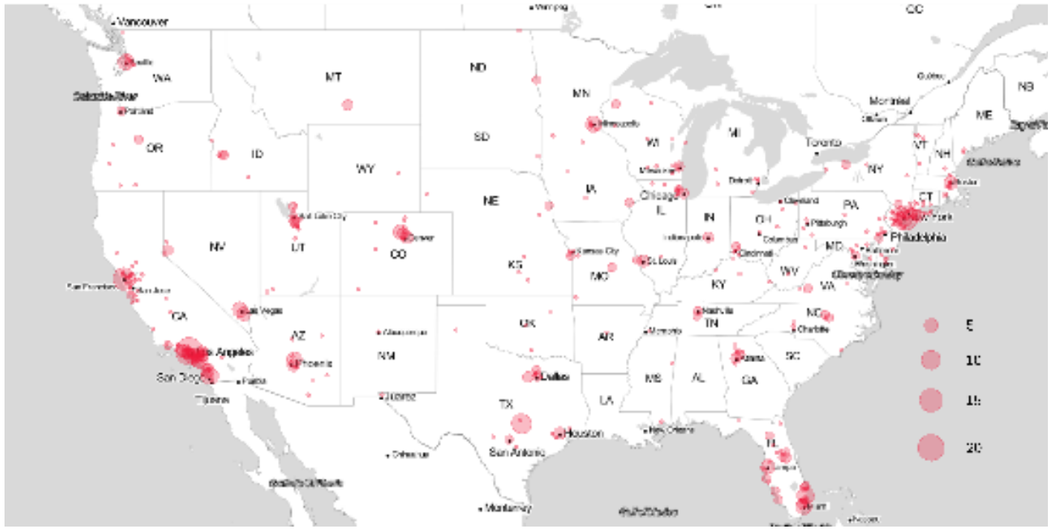


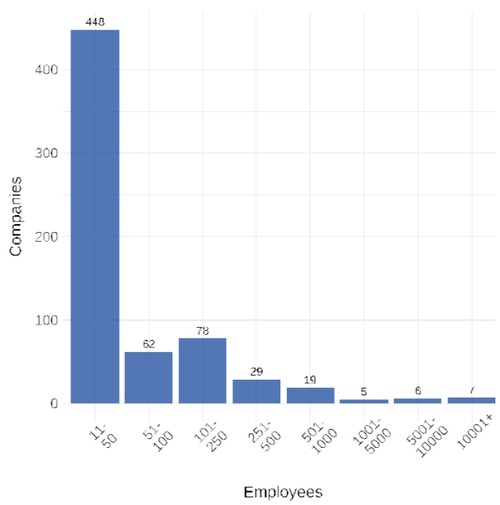


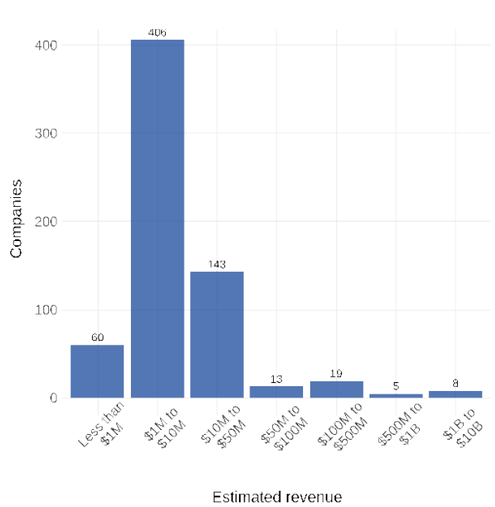


Health and Nutrition Supplements

These companies are primarily focused on health and nutrition supplements that support various aspects of health, such as weight management, muscle building, energy and metabolism, and overall well-being. These companies typically produce and sell supplements in various forms, including vitamins, minerals, protein powders, and natural ingredients. They may also offer diet plans and nutritional guidance to their customers. The products are designed to supplement the diet. The companies may conduct research to develop new products and ensure that their products meet safety and quality standards.

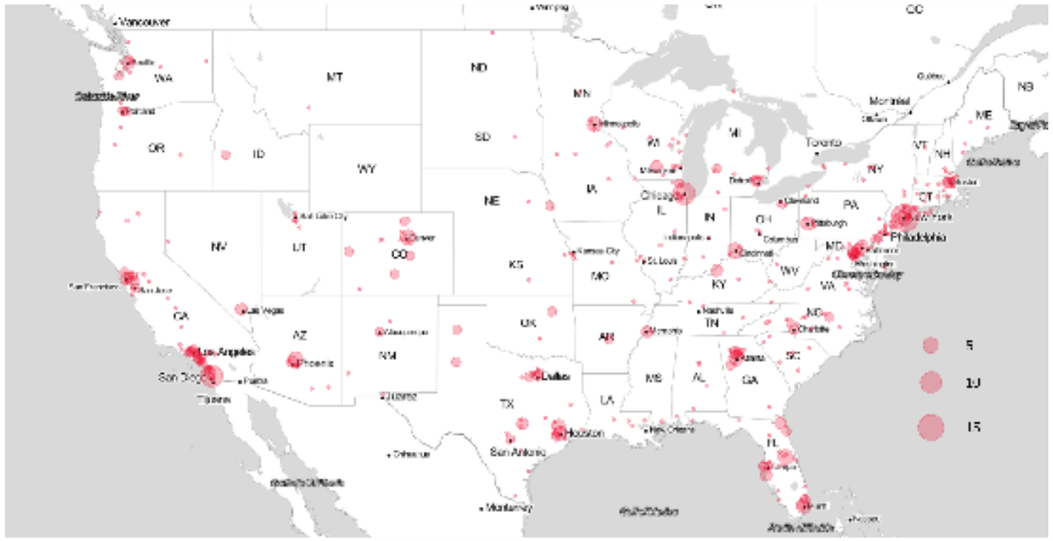


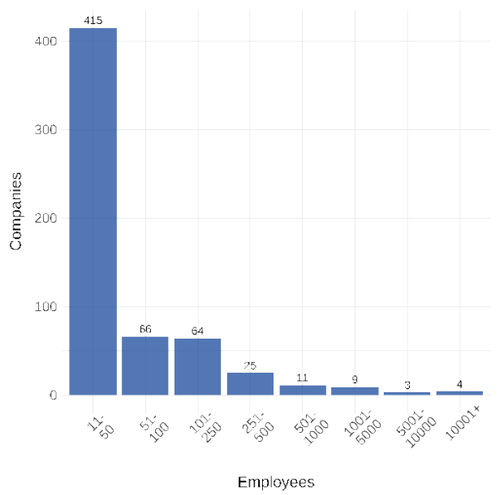


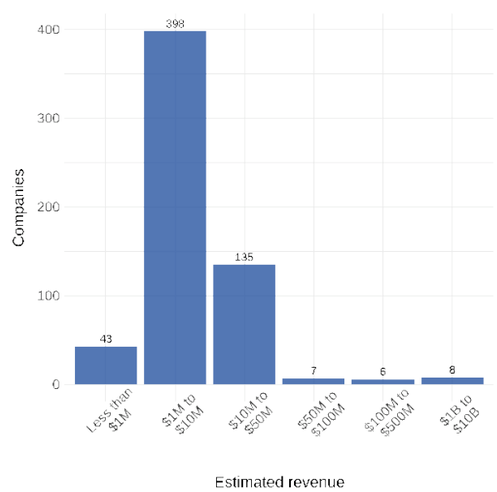


Healthcare and Medical Services

This category of companies provides a range of healthcare and medical services to patients, including treatment for various diseases and conditions, therapy, and pain management. This category of companies provides a range of services and products related to industrial equipment, systems design, installation, maintenance, and financing. These companies serve a wide range of industries, including manufacturing, energy, construction, and transportation.

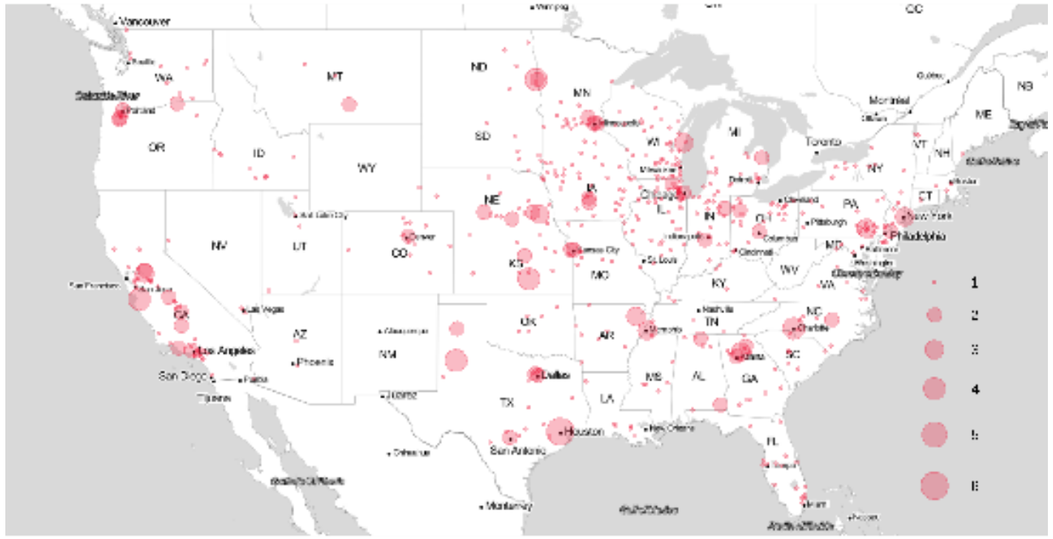


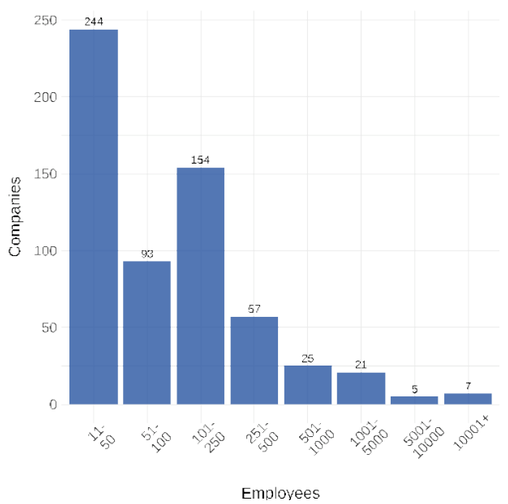


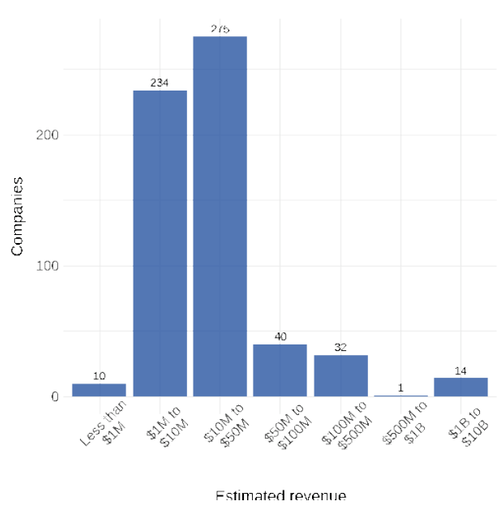


Industrial Equipment and Services

This category of companies provides a range of services and products related to industrial equipment, systems design, installation, maintenance, and financing. These companies serve a wide range of industries, including manufacturing, energy, construction, and transportation.

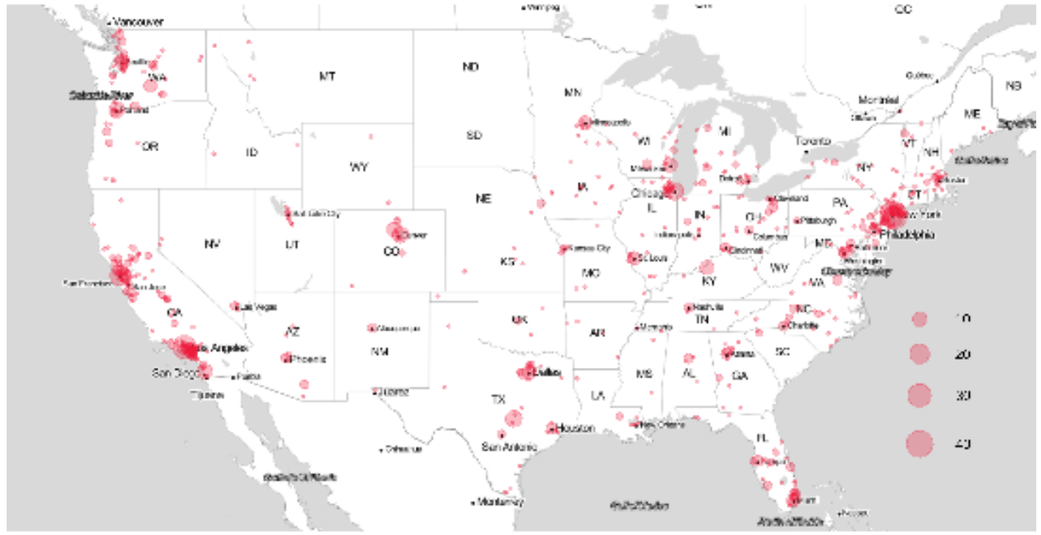


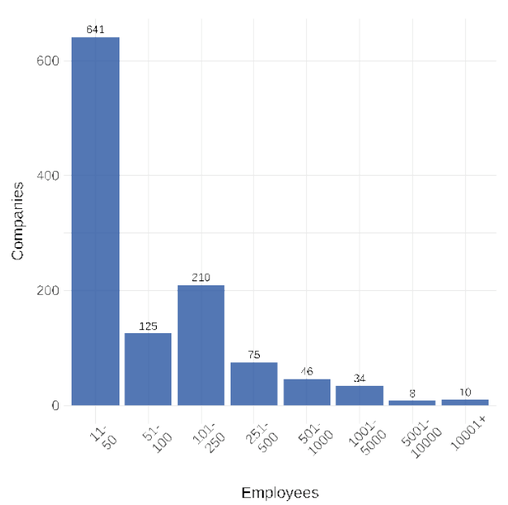


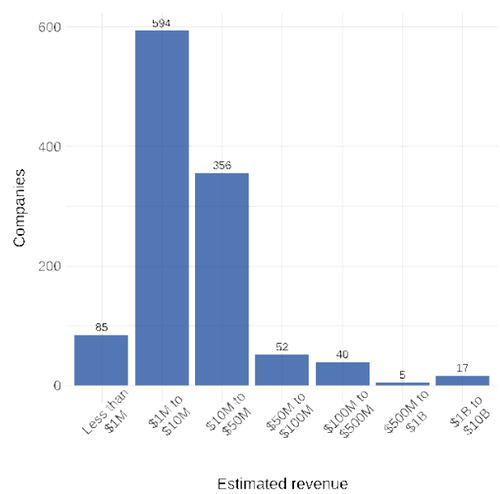


Non-Alcoholic Beverages

This category includes companies that produce and sell various types of beverages such as coffee, tea, water, juice, and other non-alcoholic drinks. The companies may also offer related products, such as coffee machines, vending machines, and bottled drinks. They may sell their products in various forms such as whole bean or ground coffee, tea bags, bottled drinks, and others.

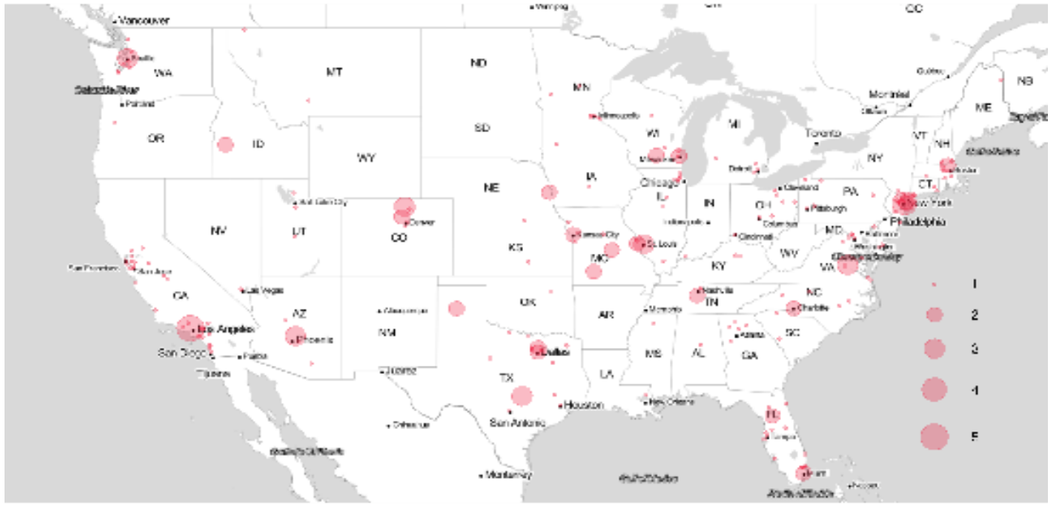






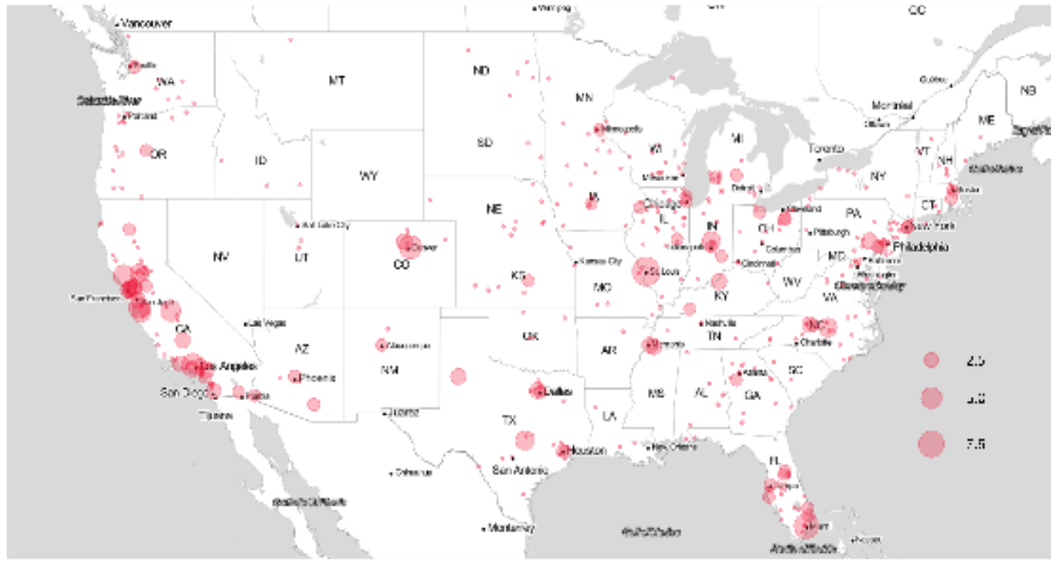
Pet Products and Veterinary Services

This category includes companies that cater to the needs of pet owners, specifically those who own dogs, cats, horses, fish, and other animals kept as pets. These companies provide a range of products and services, including pet food, treats, toys, grooming supplies, and veterinary services. They may also offer training and behavior services, as well as pet insurance.



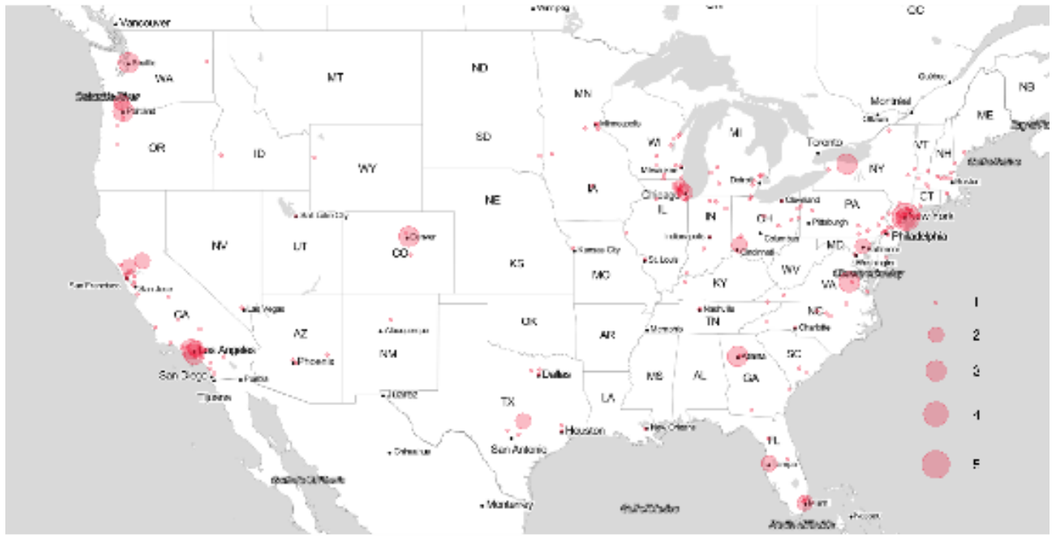
Plant and Crop Agriculture

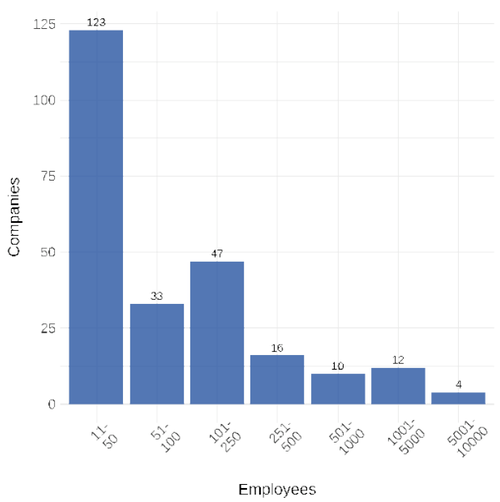
Companies in this category focus on the production and cultivation of various plants and crops. They may specialize in a particular type of plant or crop, or provides services and products for a wide range of crops. These companies may offer seed, fertilizer, plant growth and nutrition products, and other agricultural supplies. They may also provide services such as soil testing, crop management, and irrigation systems

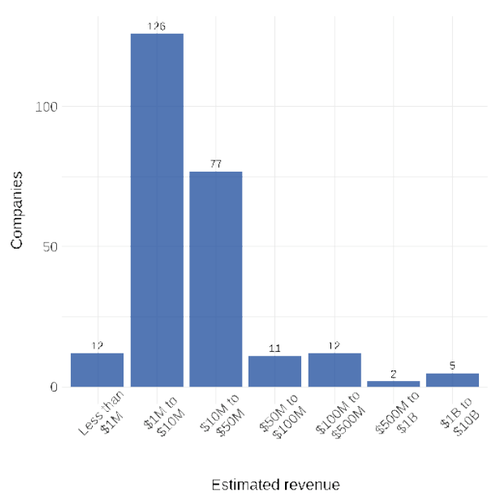


Product Design and Packaging

This category of companies specializes in creating custom product designs and packaging solutions for businesses across various industries. They provide services such as product design, packaging design, and custom manufacturing, as well as printing and branding services.

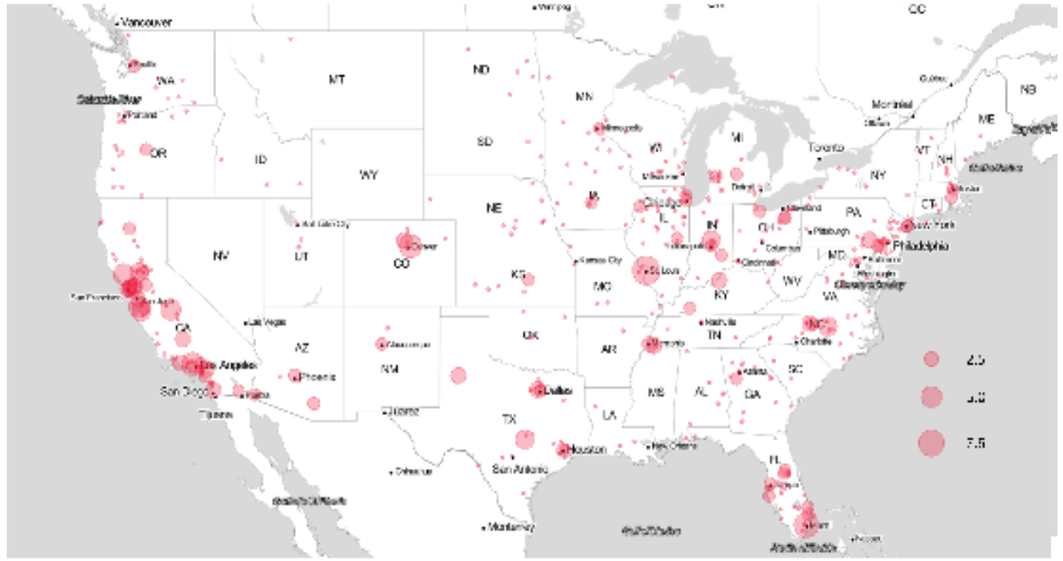


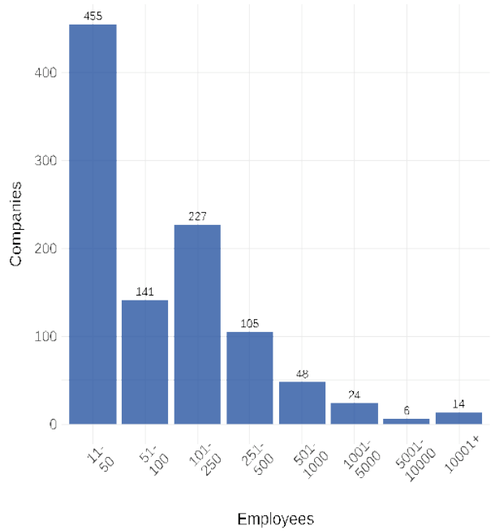


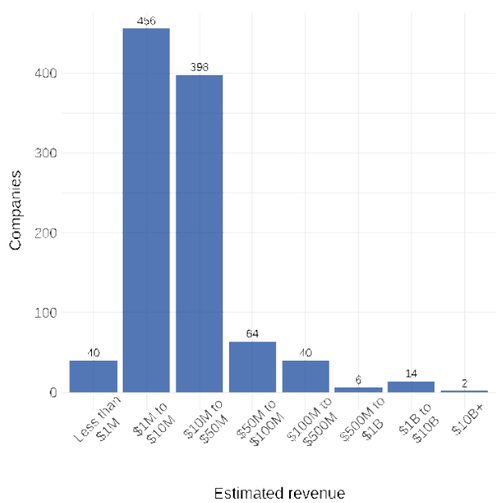


Product Development and Manufacturing

This category of companies specializes in the development and manufacturing of food products. Companies include both manufacturer of food products but also offer a range of services that includes testing, research, and the application of advanced technologies to ensure safety and quality. These companies are dedicated to meeting the rigorous safety requirements and standards of the food industry, while delivering innovative and high-quality products to their customers.

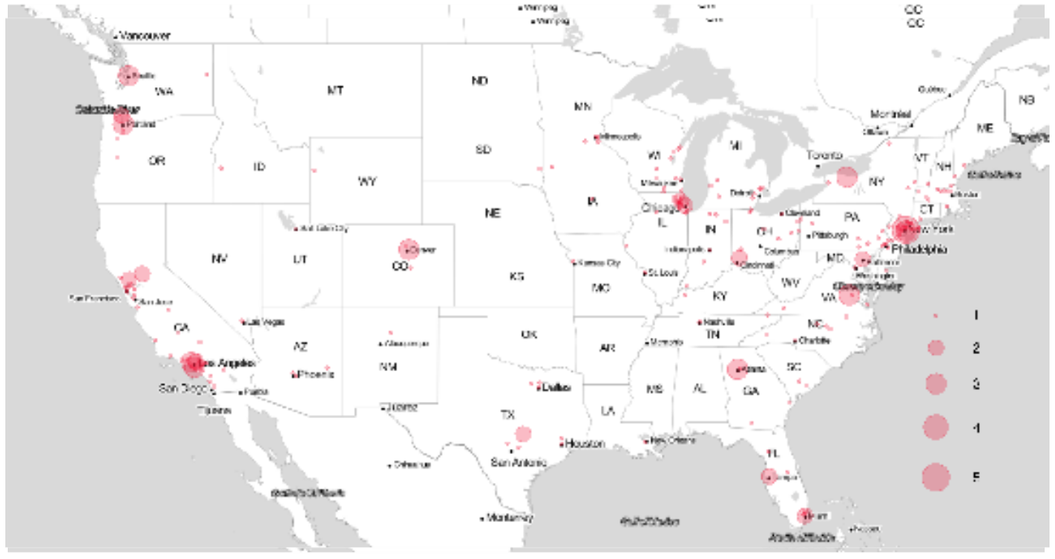


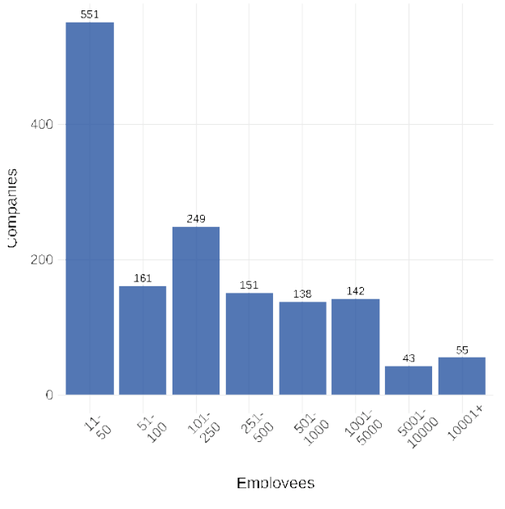


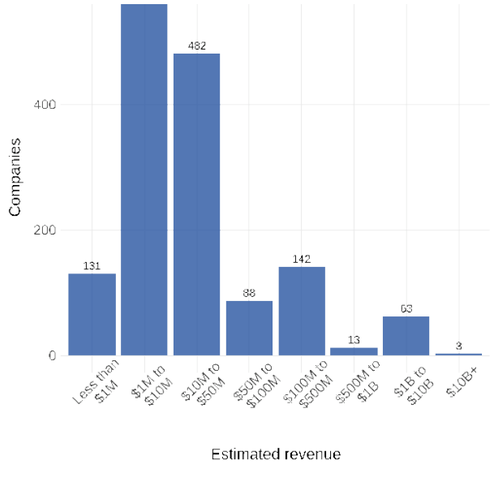


Restaurants

This category of companies provides a range of services and products related to food, dining, and the hospitality industry. These companies cater to a wide range of customers from food enthusiasts to professional chefs.

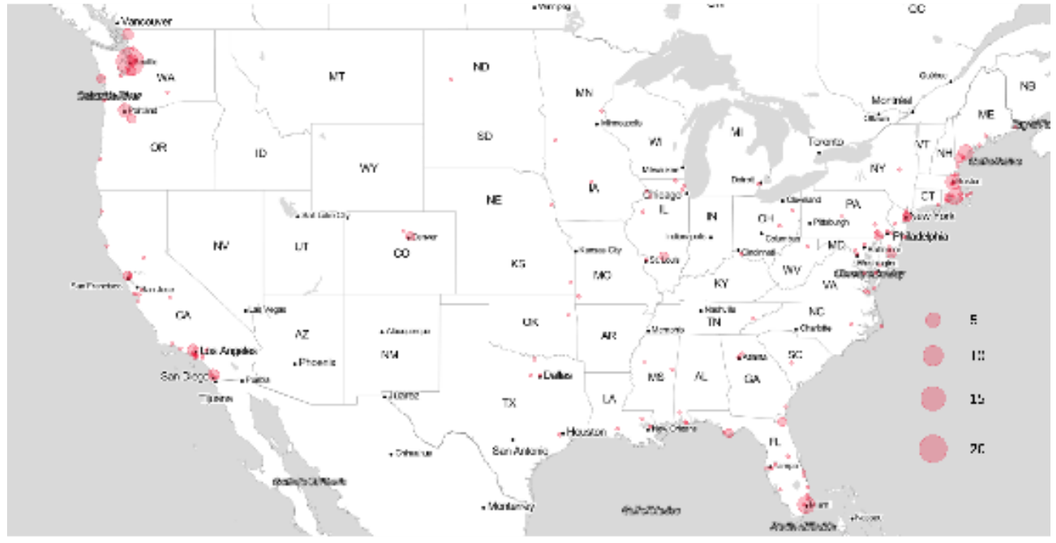


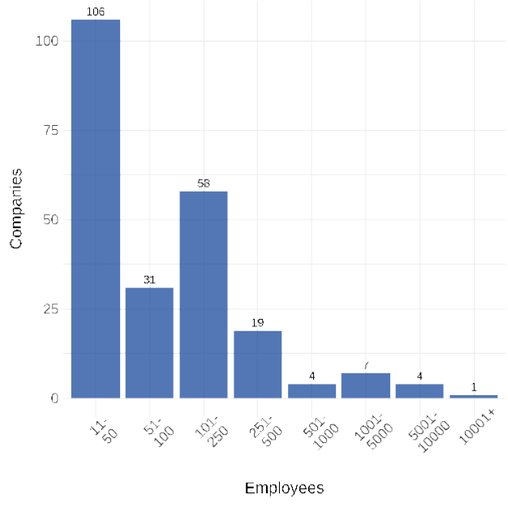


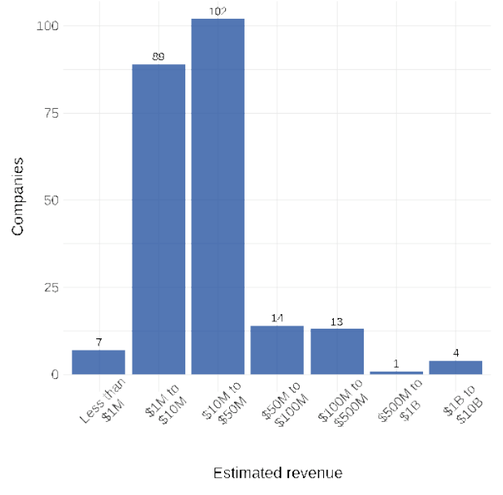


Seafood

This industry involves the catching, processing, marketing, and selling of fish and other aquatic animals for human consumption. It includes various types of seafood, such as salmon, king crab, lobster, shrimp, oysters and caviar. Some seafood products are wild-caught from the ocean or sea, while others are farmed or cultured in fresh or salt water

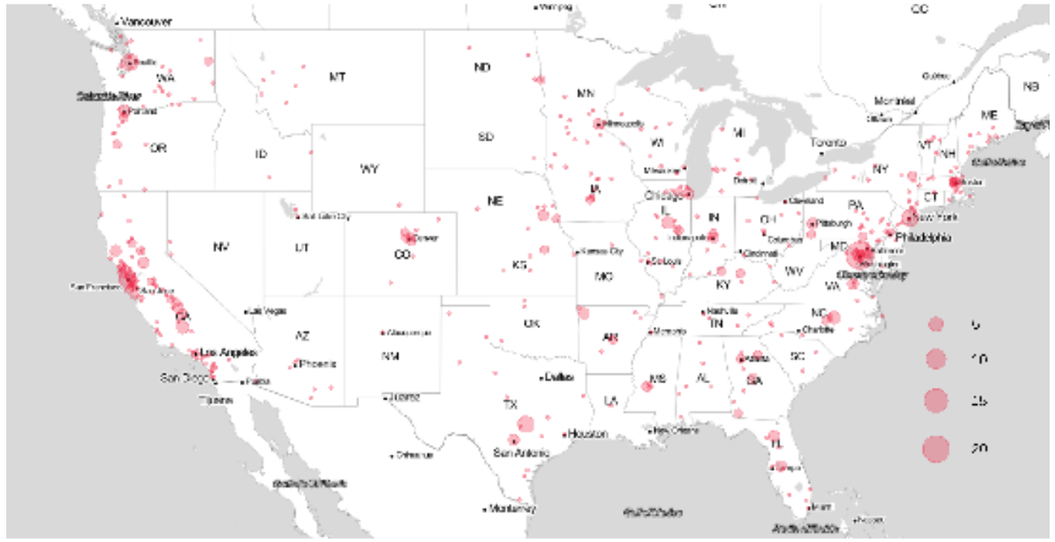


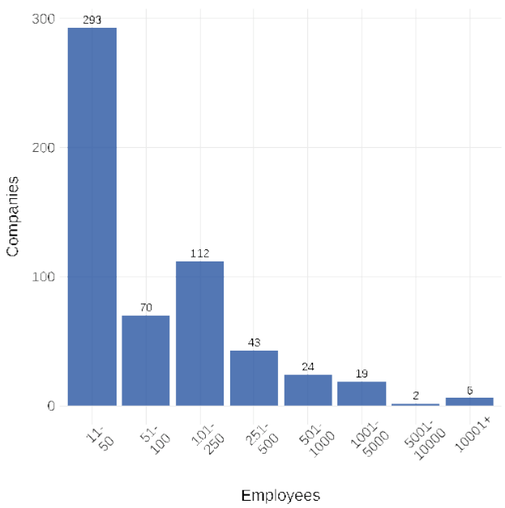


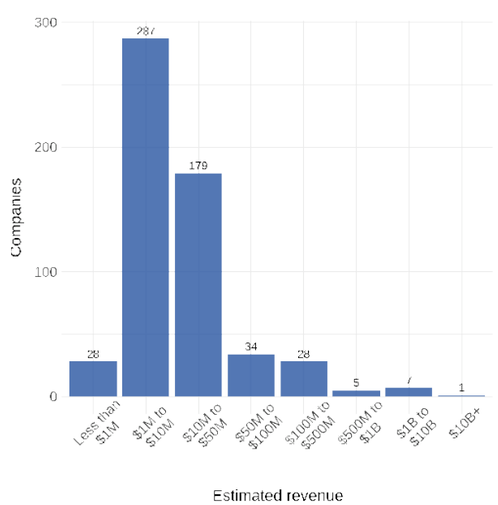


Sustainable Agriculture and Land Management

This category of companies specializes in sustainable agriculture and land management practices. They work to promote and support environmentally responsible farming practices and conservation efforts. These companies may work with local communities, farmers, and landowners to promote sustainable land management practices, provide education and training, and support local markets for sustainably produced goods.

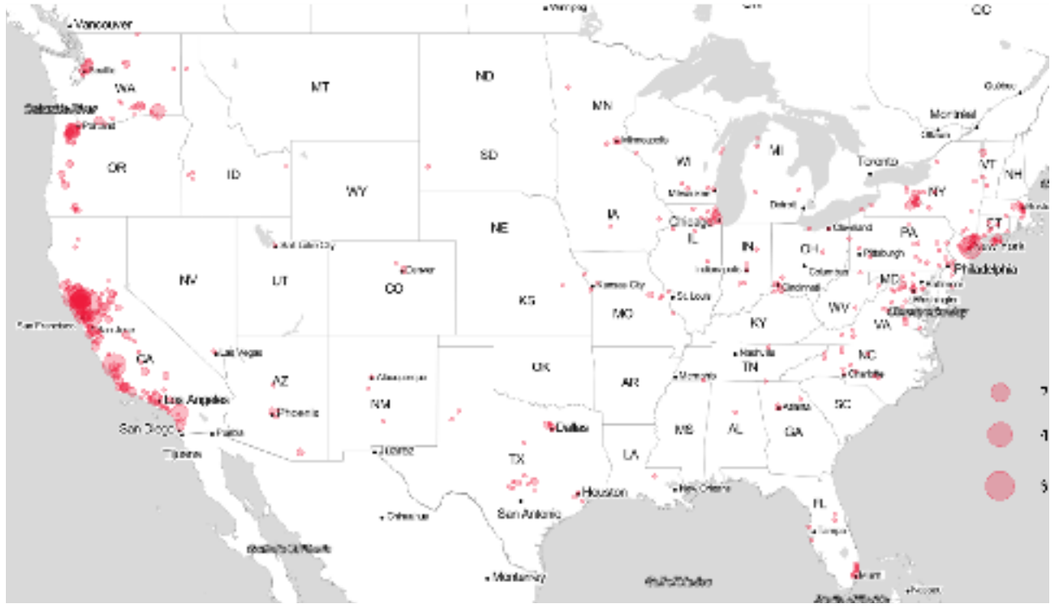


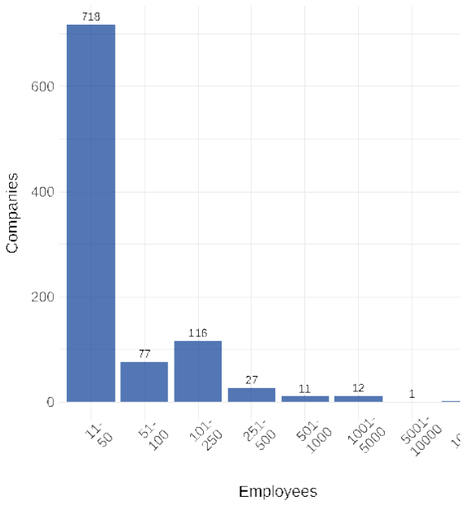


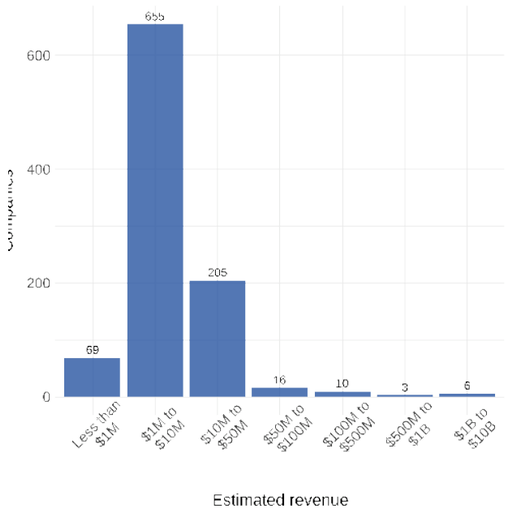


Wineries and Vineyards

This category includes companies involved in the production, processing, and selling of wine. This includes importers and distributors of wines. Wineries and vineyards grow grapes, harvest, and crush them to extract juice, and ferment the juice into wine. The wines produced by these companies can be sold under their own brand name or to other wine brands. These companies may be small family-owned businesses or larger corporations and are often located in regions known for producing high-quality wines such as Napa Valley, California.







Data and method

The Crunchbase database was used to identify all potentially relevant food and agriculture companies. The Crunchbase database is a comprehensive database of companies across various industries and sectors.

While food and agriculture may only be a small part of some companies' business, the database still classifies them as such if they have any connection to these industries. For example, a company that produces chemicals primarily for the pharmaceutical industry but also has a small division that produces fertilizers for the agriculture sector would still be classified within the food and agriculture sector in the Crunchbase database. This classification system allowed us to identify a wide range of companies that have some connection to the food and agriculture sector, providing us with a more comprehensive data set for our analysis. But, as shown in the previous section, it also has the consequence that some irrelevant companies get included.

The background information, including size, location, and website addresses, was enriched by web scraping to create the final dataset. In total, we identified 21,434 companies for analysis.

Web Scraping

Scraping websites, also known as web scraping or data scraping, is the process of extracting data or information from websites. It typically involves using software, scripts, or bots to automatically visit web pages, parse the HTML code, and collect the desired data. The extracted data can then be saved, processed, or analyzed for various purposes, such as research, data mining, business intelligence, or competitive analysis.

To analyze the profiles of the companies in the dataset, we developed a web scraping algorithm using the R programming language. Our algorithm enabled us to scrape all text from the front page and all links from the front page to other pages on the company website. We managed to scrape the websites of 86% of the companies identified. In cases where we could not scrape the website, we used the descriptions found in the Crunchbase database, if available. On average, we were able to scrape 19,061 characters from each website. In contrast, the company description in the Crunchbase database is typically only 192 characters long.

Data Preparation

After scraping the websites, we prepared the data for analysis, which involved cleaning the scraped text for irrelevant words such as stopwords and contact information. Stopwords are commonly used words, such as "the", "and", and "a", that are typically removed from text when analyzing natural language data as they do not carry significant meaning. We used R's text processing packages and regular expressions (regex) to accomplish this task. This step enabled us to ensure that our topic modeling was based on the most relevant data.

Topic Modeling

Topic modeling allowed us to discover topics, or profiles, in the data and classify companies based on their profiles. To accomplish this, we employed the unsupervised machine learning technique of topic modeling using R's topic modeling packages.

The process of topic modeling involves analyzing the text of each website and identifying the most important words and phrases. The algorithms can extract patterns from large amounts of data. Once the most important words and phrases have been identified, the topic modeling algorithm will group them into topics based on their co-occurrence patterns and provide statistics on how much of the text in a document (a website in our case) can be attributed to each topic. In our case, we decided that at least 35 percent of the website text must fall within a topic (or profiles as we call them) for the company to be classified under that topic.

Specifically, we used Latent Dirichlet Allocation (LDA) to identify topics in the data. To determine the optimal number of profiles, we employed a grid search and evaluated our results based on interpretability and coherence. We also assessed the quality of the profiles using evaluation metrics such as profile coherence and profile diversity.

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