Introduction to Human Geography with ArcGIS

Chapter 7 Exercises

Exercise 7.1: Determining industrial locations for a textile factory

Introduction

The geography of manufacturing is in constant flux, as companies seek the best global location to produce and sell goods. While the US textile industry has not completely disappeared, it has been drastically reduced by foreign competition. In this exercise, you work for a textile manufacturing company and management has instructed you to find a foreign location for a new production facility. Their reason for siting the facility abroad is because US consumers demand low-cost clothing, which cannot be made in the United States. They point out that design, marketing, finance, and logistics jobs will stay in the US, but production can only be done overseas. You must consider the factors determining industrial location as described in your textbook to find the best country for the new facility.

Objectives

- Identify key variables for industrial location decisions.

- Evaluate the best combination of variables for your potential sites.

- Argue in defense of your top three locations.

1. **Open the Chapter 7 Industrial Site Selection with Doing Business and GDP Per Capita map and sign in to your account: https://arcg.is/fHC45**

The map contains the layer Doing Business and GDP per Capita.

This layer contains rankings from the 2016 World Bank Doing Business report. Low values are the best for business, while high values are the worst. It also contains GDP per capita in US dollars for the year 2015.

The text describes factors that play a role in industrial site selection. The variables in this map relate to government policy and labor. The Doing Business ranks show how accommodating government policies are toward companies. There is an overall Rank, and subcategories for ease of Trading Across Borders, Registering Property, and more. The GDP per capita values can serve as a surrogate measure for wages. Lower values should represent lower wages.

2. **Hover your cursor over the Doing Business and GDP per Capita layer and Show Table.**

3. **Click the Rank field heading and Sort Ascending. Scroll down until you see the country ranked 1.**

The country ranked number 1 is the easiest place to do business. The 190th country is the worst.

4. **Sort in descending order for the Y2015 field to see the range of per capita GDP values.**

These are dollar amounts per year per-person. You can see that there is a very wide range, from Lichtenstein at the most affluent end to Burundi at the least.

5. **Find potential locations for your textile factory.**

   Next, you'll decide which variables and values to use in your selection. You need to find the right combination for places that are good for doing business, but where wages (GDP per capita) are relatively low.

6. **Use the GDP per capita variable, and at least one variable from the other fields.**

   This can be the overall Rank field or other fields related to doing business.

7. **In the attribute table, sort the fields you are considering using and decide what your cut-off points will be.**

   For instance, do you want a maximum GDP per capita of $2,000, or $30,000? Do you want a maximum Doing Business rank of 50 or of 150?

8. **Write down the cut-off values: Maximum GDP per capita value _____; Maximum Rank value _____**

9. **Hover your cursor over the Doing Business and GDP per Capita layer and click Perform Analysis.**

10. **In the Perform Analysis window, click Find Locations, then Find Existing Locations.**

   - **In the Find Existing Locations window, click Add Expression under step 2.**

- **Set the Add Expression window so the Doing_Business_and GDP Per Capita, where, Yr2015 is at most <put a value here>.**

- **Click Add.**

- **Click Add Expression again to add another variable.**

- **Repeat the process if you choose to add a third or more variables.**

- **Result layer name: give your layer a unique name.**

- **Show credits: Check that you are only using a couple of credits. Check your settings if it is significantly more.**

- **Click Run Analysis.**

A new layer is created that contains only the countries that meet your criteria. If there are too few or too many, change your criteria and run the analysis again.

11. **Hover the cursor over the new layer and Show Table.**

12. **Review the rankings and GDP per capita. Make note of which appear to be the best candidates.**

Transportation linkages are another important part of your site selection process, since you will be exporting your product to the United States and other markets.

13. **Look at each candidate country on the map and see if it has ocean access for global shipping. Remove any countries from your list that do not have good access.**

14. **Open the Chapter 7 Industrial Site Selection in the United States map and sign in to your account: https://arcg.is/0jnuHT**

Question 7.1.1

List the variables you used in the analysis and why you chose them. Explain the cut-off values you chose and why as well.

Question 7.1.2

Are there other variables you would like to add to your analysis if available?

Question 7.1.3

Write your top three candidate countries:

_____

Explain why they are the top candidates, based on wages (GDP per capita), ease of doing business, and transportation linkages.

Question 7.1.4

Print a screenshot of your map. You can now present your boss with potential countries for expanding your production facilities. Further research will be required to determine if there are agglomeration benefits from an existing textile industry in any of the countries. Your final decision could tilt in the direction of a country with a large textile agglomeration.

Conclusion

Finding the best location for an industrial facility is a complex process, with many variables at play. Government policies can facilitate or hinder business investments, labor skills,

and wage levels must be considered, transportation linkages must be strong, and

agglomeration effects can help reduce costs.

Exercise 7.2: Industrial site selection in the United States

Introduction

You work for a household appliance manufacturer and need to build a large

manufacturing facility within about 100 miles of your US city. You must find sites that are within

1 mile of a freeway, have low-cost land values, and where wages are not too high. After you

have identified your top three potential sites, you can meet with local city officials to check

zoning and government incentives to help make your final decision.

Objectives

- Identify potential industrial sites.

- Evaluate which sites are most suited to your company's needs.

- Argue in defense of your top three locations.

1. **Open the Chapter 7 Industrial Site Selection in the United States map and sign in to your account: https://arcg.is/0jnuHT**

    The map contains the following layers:

    a. **National Highway Network.**

    b. **USA Median Home Value.**

    c. **USA Median Household Income.**

2. **Begin by adding a Map Note to your map and add a 100-mile buffer.**

    This will identify your search area.

    - **Click the Add button, then Add Map Notes.**

    - **Give the Map Note a name and click Create.**

    - **In the Add Features window, select one of the Points icons.**

    - **Zoom to your city and click to place the Map Note point there.**

3. **Hover your cursor over your new Map Notes layer and click the Perform Analysis icon.**

    - **In the Perform Analysis window, click Use Proximity, then Create Buffers.**

    - **In step 2, enter a buffer size of 100 miles.**

    - **Give your layer a unique name.**

    - **Uncheck the Use current map extent to ensure that the full 100-mile buffer is created, regardless of your zoom level.**

    - **Click Show credits and make sure it uses less than 1 credit.**

    - **Click Run Analysis.**

   The buffer covers your study area.

4. Since you only want the outline of the buffer, change the style so that there is no fill color.

- Hover your cursor over the Buffer of your map notes layer and click the Change Styles icon.

- In the Change Styles window, under step two (Select a drawing style), click Options.

- Click the small square next to Symbols.

Showing Location Only

☐ Symbols

- In the new window, make sure the Fill tab is selected. Click the No color option (the small square with a diagonal red line). Click OK.

FILL   OUTLINE

No color   More

Suggested

Recent

Transparency

0%   50%   100%

OK   CANCEL
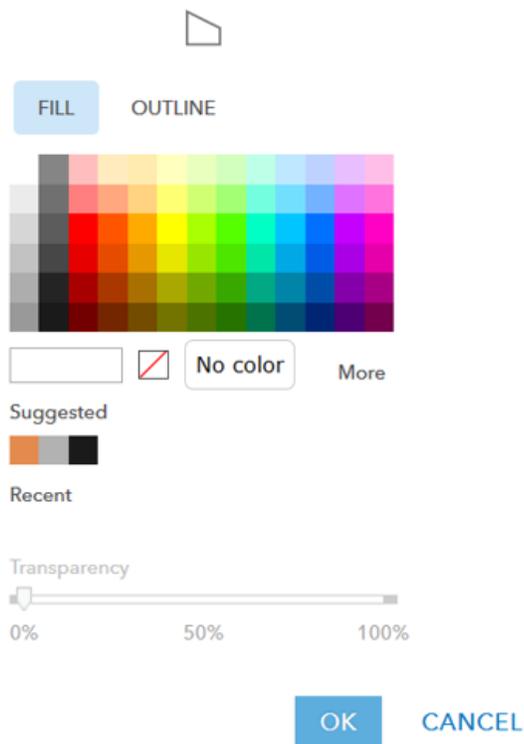
- **Click OK again, then Done.**

- **You should now see your 100-mile buffer outline but with no fill color that covers the search area.**

- **Zoom so that the 100-mile buffer is as large as possible but still fits within your screen.**

Now that you have identified the search area, you'll need to start narrowing down potential sites.

One site requirement is that the facility be within 1 mile of a freeway. You will use the Buffer tool to locate these areas.

5. **Buffer the National Highway Network layer.**

   - **Expand the layer by clicking on the small triangle to the left of the layer name.**

   - **After expanding the layer, hover your cursor over the US Highways layer name and select Perform Analysis.**

   - **In the Perform Analysis window, select Use Proximity, then Create Buffers.**

   - **In step 2, set the buffer size to 1 mile.**

   - **In step 3, give your layer a unique name.**

   - **Check Show credits. Make sure you are only using a couple of credits. If it is more, zoom in a little and check again.**

   - **Run Analysis.**

6. **As with the Map Notes buffer for your search area, use Change Styles to set the buffer color to No fill so you can better see the underlying layers.**

   Now that you have a 1-mile buffer around the freeways of your study area, you'll want to find locations with low land costs and lower wages. Since you don't have this exact data, you will use surrogate values. USA Median Home Value will be used to estimate where land values overall are lower. USA Median Household Income will be used to estimate where wages overall are lower.

7. **Turn on the USA Median Home Value.**

   - **Expand the layer and hover your cursor over the visible layer, be it County, Zip Code, Tract, or Block Group. Click Show Legend to see which colors represent low values.**
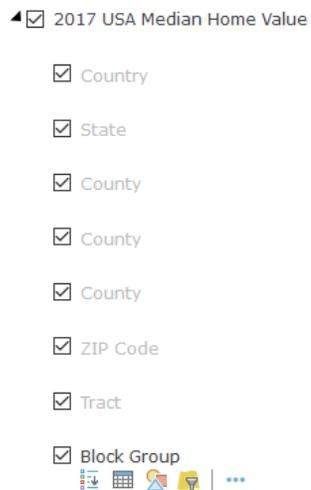
8. **Begin to zoom in to areas with low home values that are also within the freeway buffer.**

9. **As you zoom in, the unit of analysis changes. Zoom to the Tract or Block Group level.**

10. **Identify some parts of the region that may be good candidates based on low land values, which are also within the freeway buffer.**

11. **Turn off the USA Median Home Value layer and turn on the USA Median Household Income layer.**

12. **See if your selected areas are still good candidates based on lower local wages.**

13. **Identify several possible locations for your manufacturing facility based on being within 1 mile of a freeway and having relatively low land values and wages.**

14. **Turn off all layers so you can see the Imagery basemap. See if your potential sites are undeveloped or have industrial land uses.**

    You cannot locate your facility there if it is already built out with houses, parks, or other incompatible land uses.

15. **Draw a circle around your top two potential sites.**

    - **Click the Add button, Add Map Notes.**

    - **Give your map note a name and Create.**

    - **In the Add Features window, select the Circle or Freehand Area.**

Question 7.2.1

Print or take screenshots, one for each potential site.

Make sure the following are visible on your map:

- Highway Network

- Your freeway buffer, with no fill

- The Imagery basemap showing vacant or industrial land

- Your Map Note encircling each site

Question 7.2.2

Explain why site 1 is a good candidate. Discuss its proximity to the freeway, its house/land value, its income/wage level, and the land use as seen in the Imagery basemap.

Question 7.2.3

Explain why site 2 is a good candidate. Discuss its proximity to the freeway, its house/land value, its income/wage level, and the land use as seen in the Imagery basemap.

Conclusion

Multiple site and situation factors must be considered when locating a new manufacturing facility. Among the most important are often land and labor costs, as well as proximity to transportation networks. In addition, agglomerations, government incentives, and zoning laws play an important role. A good location can contribute to higher profits, while a poor location can reduce a facility's competitiveness and long-term viability.

Exercise 7.3: The changing geography of global manufacturing

Introduction

As companies seek the best location to maximize profits in a globalized world, geographic patterns of manufacturing continuously change. The Industrial Revolution made Europe the center of production in the 18th and 19th centuries, but the center of industrial activity then moved to North America during the 20th century. Moving into the 21st century, we are seeing new spatial patterns of manufacturing. In this exercise, you will explore how industrial production has shifted globally since the year 2000.

- Describe where the most manufacturing value added occurs.

- Calculate how the share of global manufacturing value added has changed in the 21st century.

- Determine where the largest growth in manufacturing value added has occurred in this century.

- Evaluate why China has become a global manufacturing hub.

- Explain the relationship between US manufacturing value added and manufacturing employment rates.

1. **Open the Chapter 7 Industrial Site Selection in the United States map and sign in to your account: https://arcg.is/1KTmaW**

    The map contains the Manufacturing Value Added layer, which shows the value of manufacturing output (current $US) for various years. The map opens showing manufacturing value added with graduated circles for the year 2013 (the most recent year with mostly complete data).

2. **Based on the map, complete the following table.**

3. **Click the largest four circles. Write the country names in the table (column A). In columns B and D, write the value for Yr2000 and Yr2013.**

4. **Calculate the share of the world total in columns C and E.**

- **To get the world total, hover your cursor over the Manufacturing Value Added layer and Show Table.**

- **Click the Yr2000 field name and select Statistics. Write down the Sum of Values. Do the same for Yr2013.**

- **To calculate column C, divide the values in column B by the Sum of Values for Yr2000. For column E, divide column D by the Sum of Values for Yr2013.**

Question 7.3.1

(A) Top four manufacturing countries in 2013	(B) Value added, Year 2000.	(C) Share of world total, Year 2000.	(D) Value added, Year 2013.	(E) Share of world total Year 2013.
#1:				
#2:				
#3:				
#4:				

Question 7.3.2

Based on the textbook, explain why China's share has grown so much.

Question 7.3.3

Did US manufacturing value added (in $US) decline or increase?

Question 7.3.4

Explain how trends in manufacturing value added since the year 2000 differ from trends in employment in the US, as seen in Figure 7.15. Why do they move in different directions?

Conclusion

Technology and globalization are reshaping the geography of manufacturing. As you have seen in this exercise, the share of manufacturing output has grown at different rates in different countries. But even as manufacturing output increases, there is no guarantee that jobs will increase as well. Increasingly, automation allows robots to do the work of people, allowing for greater output with fewer workers.

Exercise 7.4: The changing geography of US manufacturing

Introduction

While China has seen phenomenal growth in manufacturing output since the year 2000, output has also increased in the United States. Yet despite growth in output, employment in the manufacturing sector has fallen substantially. In fact, fewer Americans work in manufacturing now than in the 1940s, when the population was well under half its current size. In this exercise you will explore which counties were most dependent on manufacturing in the year 2000 and where the greatest declines in the proportion of manufacturing workers have been. Places with the greatest decline are those most likely to be suffering social disruption, as manufacturing workers struggle to find new sources of living-wage employment.

Objectives

- Identify the counties most dependent on manufacturing employment in the year 2000.

- Calculate the loss on manufacturing employment from 2000 to 2015 in the US.

- Use hot spot analysis to locate clusters of counties with the greatest decline in manufacturing employment.

- Describe the impacts of deindustrialization on workers of communities that lost manufacturing jobs.

1. **Open the Chapter 7 US Manufacturing Change 2000 to 2015 map and sign in to your account: https://arcg.is/0SaKvv**

   The map contains the US Manufacturing Employment layer. This layer contains data from the US Census Bureau on the number of people employed in manufacturing during the years 2000 and 2015. The map opens showing a choropleth map of the percentage of workers in the manufacturing sector by county in the year 2000.

2. **Look at the map and think about where the counties most dependent on manufacturing employment in 2000 were.**

3. **To help better visualize where there are clusters of manufacturing counties, run a hot spot analysis.**

   - **Hover your cursor over the US Manufacturing Employment layer and click the Perform Analysis icon.**

   - **In the Perform Analysis window, select Analyze Patterns and Find Hot Spots.**

- **In step 2 of the Find Hot Spots window, set the field to 2000 Pct Manufacturing. This is the percentage of workers in the manufacturing sector in the year 2000.**

- **In step 4 of the Find Hot Spots window, give your layer a unique name.**

- **Uncheck Use current map extent to ensure that all counties are included in your analysis.**

- **Click Show credits and make sure you are using about 3 credits.**

- **Click Run Analysis.**

Question 7.4.1

Describe where manufacturing was most important. You can drag your hot spot analysis layer under the USA States layer to see state boundaries.

We can see large areas that were substantially dependent on manufacturing in 2000. But as you saw in the previous exercise, the geographic patterns of global manufacturing have changed since then.

4. **Calculate how many fewer people worked in manufacturing in the year 2015 versus the year 2000 in the United States.**

   - **Hover your cursor over the US Manufacturing Employment layer and click Show Table.**

   - **In the table, click on the field heading for 2015 Total Manufacturing, then click Statistics. Write down the Sum of Values. Do the same for the 2000 Total Manufacturing field. (Note that these values differ from figure 7.15 in the textbook.)**

   These numbers are self-reported in the census, while the numbers in figure 7.15 are from the US Bureau of Labor Statistics.)

Question 7.4.2

How many fewer manufacturing workers were there by 2015?

You have identified the overall decline in manufacturing jobs in the United States, but that does not show the spatial patterns of decline.

5. **Identify the counties where manufacturing employment as a percentage of all employment declined.**

- **Turn off your hot spot layer so you can see the US Manufacturing Employment layer.**

- **Hover your cursor over the US Manufacturing Employment layer and click Change Style.**

- **In the Change Style window, set step 1 to Difference in Pct. This will map the difference in the percentage of workers in manufacturing between 2000 and 2015.**

- **In step 2, click Options under Counts and Amounts (Color).**

- **In the new Change Style window, set the Theme to Above and Below.**

- **In the legend slider, set the middle value to 0 and the bottom value to -0.1. Change these by clicking the values to the left of the legend slider.**
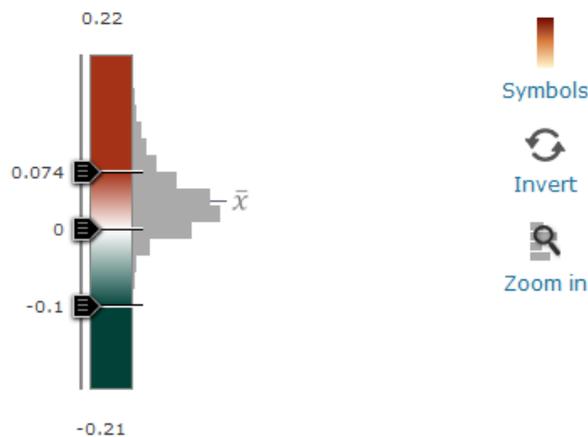
Change Style

US Manufacturing Employment - Manufacturing
Employment Census

Difference in Pct

Divided By: None ▾

Theme   Above and Below ▾

```
        0.22
                                    ▮
                                  Symbols
0.074 ▷
                                    ↻
                                  Invert
    0 ▷
                                    🔍
                                  Zoom in
 -0.1 ▷

       -0.21
```

- **Click OK, then Done.**

Your map now shows counties where there were more workers in manufacturing in 2000 than in 2015 (those with values over 0), and counties where there were less (values less than 0).

Question 7.4.3

Where do you see a decline in the proportion of people working in manufacturing?

You may see that declines are widespread.

6. **To locate clusters of counties with the greatest declines, run a hot spot analysis.**

- **Hover your cursor over the US Manufacturing Employment layer and click the Perform Analysis icon.**

- **In the Perform Analysis window, select Analyze Patterns and Find Hot Spots.**

- **In step 2 of the Find Hot Spots window, set the field to Difference in Pct.**

- **In step 4 of the Find Hot Spots window, give your layer a unique name.**

- **Uncheck Use current map extent to ensure that all counties are included in your analysis.**

- **Click Show credits and make sure you are using about 3 credits.**

Question 7.4.4

Where are the clusters of counties that saw the biggest declines in the proportion of workers in manufacturing?

7. **Turn on Pct Manufacturing 2000 hot spot layer. Turn your Difference Pct hot spot layer on and off to visually compare the clusters.**

Question 7.4.5

How to the clusters of greatest decline spatially relate to the places most dependent on manufacturing in 2000? Which areas overlap, and which do not?

Conclusion

The good news is that the United States continues to increase its manufacturing output. The bad news is that fewer workers are needed to do this, and many counties have seen dramatic declines in their share of manufacturing workers. This is especially hard on places where good employment opportunities were once closely tied to manufacturing.

Exercise 7.5: Trouble in the heartland: Manufacturing decline and deaths of despair

Introduction

As you have seen in these exercises, many counties have faced steep declines in the proportion of manufacturing workers. As with any economic decline, displaced workers can face difficult and stressful times as they struggle to reinvent themselves under changing economic circumstances. In this exercise you will compare declining manufacturing employment with deaths from drugs and alcohol, symptoms of what are sometimes referred to as deaths of despair.
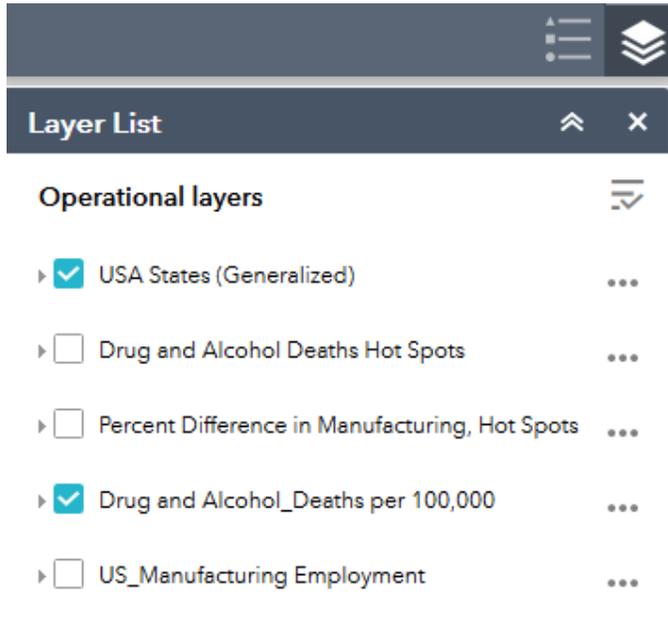
Objectives

- Compare hot spots of manufacturing decline with hot spots of drug and alcohol deaths.

- Formulate ideas as to why there is or is not a strong spatial relationship between hot spots.

- Describe the current and future employment situation for manufacturing workers.

1. **Open the Chapter 7 US Manufacturing Decline and Drug and Alcohol Deaths web application:**

- **https://learngis.maps.arcgis.com/apps/webappviewer/index.html?id=dad488f86aac47d6ba4f0550ffd43375**

2. **Click the Layer List in the upper right of your screen to see the map's layers.**

The following layers are included:

a. **US Manufacturing Employment. This layer contains data from the US Census Bureau on the number of people employed in manufacturing during the years 2000 and 2015.**

b. **Drug and Alcohol Deaths per 100,000. This map shows the death rate from drugs and alcohol by county.**

c. **Percent Difference in Manufacturing Hot Spots. This map shows hot spots for the difference in the proportion of manufacturing**

workers between 2000 and 2015. It is the same as the map you created in the previous exercise.

    d. **Drug and Alcohol Deaths Hot Spots. This shows hot spots based on the death rate from the Drug and Alcohol Deaths per 100,000 layer. It is the same as figure 7.26 in your textbook.**

The map opens showing a choropleth map of the drug and alcohol death rate by county.

3. **View the map and think about any spatial patterns that you see.**

4. **Compare the hot spot maps of manufacturing decline and drug and alcohol deaths.**

5. **In the Layer List, turn on the two hot spot layers. Turn off the Drug and Alcohol Deaths per 100,000 layer.**

6. **Click the X in the upper-right corner of the Layer List window to close it.**

The Drug and Alcohol Deaths Hot Spots layer is visible, since it is listed above the Percent Difference in Manufacturing, Hot Spots layer.

7. **Near the upper left of the screen, click the Swipe tool, then select Drug and Alcohol Deaths Hot Spots for the layer you want to swipe.**

The Swipe tool allows you to easily compare two layers by swiping the vertical swipe bar left and right. The layer on the left side shows hot spots for drug and alcohol deaths. The layer on the right side shows hot spots for the greatest percent change in manufacturing workers between 2000 and 2015. In the layer on the right, hot spots (red) represent clusters of manufacturing job loss. Cold spots (blue) show clusters of lesser manufacturing job loss.

8. Swipe back and forth to answer the following questions.

Question 7.5.1

How well do the two hot spot maps correspond? Does a significant decline in the proportion of manufacturing workers appear to be the cause of drug and alcohol deaths? Why or why not? Include examples of specific states/areas where the hot spots have a strong spatial relationship and where they do not.

Question 7.5.2

What other variables could help explain drug and alcohol deaths? For instance, you can consider other economic changes, poverty, opioid prescription rates, and other factors.

Question 7.5.3

Based on the textbook, how well have displaced manufacturing workers done in terms of finding new employment?

Question 7.5.4

Based on the textbook, what does the future look like for manufacturing workers in terms of the quantity needed and the skills required?

Conclusion

Manufacturing decline has caused substantial pain for many workers in the United States, some of which can manifest itself in drug and alcohol abuse. But with that said, there are many other factors that can lead people to abuse or not abuse substances. The United States has a strong future in manufacturing, but the landscape of labor is quickly shifting, both in terms of the number of manufacturing jobs likely to be available and in the skillsets that these jobs will require.