Project Report

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The focus of research is on specific higher level technology usage across different industries with relationships to salary of employees. Using data collected from the US Department of Commerce (2021) on the United States Census Bureau website on Friday 7/16/2022. Access was acquired using a free API key and then converted to json format for processing. Initial investigations into the data revealed breakdowns of tech usage and implementation by industry, number of firms, etc. It was decided to focus on relationships between the company summary data sets and the technology characteristics of businesses dataset. With this information we hoped to answer the following questions:

1) What industries use which tech the most?

2) Which industries use tech the least?

3) Which industries are trying to get into these areas?

4) Has increased technology usage improved worker pay?

5) Does pay go up as more technology is implemented?

Initially, the tables were merged on the column of NAICS2017, as it was later renamed to industry.   The data coming from multiple tables had a large amount of extraneous information. Cleaning the data by removing columns not associated with our chosen areas of focus allowed for more concise and precise evaluation of the proposed questions. Columns were renamed with our own convention based upon the North American Industry Classification System or NAICS abbreviation. Refer here for the list of name changes and derived columns with a sample image. All other columns were dropped from the dataframe. The values Don't know

and total use were dropped from the renamed Level column. After ETL was completed a working dataframe for reference was set.

Secondary investigations were performed to identify the representations we would like to develop, to present our findings, and to formulate results about questions and hypotheses. With the functional dataframe in place, specific aspects for insight chosen, the choice was made to divide and conquer to efficiently develop visualizations. To create the visualizations we utilized pandas and seaborn.

The industries utilizing AI technology the most were information, professional, scientific, and technical services, and lastly management of companies and enterprises. These industries utilized AI by orders of magnitude more than the lowest utilizing industries.

For a list of all industries click here

Top 10 Industry with Highest Percentage of Firms Uses A High Level of AI
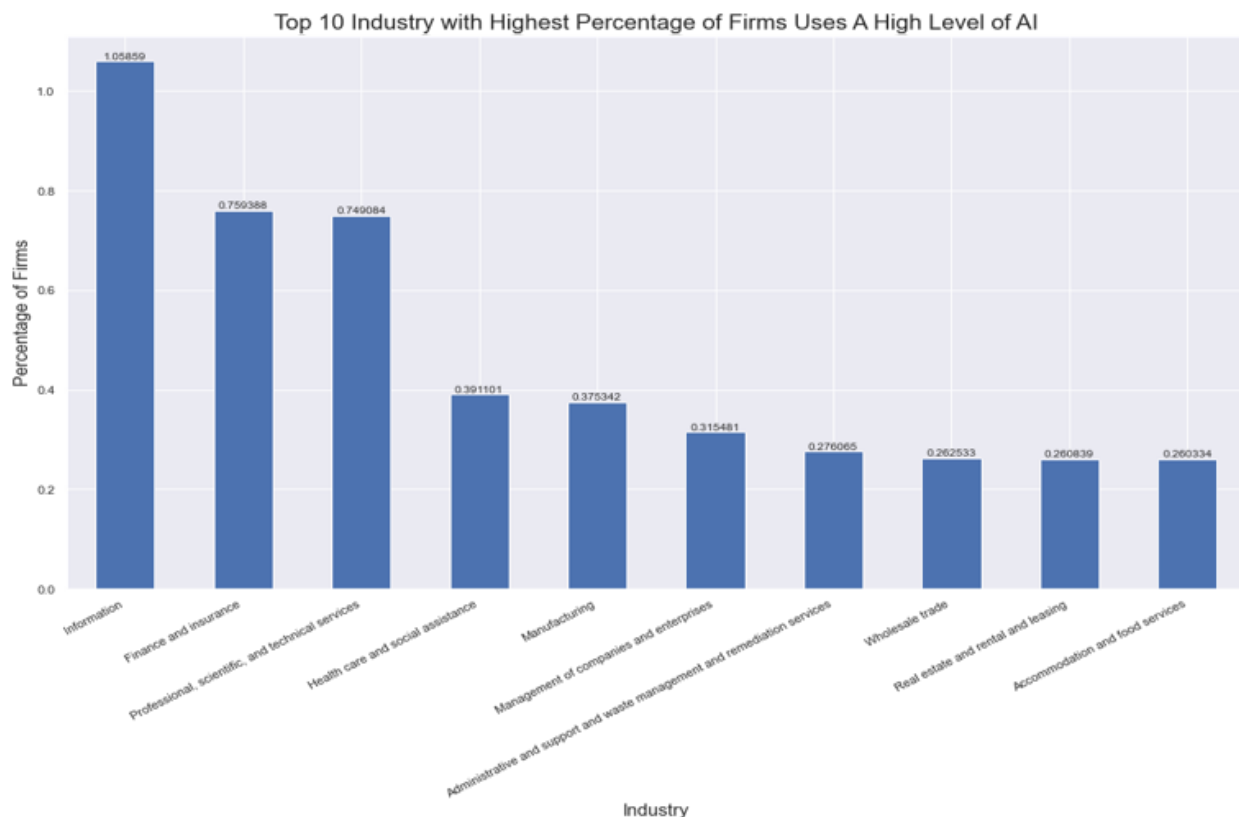
There is a substantially larger percentage of firms with high usage in Cloud based solutions. High usage AI technologies are measured in the single digit percentages, whereas cloud based

technologies are measured in the tens of percentages. Here we can see a consistent presence of the top 3 industries in both technologies assessed.

Top 10 Industry with Highest Percentage of Firms Uses A High Level of Cloud Based Solutions
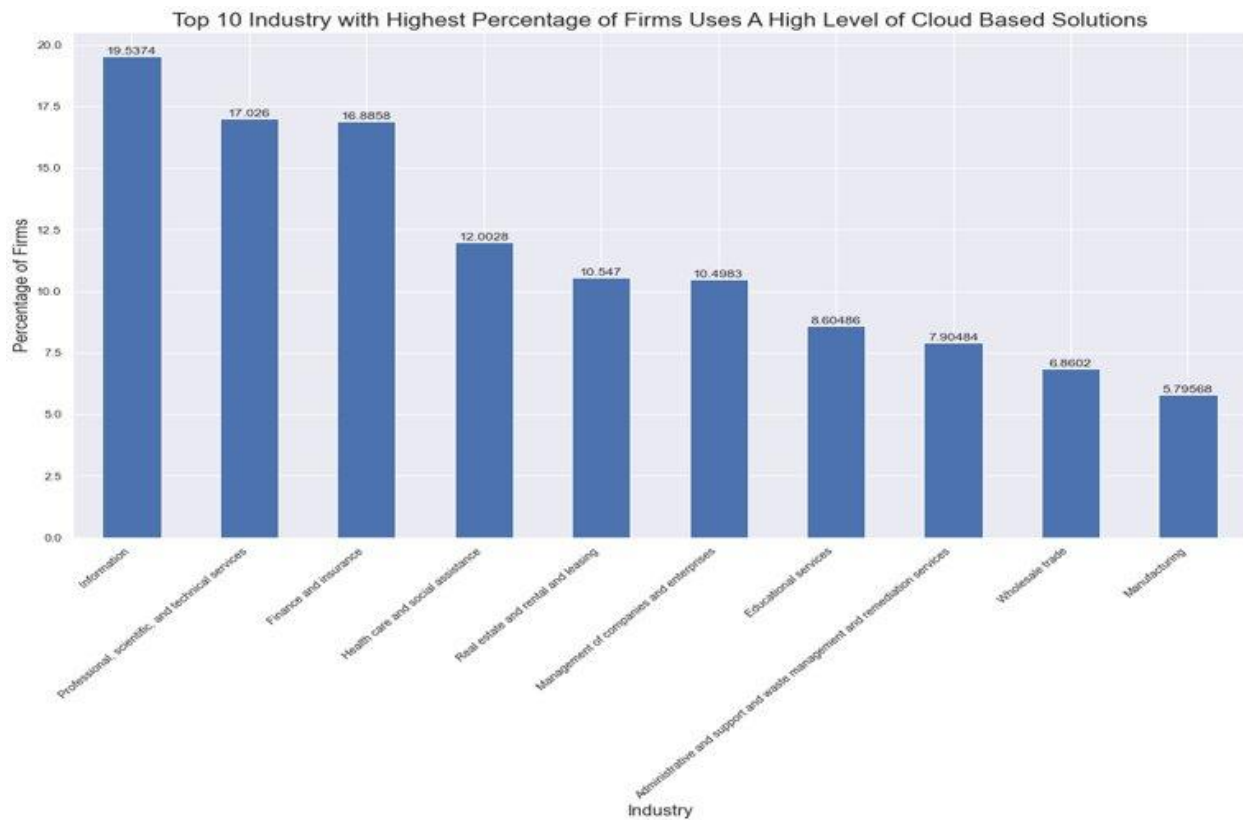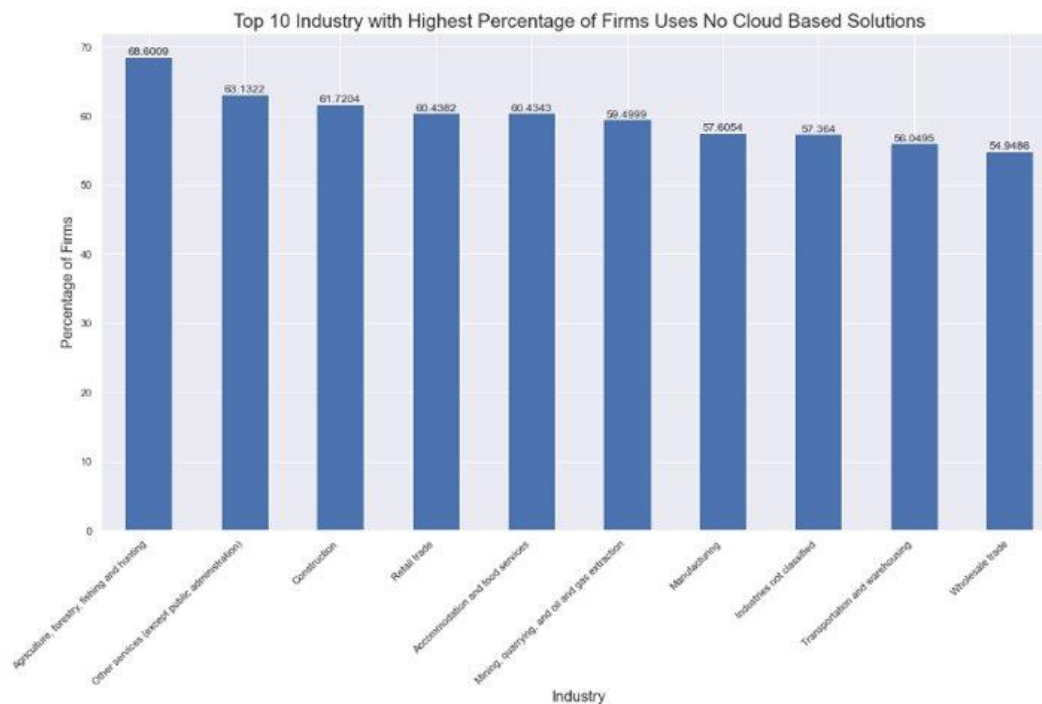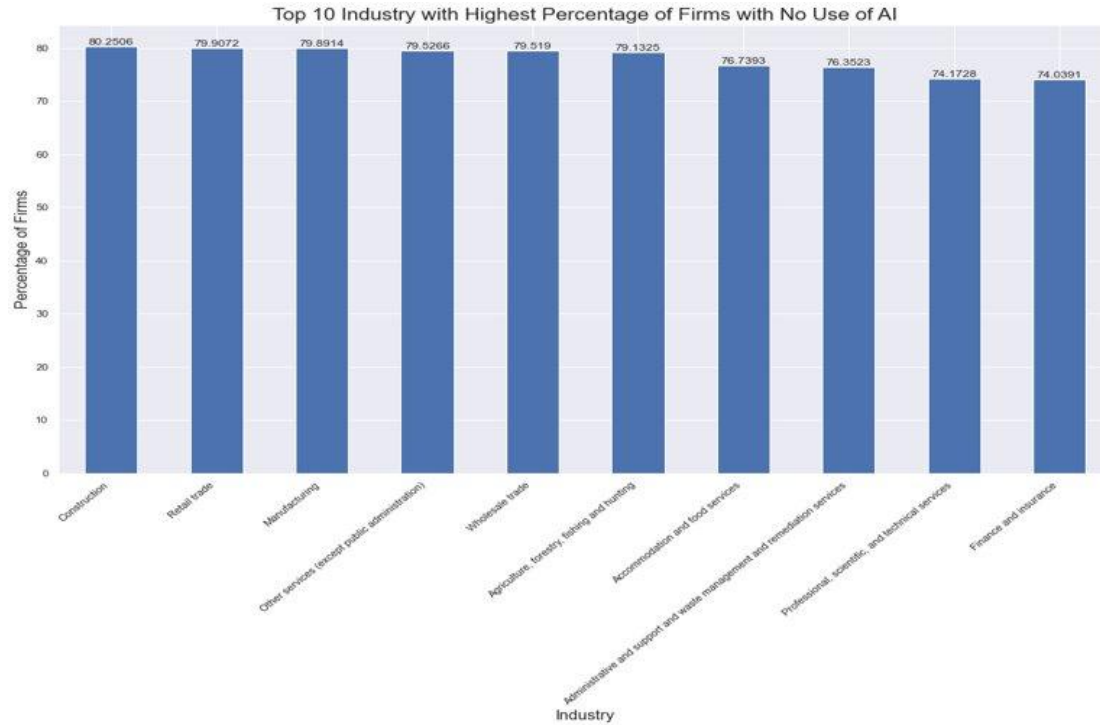
With reference to salary and the industries mentioned: management of companies and enterprises, information, finance and insurance, and professional, scientific, and technical services that utilized AI and cloud based solutions the most are above the trend in payroll per total number of employees.

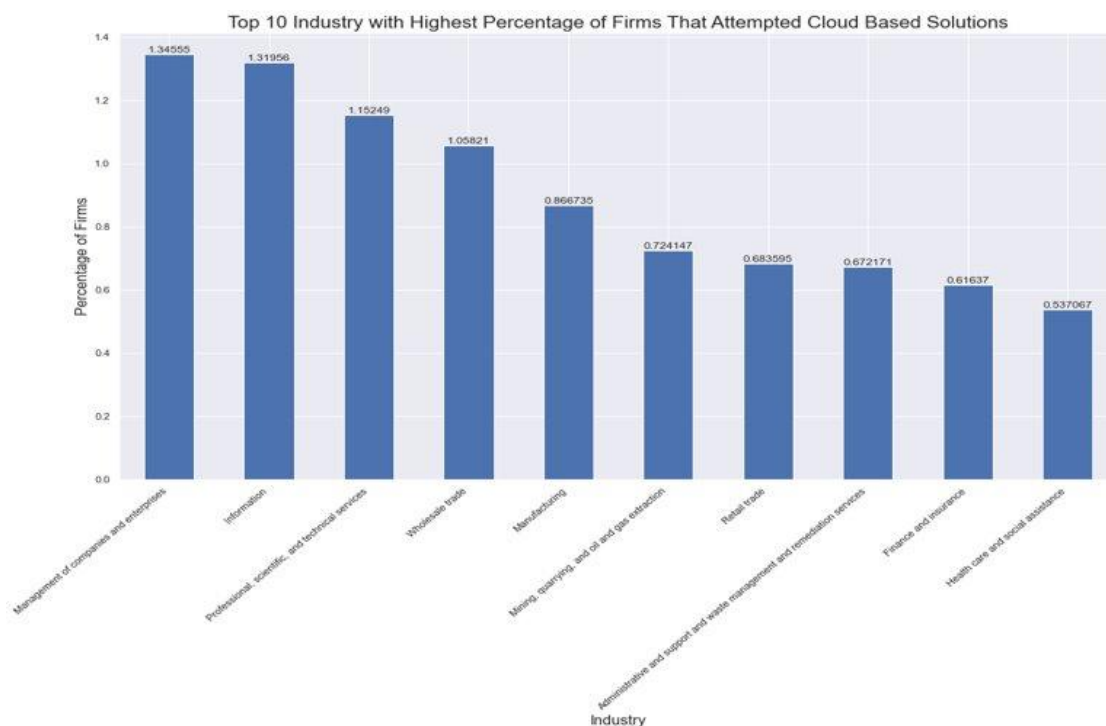**Total Annual Payroll vs Total Number of Employees by Industry**
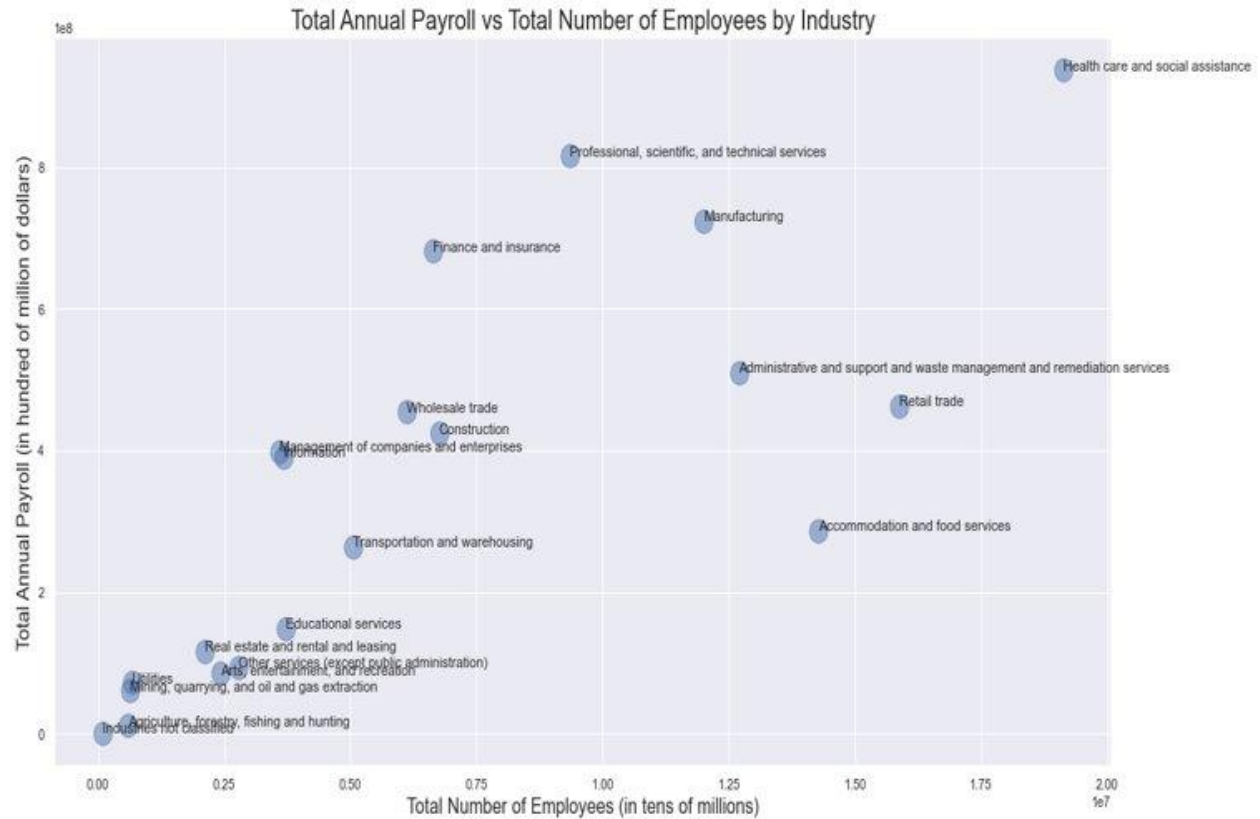
Firms that demonstrate the least amount of utilization of AI and cloud based technologies would be industries that are more associated with physical va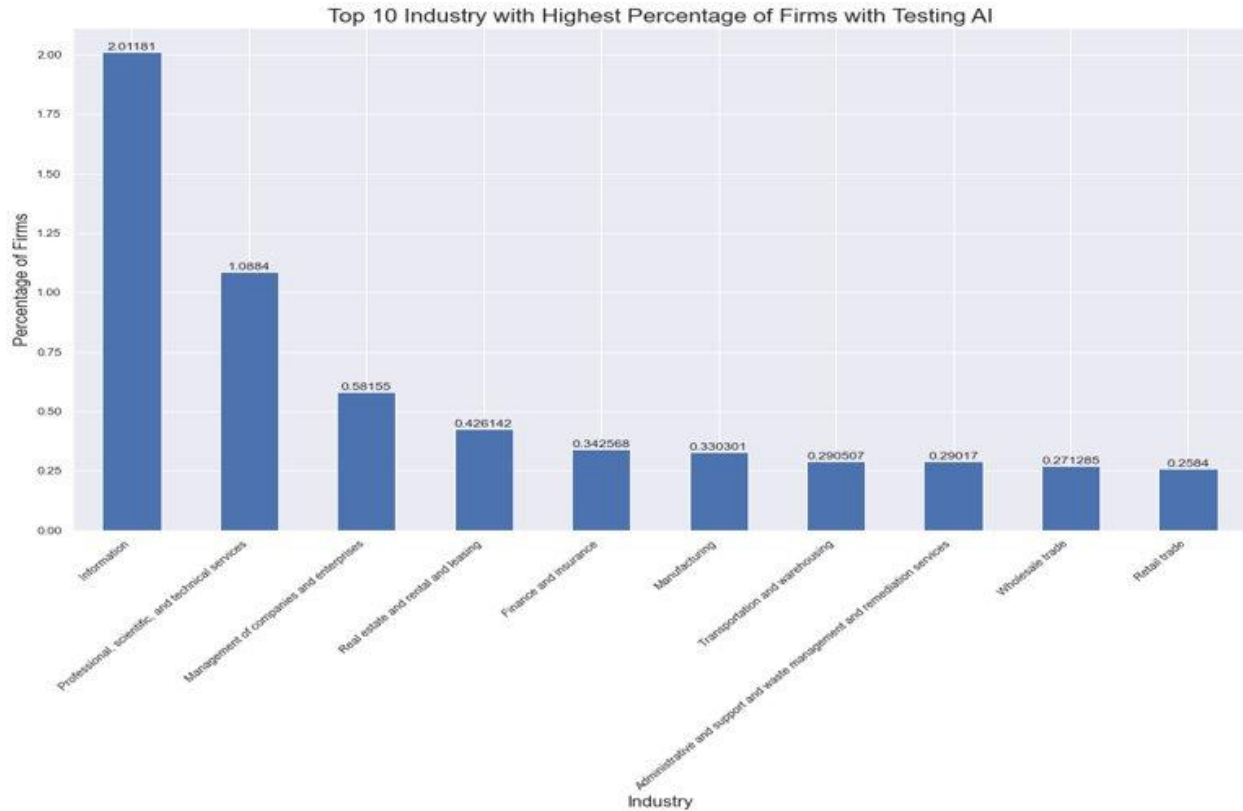lue based things or blue collar jobs. Construction finds itself as a top 3 industry with the least utilization of cloud based and AI

Top 10 Industry with Highest Percentage of Firms Uses No Cloud Based Solutions

Top 10 Industry with Highest Percentage of Firms with No Use of AI

Companies that have a high utilization of AI and cloud based technologies are also associated with the highest level of testing for the technologies. Information, professional, scientific, and technical services, management of companies, and enterprises are the top three industries to experiment with the implementation of cloud based and AI technologies. As previously mentioned all three show up on the highest utilization of both technologies lists.

Top 10 Industry with Highest Percentage of Firms That Attempted Cloud Based Solutions

Top 10 Industry with Highest Percentage of Firms with Testing AI

Next the association to the implementation of these technologies and if they have a positive association with the salary of the corresponding workers is addressed. Without a doubt there is a correlation between the usage of these technologies and the pay that is available for employees. As demonstrated in the next visualization companies that have high usage of AI technology have a substantially larger average salary than firms not associated or less associated with AI technologies.

Comparison on Average Annual Salary with a High Level Usage of AI
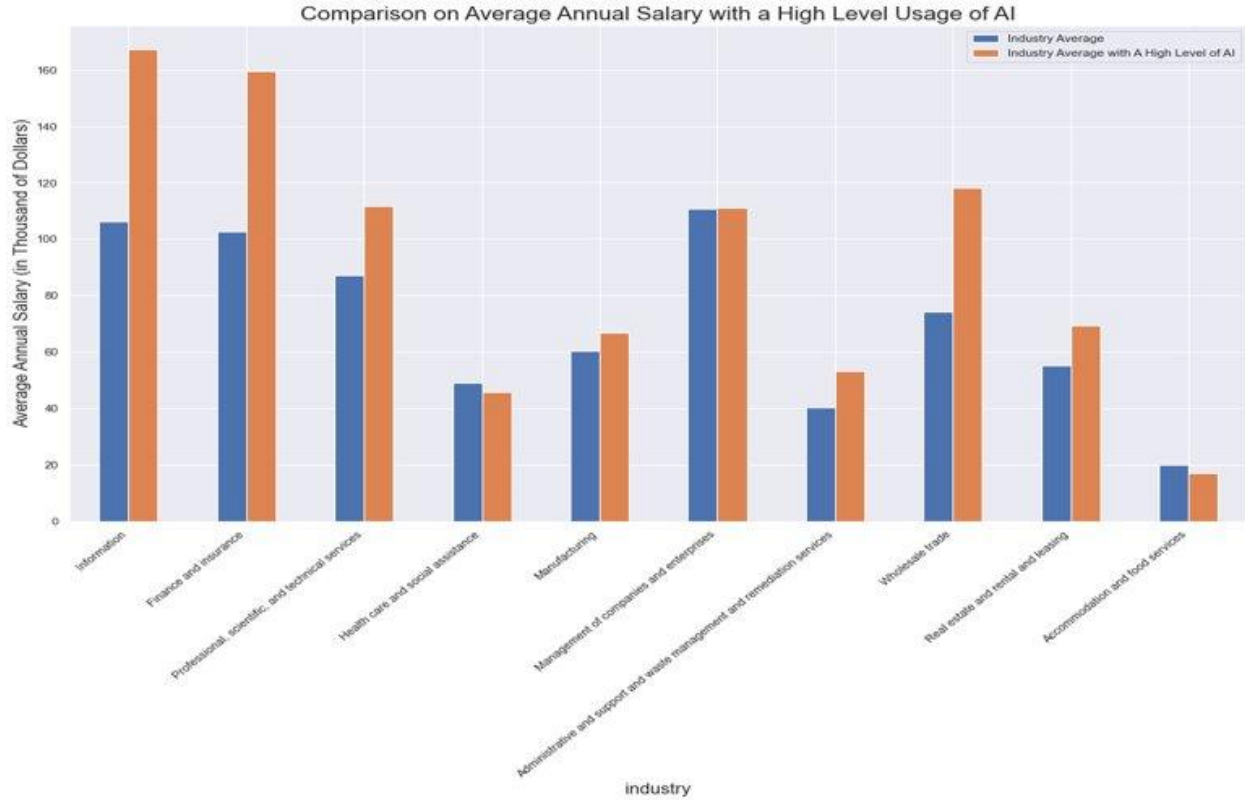
In comparison to AI, cloud based technologies have less positive impact on salary. However, they do still have a positive impact on average employee salary.

Comparison on Average Annual Salary with a High Level Usage of Cloud-Based Technology
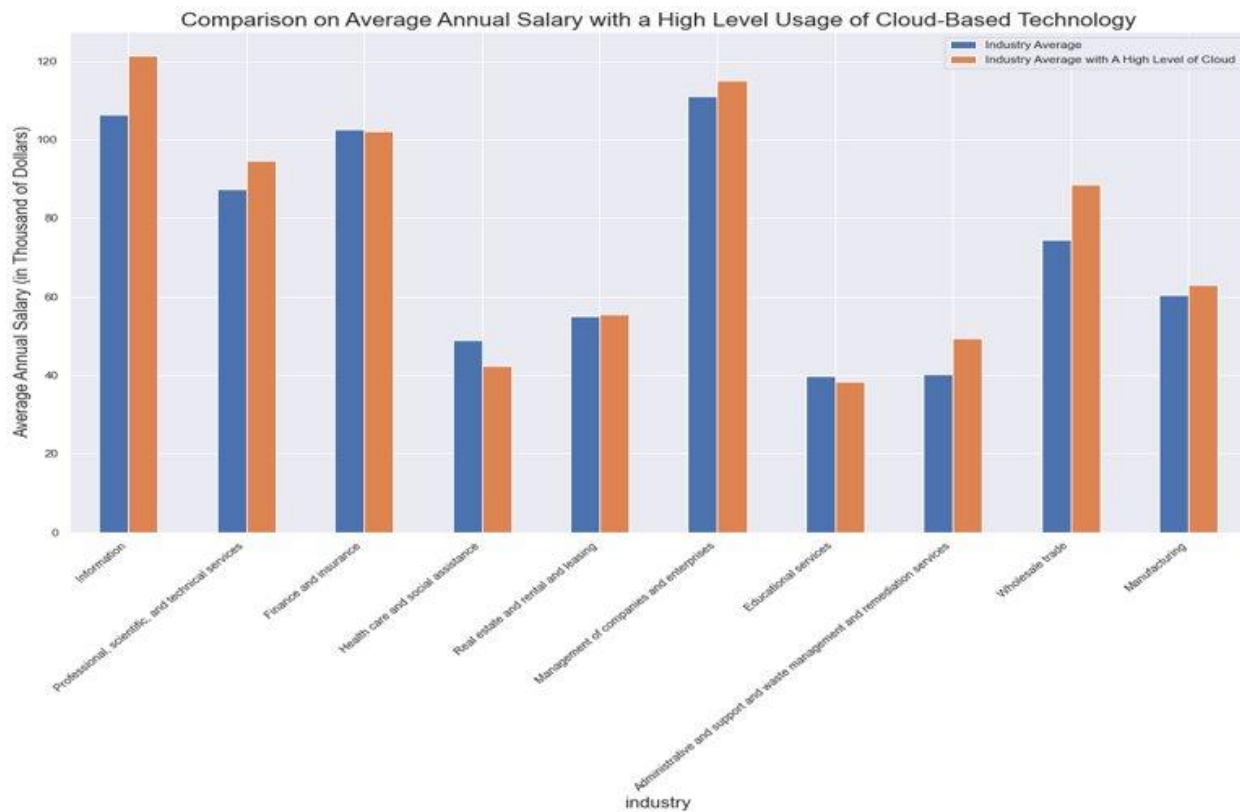
While not generating nearly as substantial an effect as AI, high level cloud based companies do see a smaller increase in pay in most industries that utilize it at a higher level. Conversely, firms that do not utilize cloud based technologies appear to see lower salaries than average.This demonstrates that cloud based technology creates salary increases for employees.

Comparison on Average Annual Salary with No Usage of Cloud-Based Technology

While more research can be done, there is considerable evidence to demonstrate that use of these higher level technologies creates higher salaries for employees. The original questions and their responses are:

1. What industries use which tech the most?

    a. Information and finance utilizes AI the most

2. Which industries use tech the least?

    a. Jobs traditionally considered blue collar are utilizing technologies the least.

3. Which industries are trying to get into these areas?

a. Information and finance are testing AI the most.

4. Has increased technology usage improved worker pay?

   a. Implementation or attempting to implement AI has the strongest

   relationship with higher average salaries.

5. Does pay go up as more technology is implemented?

   a. The implementation of AI increases the average salary of those that

   utilize it at a high level.

Cloud based technology is a more established commodity. All aspects of cloud based

technology comparatively to AI saw diminished benefit.

Name Changes: import name - changed name [Go Back](#)
        NAICS2017_LABEL - Industry
        PAYANN_y - Annual Payroll
        EMP_y - Number of Employees
        TECHUSE_LABLE - Tech Level
        EMP_x = Total Number of Employees (Industry)
        PAYANN_x - Total Annual Payroll (Industry)
        FIRMDEMP_x - Total Number of Firms
        FIRMDEMP_y - Number of Firms
        Technology Used - Tech Level split, first section
        Level - Tech Level split, second section (Tech level was then dropped)
        Percentage of Firms - Number of Firms/Total Number of Firms*100
        Average Salary - Annual Payroll/Number of Employees
        Average Salary by Industry - Average Salary mean

Total Number of Employees (Industry)	Industry	Total Annual Payroll (Industry)	Total Number of Firms	Number of Employees	Annual Payroll	Number of Firms	Technology Used	Level	Percentage of Firms	Average Salary	Average Salary by Industry

Industries: [Go Back](#)

1. Accommodation and food services

2. Administrative and support and waste management and remediation services

3. Agriculture, forestry, fishing and hunting

4. Arts, entertainment, and recreation

5. Construction

6. Educational services

7. Finance and insurance

8. Healthcare and social assistance

9. Industries not classified

10. Information

11. Management of companies and enterprises

12. Manufacturing

13. Mining, quarrying, and oil and gas extraction

14. Other services (except public administration)

15. Professional, scientific, and technical services

16. Real estate and rental and leasing

17. Retail Trade

18. Transportation and warehousing

19. Utilities

20. Wholesale trade

Source:

US Department of Commerce. (2021, October 14). *Annual Business Survey (ABS)*

   APIs. United States Census Bureau. Retrieved July 15, 2022, from

   https://www.census.gov/data/developers/data-sets/abs.2019.html