

# Investigation into Determining the Best Location for Opening a New Brewery

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## Coursera IBM Data Science Capstone Project

“Beer is proof that God loves us and wants us to be happy. — Benjamin Franklin

### **Introduction / Problem Description:**

Ok, Ben Franklin never said that, but as far as often quoted misquotes go, it is of the highest quality. But beyond being just an enjoyable pint, beer is also big business. Forget about the big multinationals. According to The Brewers Association, the craft brewing industry contributed \$79.1 billion to the U.S. economy in 2018, more than 550,000 jobs (1). Nationally, the number of craft breweries is growing, though the annual growth rate is decelerating. The growth rate was 21% from 2014-2015 and has fallen to 13% from 2017-2018(2). That being said, if you want to investigate the possibility of opening a brewery, there are several things to consider. Kate Lundin, a business start-up blogger on crowdspring.com, lists several considerations (3):

- Choose a business model: What is the planned size of your brewery? Will you operate a brewpub, a microbrewery, a contract brewery, or a regional craft brewery?
- Get to know the legal stuff: There are federal laws, as well as the laws of your state and any states in which you intend to market your beer.
- Fill in the business blanks: A brewery is a business.
- Define your brand: Will you target an upscale market where you will command high dollars per pint, or something lower cost, higher volume?
- Crunch the numbers: Again, a brewery is a business. You may expect to be losing money for several years.
- Build your brewing infrastructure: Equipment is numerous and expensive.
- Optimize your packaging: Bottles, cans, kegs: What is your target mix?

One item not listed that may be of high importance is location. Most brewers begin brewing at home and scale up slowly. If you are looking to open a brewery in your hometown, then your location is already set.

However, if you have flexibility as to location, something to consider would be the potential market (the population of a given area), and how that market is currently being served (number of breweries within a given radius).

### **Target Audience:**

The target audience for this report is any group or individual contemplating the brewery business and the possibility of opening or buying a brewery. The analysis, while limited to a single U.S. state and a single type of venue, could easily be tailored to any location and any venue type in the Foursquare database.

## Data and its Usage:

For this report, I will investigate population centers (by zip code) in the U.S. state of Indiana. This information is available from the U.S. Census Bureau via API. Within the report I will obtain the population for each zip code in the state. Then the populations will be analyzed and areas that are too low in population or are saturated with breweries will be dropped from consideration. Given a zip code, Nominatim will be used to retrieve a latitude and longitude associated with the zip code, and this lat./long. data will be used in making calls to Foursquare. Information returned by Foursquare will be a list of breweries within a given radius. The count of the breweries and the population (and the name associated with the zip code) will be analyzed with the intent of finding an area with a relatively high population and a relatively low number of breweries already present. Additionally, a list of all breweries discovered will be built for further analysis of targeted areas.

## Methodology:

How many breweries are too many? As shown in figure 1, below, the most common value for a U.S. state is two breweries per 100,000 (adults 21 plus), the average being 3.9. It can also be seen that in some circumstances, an economy may sustain up to 12 – 14 breweries per 100,000.

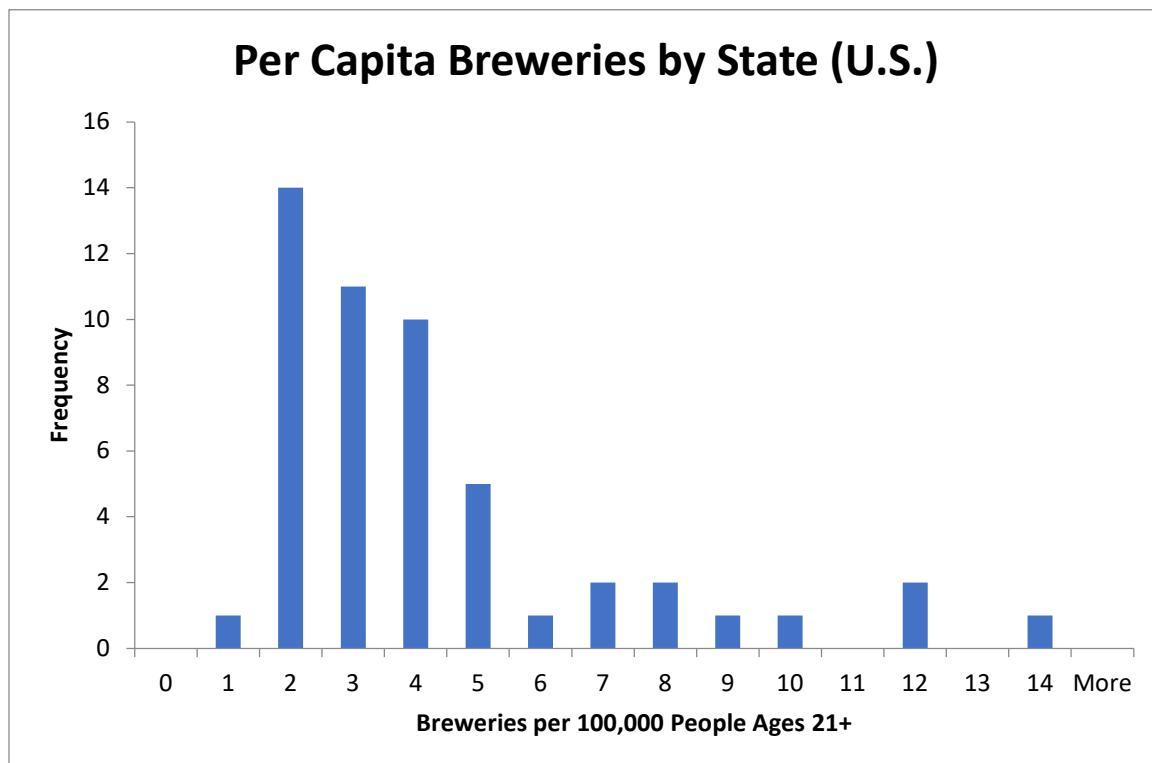


Figure 1. Per Capita Brewery Distribution Among U.S. States

It is not surprising that Maine (11.3) and Vermont (13.5) are two of the top three, as New England has a strong beer culture, even generating its own style of beer (New England IPA).

The number two spot goes to Montana (11.4). The state of Indiana, currently under consideration (due to its proximity to the author), boasts 3.7 breweries per 100,000. Just below the average, with what appears to be plenty of room for growth.

And growth matters. As shown below in Figures 2 and 3, there has been solid growth in this industry.

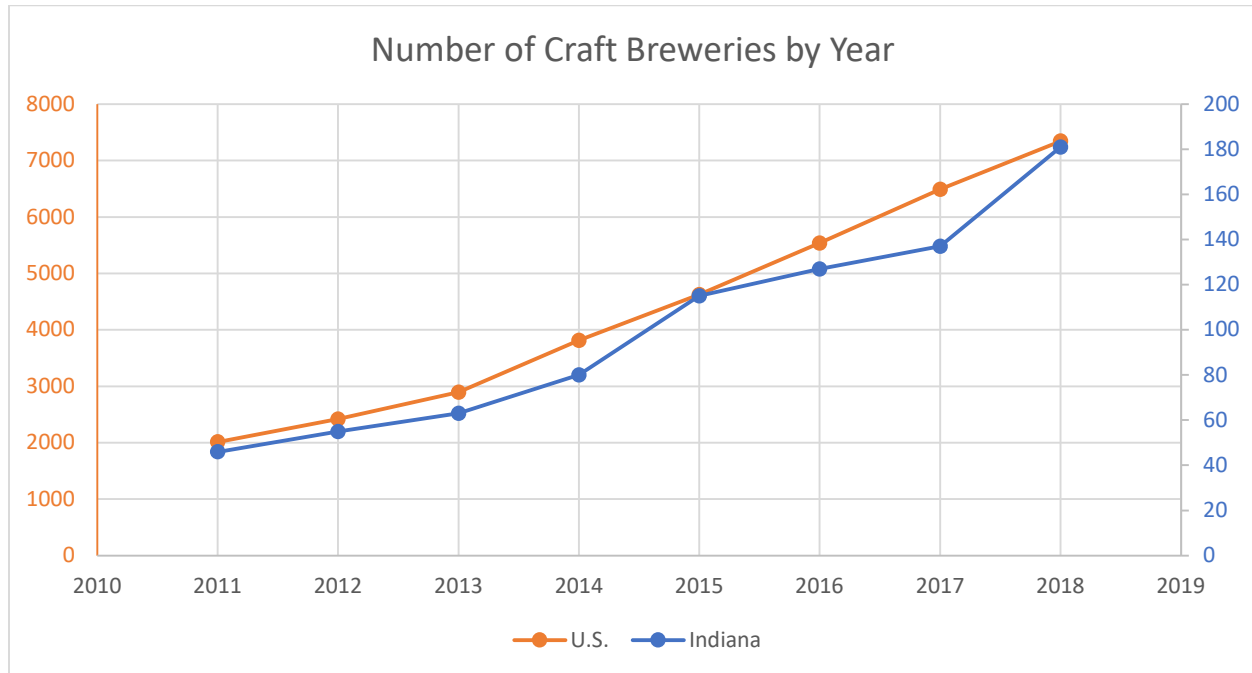


Figure 2. U.S. and Indiana Brewery Counts by Year

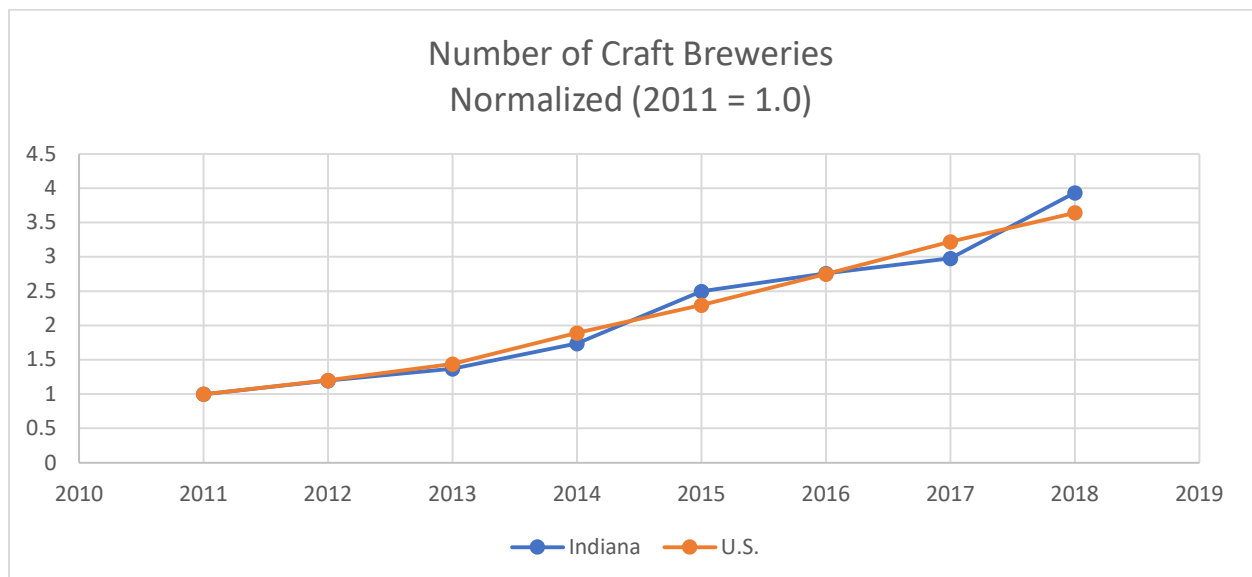


Figure 3. U.S. and Indiana Brewery Counts by Year, Normalized

In rough terms, growth in the state of Indiana has paralleled that of the national numbers. Looking at the year over year growth rate, Indiana has a slight upward trend, but is quite variable, compared to the national growth rate, which is trending downward.

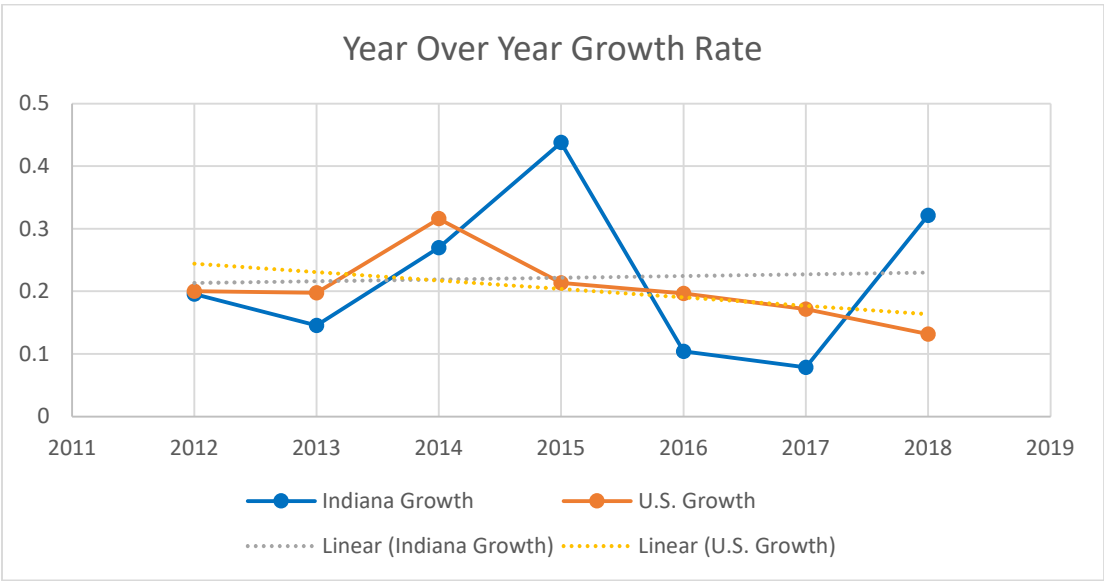


Figure 4. U.S. and Indiana Brewery Growth Rates

So the growth rate for breweries in Indiana is safely in the 10 to 20 percent range. When looking for a location, population is a consideration. Figure 5 shows something about the population distribution in Indiana. As would be expected, many small towns, and a few larger ones.

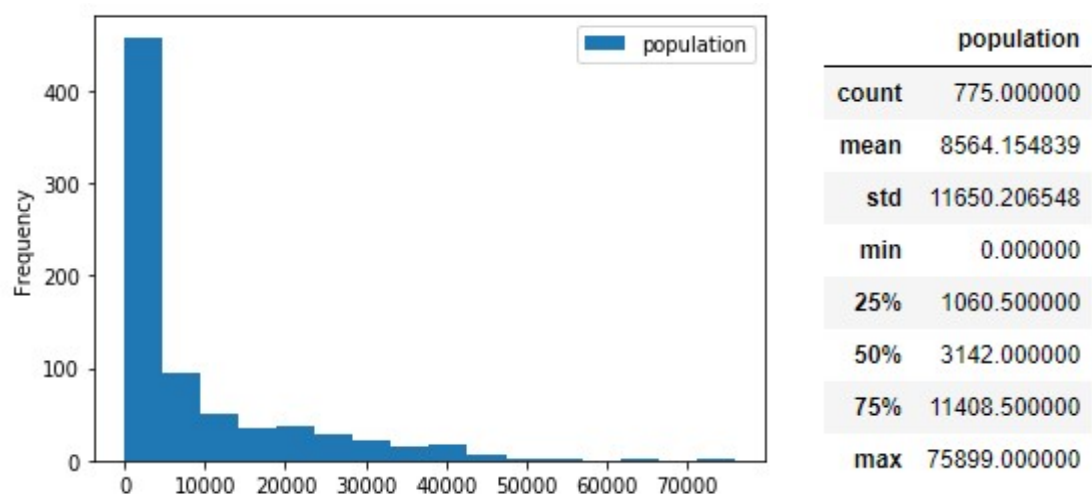


Figure 5. Indiana Population Distribution

Figure 6 plots this on a map to give the reader an idea of the population’s geographical spread:

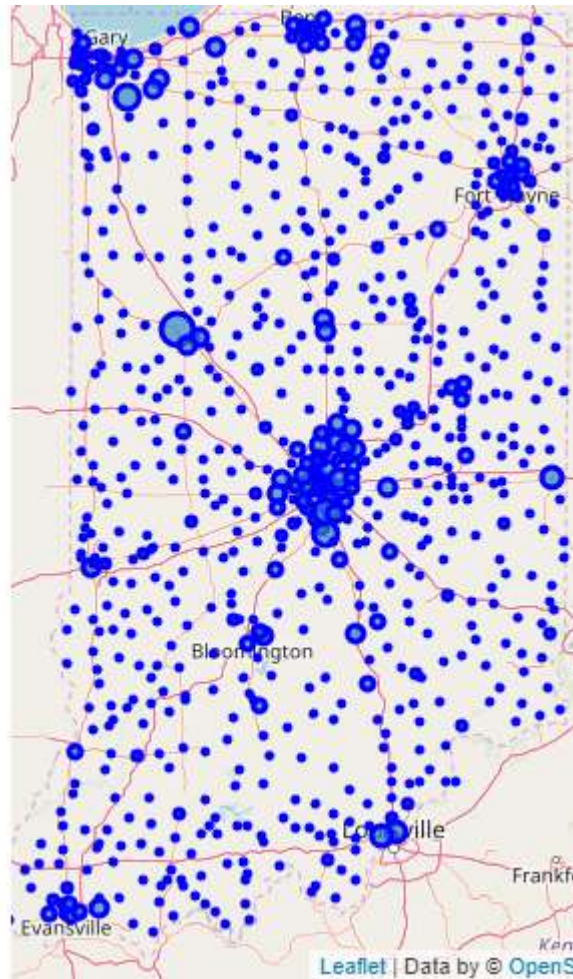


Figure 6. Population Map of Indiana, by Zip Code

The next consideration is to determine, for a given Zip Code, how many breweries are in the area. In Figure 7, below, each marker's size is proportional to the number of breweries within twenty miles. The range of twenty miles is, of course, arbitrary.

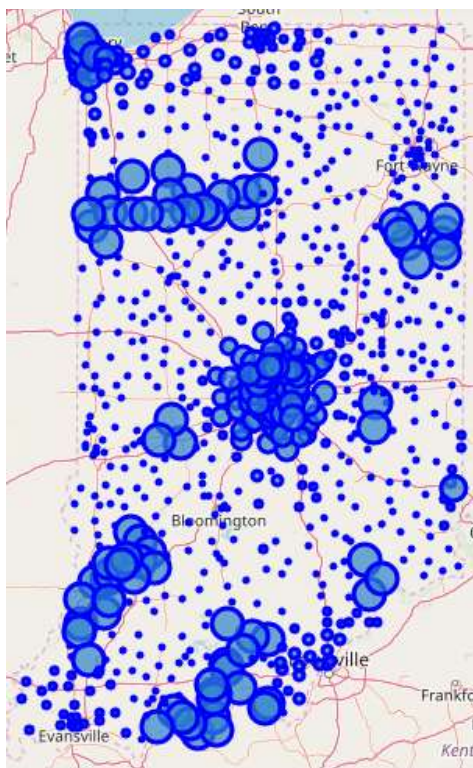


Figure 7. Brewery Availability by Zip Code

Now in an effort to bring these two datasets together, population and brewery proximity will be combined. Figure 8 is a scatter plot of number of breweries reported within the search radius vs. population. No particular model neatly fits this data.

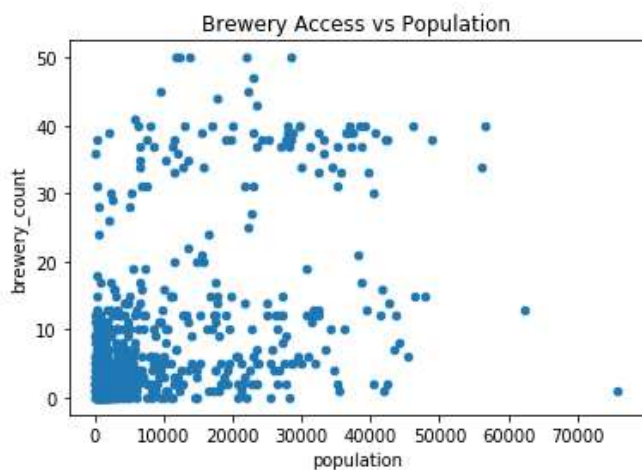


Figure 8. Brewery Access vs. Population

As a first step, a cluster analysis was conducted using k-means clustering. The data were analyzed with 5, 4, 3 and 2 clusters.

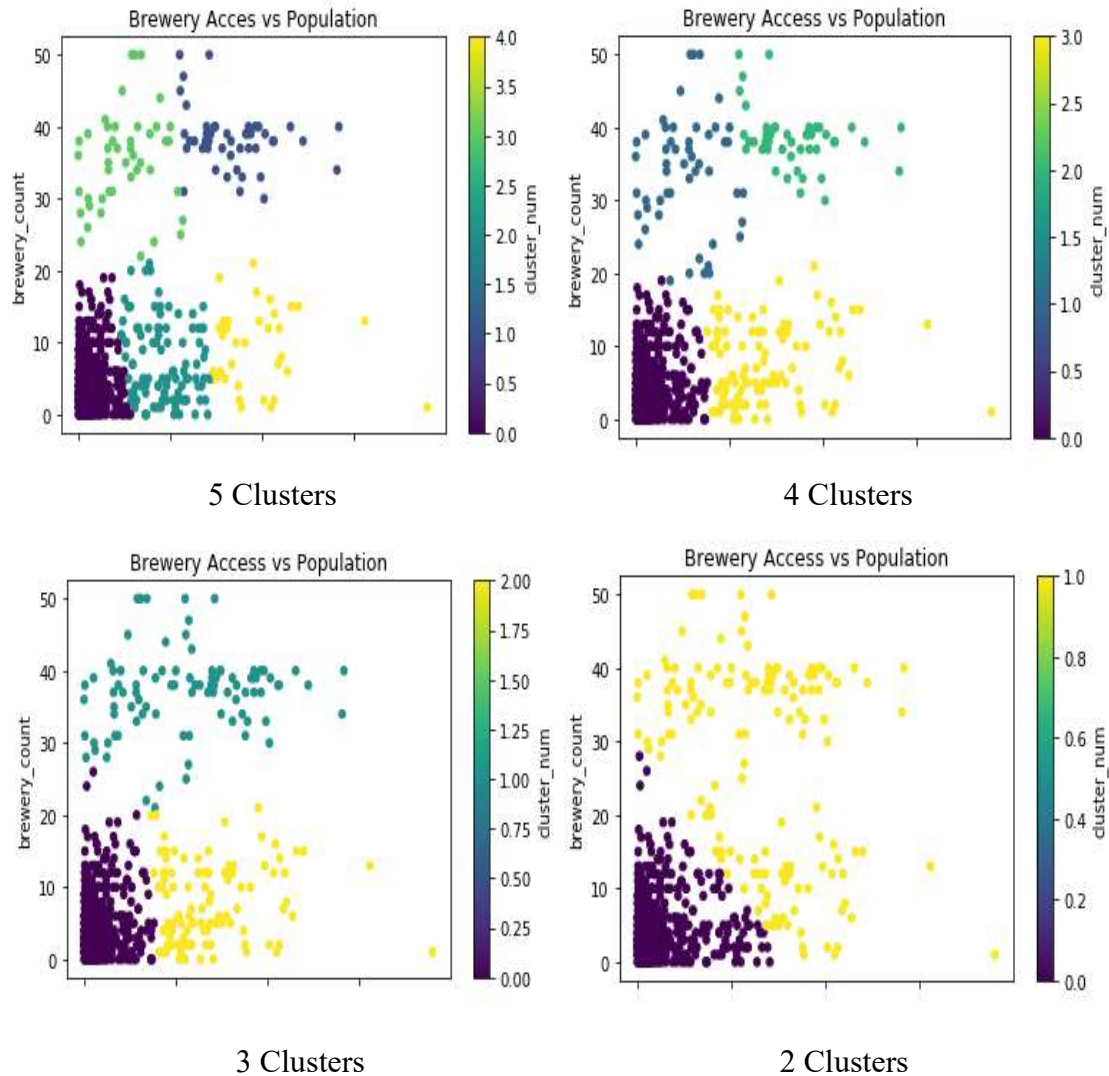


Figure 9. Cluster Analysis of the Brewery Count – Population Relationship

In all these cases, the yellow cluster is the cluster containing higher population and lower count of breweries. With 5 clusters, the selection seems a bit narrow, while with 2 clusters, it is a bit broad. The analysis with 3 or 4 clusters yields essentially the same data, so this data subset is selected for further consideration. The map in figure 10 represents this data, with markers proportional to population and inversely proportional to the number of breweries in the area. By clustering, we have eliminated areas of low population as well as those currently saturated with breweries.



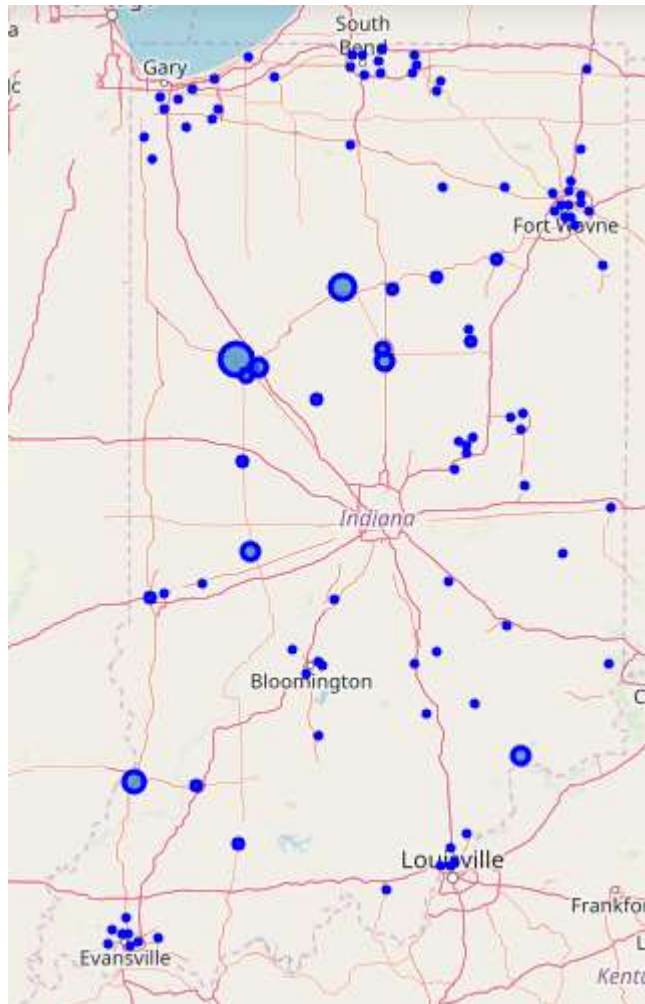


Figure 10. Geographic distribution of cluster of cities with relatively high populations and relatively few breweries

So, we see that the desirable cluster of cities is spread wide across the state.

Since Indiana currently supports 3.7 per 100,000, and is a growth market, we can estimate that a population could support up to 13.5 per 100,000 (as does Vermont) given the time to develop. A more conservative number of 10 per 100,000 can be set to be safe. From this a “brewery deficit” can be calculated, generated from available population, supportable number of breweries, and current number of breweries. Note that this includes also a correction because, as an estimate, 25% of the population is under the age of 21.

## Results:

There was a total of 15 cities (Zip Codes) that resulted in a positive deficit for per capita number of breweries. Of these, the top nine candidates had a deficit greater than one, indicating a good possible location for a new brewery. These are all listed in Figure 11, below.



zipcode	population	address	brewery_count	def_corrected
47906	75899	West Lafayette	1	4.692425
47905	41910	Lafayette	1	2.14325
46947	28125	Logansport	0	2.109375
47591	25416	Vincennes	0	1.9062
46902	35403	Howard County	1	1.655225
47250	21984	Madison	0	1.6488
46135	20800	Greencastle	0	1.56
47909	42532	Norma Jean Addition	2	1.1899
46901	40357	Howard County	2	1.026775
47802	35054	Terre Haute	2	0.62905
47546	21137	Jasper	1	0.585275
47501	18001	Washington	1	0.350075
47904	17225	Eastwitch	1	0.291875
46992	16352	Valley Brook	1	0.2264
47933	27661	Crawfordsville	2	0.074575

Figure 11. Zip Codes in Indiana that Could Best Support a New Brewery

### Discussion:

A little bit deeper research will show that reliance on free datasets is a flawed approach, but it was useful in narrowing the field. Further research (simple searches on Google Maps) into the top nine candidates yields different actual counts of breweries. These numbers remove several of the top contenders as shown in Figure 12, below.

zipcode	population	address	brewery_count	original_deficit	actual_breweries	corrected_deficit
47906	75899	West Lafayette	1	4.6924	3	2.692425
46947	28125	Logansport	0	2.1094	1	1.109375
46901	40357	Howard County	2	1.0268	2	1.026775
47591	25416	Vincennes	0	1.9062	1	0.9062
46902	35403	Howard County	1	1.6552	2	0.655225
46135	20800	Greencastle	0	1.56	1	0.56
47909	42532	Norma Jean Addition	2	1.1899	3	0.1899
47905	41910	Lafayette	1	2.1433	3	0.14325
47250	21984	Madison	0	1.6488	2	-0.3512

Figure 12. Re-evaluation of Top Contenders, Phase One

Further, several of these top choices are really the same geographic area, just with multiple Zip Codes. West Lafayette, Lafayette, and Norma Jean Addition are combined into West Lafayette,

and the two Howard County entries are combined into Kokomo. Combining these and dropping the lower end results yields Figure 13:

zipcode	population	address	actual_ breweries	corrected_ deficit
47906	160341	West Lafayette	3	9.03
46901	75760	Kokomo	2	3.68
46947	28125	Logansport	1	1.11
47591	25416	Vincennes	1	0.91

Figure 13. Final Top Four Candidates Cities

So, these are the top four candidates. Even allowing for the student population in West Lafayette (home of Purdue University) that may skew the population, a deficit of nine is a healthy start. Depending on factors such as the searcher's current location, any one of these four locations could be a good location to open a new brewery.

### Conclusion:

The methodology used in this report could easily be applied to other venue types, for example Seafood Restaurant, Café, Night Club or any venue type listed in the Foursquare database. Additionally, the chosen location (the U.S. state of Indiana) and the search radius were arbitrary and could be adjusted.

Choice of location is a key factor in the success of any new business. With modern transportation infrastructure, access to raw materials (water, barley, wheat, yeast) is rarely a deciding factor in opening a brewery. Local water quality is a major factor for consideration but is beyond the scope of this report. A new brewery needs a thirsty population to support it. In this report, I have described a method of choosing the top choices for locating a new brewery based on population and existing breweries. It has yielded a small number of prime candidates, which will simplify the task of further researching these areas in more detail.

### References:

1. <https://www.brewersassociation.org/statistics-and-data/economic-impact-data/#state-impact>
2. <https://www.brewersassociation.org/press-releases/brewers-association-releases-annual-growth-report/>
3. <https://www.crowdspring.com/blog/how-to-start-a-brewery-business/>