University for the Creative Arts

BERLIN SCHOOL OF BUSINESS & INNOVATION

Essay / Assignment Title: Exploring Artificial Intelligence Trends Across Sectors through Tableau Visualizations.

Programme title: MSc Data Analytics

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Year: 2025 - 2026

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Date: 06/02/2026

ABSTRACT

This paper will analyze the trends in artificial intelligence investment around the world and in sectors in the last five years (2018-2024) through interactive visualization tools in Tableau. The study of three integrated data sets, such as AI investment data of 25 and more focal areas, OECD sectoral adoption data, and Eurostat regional data indicates that cumulative AI investment has reached up to 340.8 billion, but still, organizations have adopted it only up to 16.6. The infrastructure category, at 45% of 2024 totals ($37 billion), is the most dominant, but fields relating to applications such as robotics exhibit explosive year-over-year growth (1,600%). Information and communication industry holds the first position in terms of adoption, then comes the Finance and Insurance; traditional industries are far behind. The Python-based data preprocessing allowed processing challenges with the Eurostat TSV complex structure, whereas interactive dashboards and year parameter, calculated field, and geographic heatmap features of Tableau allowed finding patterns. The results show that AI is moving to the early majority stage, and the number of significant implementation gaps between investment and deployment is large because of the need of infrastructure, the lack of talent and the complexity of change in the organization. The methodology based on visualization was fundamental to the exposure of inverse correlations between the amount of investment and the rate of expansion, sector trends, and geographic clustering patterns that mere data cannot display.

1. INTRODUCTION

Artificial Intelligence has evolved past being in the experimental phase of technology to become a strategic necessity that is transforming industries around the world. The global AI investment is expected to increase four times between 2018 and 2024, growing to billions to trillions of dollars of cumulative investment, with a previously unseen boom in the deployment of technological capital (Stanford HAI, 2024). However, even with such a huge financial investment, organizational adoption is low at 16.6 which shows a big gap between investment and operational implementation.

The paper examines the trends in AI adoption along various dimensions, including time trends, sector expansion, geographic touchpoints and geographic areas of interest and focus of investment with the aid of complex data visualization tools. The study answers three main questions: How have patterns of AI investment in various areas of application changed? Are the sectoral differences in the use of AI in organizations? What can interactive visualization tell us about the correlation between investment size and growth momentum?

The project uses Tableau to be the main tool of visualization with the addition of Excel analytics and Python-based preprocessing of the data to convert multi-dimensional multi-faceted data into actionable information that can be used by the stakeholders, such as investors, enterprises, policymakers, and technology providers.

2. LITERATURE REVIEW

2.1 The trends in AIs adoption and investment.

According to the recent literature, AI is being diffused in the economic sectors at a high pace. According to the OECD (2023), the adoption of AI is unevenly distributed in the enterprises with 10 or more employees based on industries, with information and communication industries showing the highest adoption rates. According to McKinsey Global Institute (2023), although 50-60 percent of organizations test AI in any of their business functions, a full-scale implementation is deficient due to gaps in data infrastructure, talent shortage, and organizational inertia.

In Stanford AI Index Report (2024), it is noted that in 2021, AI investment in the major corporations around the world was at all-time highs before declining in 2022-2023 due to market revaluation after the initial hype. The report cites infrastructure and underlying models as two major areas of investment focus, which is in line with the findings that general-purpose AI capabilities should be deployed first before applications-specific deployment.

2.2 Sectoral Differences in AI adoption.

There are heterogeneous adoption patterns in sectoral analysis. Brynjolfsson and McElheran (2016) determine that technological-intensive industries embrace digital innovations faster and more wholesomely compared to traditional industries. Financial services can be noted as highly integrative of AI due to regulatory demands, requirements to detect fraud, and algorithmic trading use (Cao, 2022). On the other hand, construction, agriculture, and traditional manufacturing have lower adoption rates because of the issue of digitization and the lack of skills among workforce (Acemoglu and Restrepo, 2020).

2.3 Data Visualization for Artificial Intelligence.

Proper visualization converts data that is complicated into information that can be accessed. Few (2012) highlights that the recognition of patterns that cannot be detected by the analysis of tabular data is made possible with the help of the following: selection of the chart, use of colors, and design of the layout. Kirk (2019) suggests interactive dashboards to enable the analysis of the data through exploration, enabling the users to dynamically filter, drill-down, and cross-reference the dimensions. Computer programs For the analysis of multidimensional AI adoption, Tableau is especially applicable due to its ability to integrate various sources of data, introduce calculative fields and develop geographic images (Murray, 2017).

3. METHODOLOGY

3.1 Data Sources

Three major datasets were used to conduct this analysis:

- AI Investment Data (AI_Investment.csv): This is the data on global AI investment in billions of U.S. dollars in 25+ of focus areas between 2018 and 2024, such as AI Infrastructure, Data Management, Healthcare, Robotics, NLP Customer Support, Manufacturing, and emerging technologies.
- OECD Business Data (ORCDdataset.csv): The data is on the AI adoption rates by sector expressed as percentage of enterprises using AI, by country (REFAREA), economic activity (NACE classification), and in percentages (2020-2024).
- Eurostat Regional Data (Eurostat_clean_long.csv): This data contains European regional AI adoption statistics in NUTS geographic granularity and allows visualization of heatmaps of the adoption patterns of each country and sub-region in Europe.

3.2 Data Cleaning and Pre-processing

Python Pre-processing Eurostat Data.

- Eurostat data was also very difficult to process using Tableau because of its complicated TSV format, and this arrangement had to be cleaned by using Python. The following transformations were used in the pandas library:
- Column Splitting: The original TSV had collapsed metadata in a column (freq,nacer2,sizeemp,indicis,unit,geo\TIMEPERIOD). Str.split (, expand=True) was used to then subdivide this into discrete fields: frequency, NACE sector code, employment size, type of indicators, unit, and geographic code.
- Data Reshaping: I used the melt() data manipulation function to transform the wide data (years as columns: 2023, 2024, 2025) into long format data with Year and AdoptionRate columns, which was necessary to use in Tableau as time-series data.
- Missing Value Handling: I have substituted the missing data indicator in Eurostat (":) with pd.NA and changed to numbers with error coercion using pd.tonumeric() to ensure that my visualizations handled nulls correctly.
- Data Type Conversion: I made sure that the Year column would be integer and AdoptionRate will be a float which will optimize the performance of Tableau to identify fields and calculate.

```
[11]: print(df.head())
      print(df.columns)
```

```
  freq,nace_r2,size_emp,indic_is,unit,geo\TIME_PERIOD   2023  2024    2025
0                          A,C,GE10,E_AI_CC,PC_ENT,AT    9.95     :   27.04
1                         A,C,GE10,E_AI_CC,PC_ENT,AT1    9.35     :       :
2                        A,C,GE10,E_AI_CC,PC_ENT,AT11    5.81     :       :
3                        A,C,GE10,E_AI_CC,PC_ENT,AT12    6.38     :       :
4                        A,C,GE10,E_AI_CC,PC_ENT,AT13   17.93     :       :
Index(['freq,nace_r2,size_emp,indic_is,unit,geo\TIME_PERIOD', '2023 ', '2024 ',
       '2025 '],
      dtype='object')
```

Figure 1 (Eurostat dataset before cleaning)

```
[23]: print(df_long.head(10))
```

	freq	nace_r2	size_emp	indic_is	unit	geo	Year	Adoption_Rate
0	A	C	GE10	E_AI_CC	PC_ENT	AT	2023	9.95
1	A	C	GE10	E_AI_CC	PC_ENT	AT1	2023	9.35
2	A	C	GE10	E_AI_CC	PC_ENT	AT11	2023	5.81
3	A	C	GE10	E_AI_CC	PC_ENT	AT12	2023	6.38
4	A	C	GE10	E_AI_CC	PC_ENT	AT13	2023	17.93
5	A	C	GE10	E_AI_CC	PC_ENT	AT2	2023	7.98
6	A	C	GE10	E_AI_CC	PC_ENT	AT21	2023	6.20
7	A	C	GE10	E_AI_CC	PC_ENT	AT22	2023	8.73
8	A	C	GE10	E_AI_CC	PC_ENT	AT3	2023	11.24
9	A	C	GE10	E_AI_CC	PC_ENT	AT31	2023	11.59

```
[25]: df_long.to_csv(
          "eurostat_clean_long.csv",
          index=False
      )
```

Figure 2 (Eurostat dataset after cleaning)

Tableau Data Integration

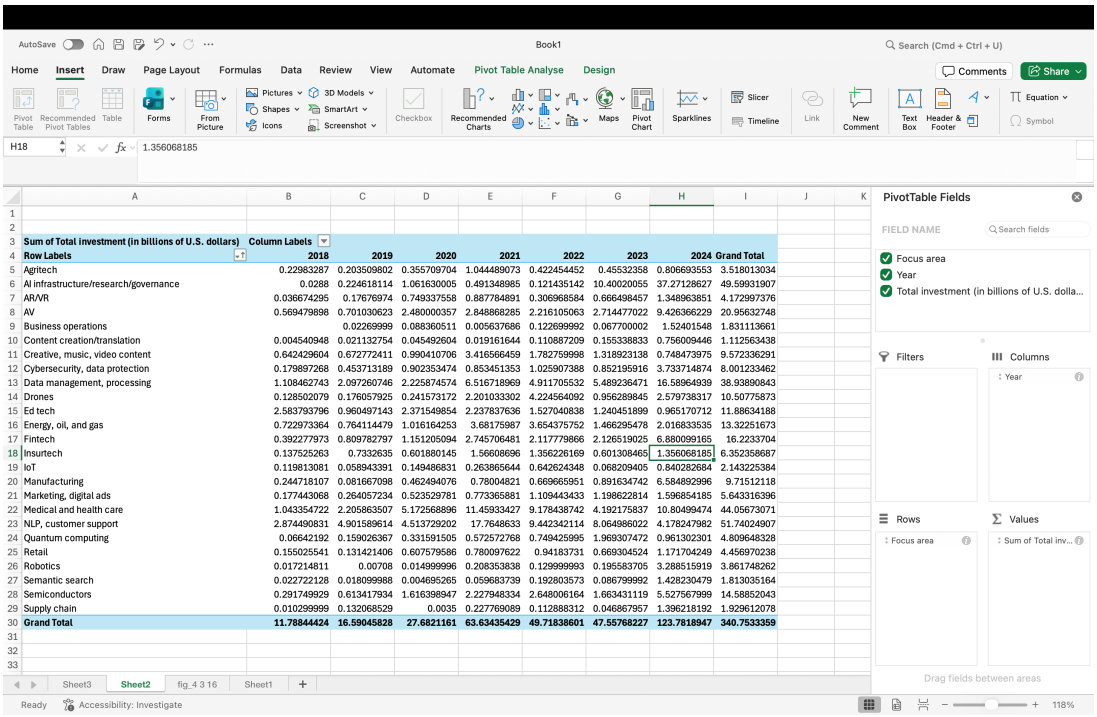
- I imported all the three CSV files to Tableau, creating relationships between the datasets based on the Year as the main connecting field.
- To make the analysis of the growth dynamic in all the visualizations I developed calculated fields: ((SUM([Investment Current Year]) - SUM([Investment Previous Year]) / SUM([Investment Previous Year])) * 100.
- I created geographic mapping by integrating Eurostat geo codes with geographic information that is inbuilt in Tableau which allowed me to render the heatmap appropriately.

Excel Data Preparation

The creation of calculated fields using Excel, development of pivot tables, and construction of combo charts were used. Growth rates have been determined using the

Formula: *((InvestmentCurrentYear - InvestmentPreviousYear)/InvestmentPreviousYear) x 100.*

Pivot tables aggregated investment by area of focus and time interval, and cross-tabulation analysis was done.



Sum of Total investment (in billions of U.S. dollars)	Column Labels							
Row Labels	2018	2019	2020	2021	2022	2023	2024	Grand Total
Agritech	0.22983287	0.203509802	0.355709704	1.044489073	0.422454452	0.45532358	0.806693553	3.518013034
AI infrastructure/research/governance	0.0288	0.224618114	1.061630005	0.491348985	0.121435142	10.40020055	37.27128627	49.59931907
AR/VR	0.036674295	0.17676974	0.749337558	0.887784891	0.306968584	0.666498457	1.348963851	4.172997376
AV	0.569479898	0.701030623	2.480000357	2.848868285	2.216105063	2.714477022	9.426366229	20.95632748
Business operations		0.02269999	0.088360511	0.005637686	0.122699992	0.067700002	1.52401548	1.831113661
Content creation/translation	0.004540948	0.021132754	0.045492604	0.019161644	0.110887209	0.155338833	0.756009446	1.112563438
Creative, music, video content	0.642429604	0.672772411	0.990410706	3.416566459	1.782759998	1.318923138	0.748473975	9.572336291
Cybersecurity, data protection	0.179897268	0.453713189	0.902353474	0.853451353	1.025907388	0.852195916	3.733714874	8.001233462
Data management, processing	1.108462743	2.097260746	2.225874574	6.516718969	4.911705532	5.489236471	16.58964939	38.93890843
Drones	0.128502079	0.176057925	0.241573172	2.201033302	4.224564092	0.956289845	2.579738317	10.50775873
Ed tech	2.583793796	0.960497143	2.371549854	2.237837636	1.527040838	1.240451899	0.965170712	11.88634188
Energy, oil, and gas	0.722973364	0.764114479	1.016164253	3.68175987	3.654375752	1.466295478	2.016833535	13.32251673
Fintech	0.392277973	0.809782797	1.151205094	2.745706481	2.117779866	2.126519025	6.880099165	16.2233704
Insurtech	0.137525263	0.7332635	0.601880145	1.56608696	1.356226169	0.601308465	1.356068185	6.352358687
IoT	0.119813081	0.058943391	0.149486831	0.263865644	0.642624348	0.068209405	0.840282684	2.143225384
Manufacturing	0.244718107	0.081667098	0.462494076	0.78004821	0.669665951	0.891634742	6.584892996	9.71512118
Marketing, digital ads	0.177443068	0.264057234	0.523529781	0.773365881	1.109443433	1.198622814	1.596854185	5.643316396
Medical and health care	1.043354722	2.205863507	5.172568896	11.45933427	9.178438742	4.192175837	10.80499474	44.05673071
NLP, customer support	2.874490831	4.901589614	4.513729202	17.7648633	9.442342114	8.064986022	4.178247982	51.74024907
Quantum computing	0.06642192	0.159026367	0.331591505	0.572572768	0.749425995	1.969307472	0.961302301	4.809648328
Retail	0.155025541	0.131421406	0.607579586	0.780097622	0.94183731	0.669304524	1.171704249	4.456970238
Robotics	0.017214811	0.00708	0.014999996	0.208353838	0.129999993	0.195583705	3.288515919	3.861748262
Semantic search	0.022722128	0.018099988	0.004695265	0.059683739	0.192803573	0.086799992	1.428230479	1.813035164
Semiconductors	0.291749929	0.613417934	1.616398947	2.227948334	2.648006164	1.663431119	5.527567999	14.58852043
Supply chain	0.010299999	0.132068529	0.0035	0.227769089	0.112888312	0.046867957	1.396218192	1.929612078
Grand Total	**11.78844424**	**16.59045828**	**27.6821161**	**63.63435429**	**49.71838601**	**47.55768227**	**123.7818947**	**340.7533359**

Figure 3 (Pivot Table)

4. EVALUATION & FINDINGS

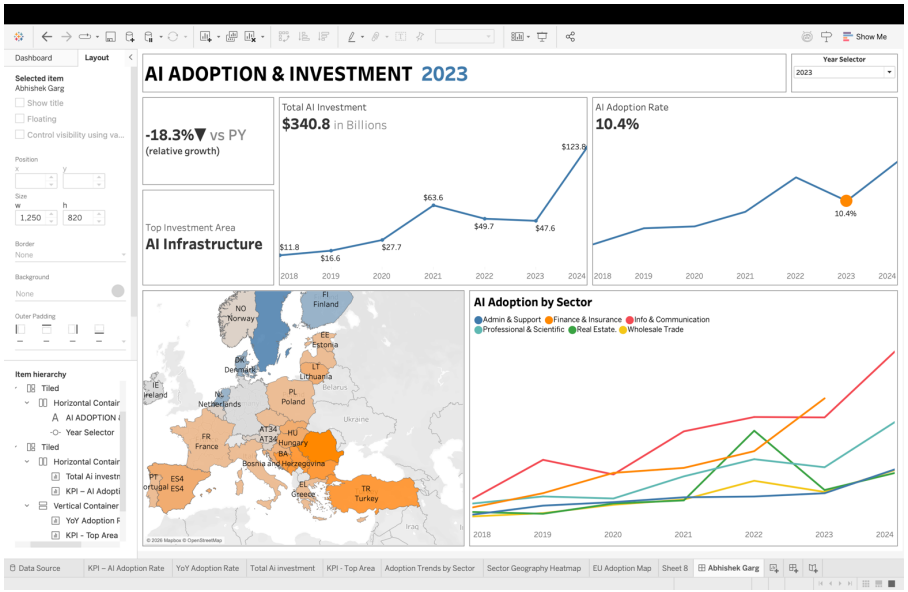


Figure 4 (Dashboard Overview)

4.1 Growth in AI Investment: The amount of AI investment has grown exponentially, with spending increasing by a staggering 11.8B in 2018, then 340.8B in 2021, and it indicates that the technology is leaving the lab and becoming a business strategy. The market is still in the upswing, as 2024 has increased by 53.3% per year.

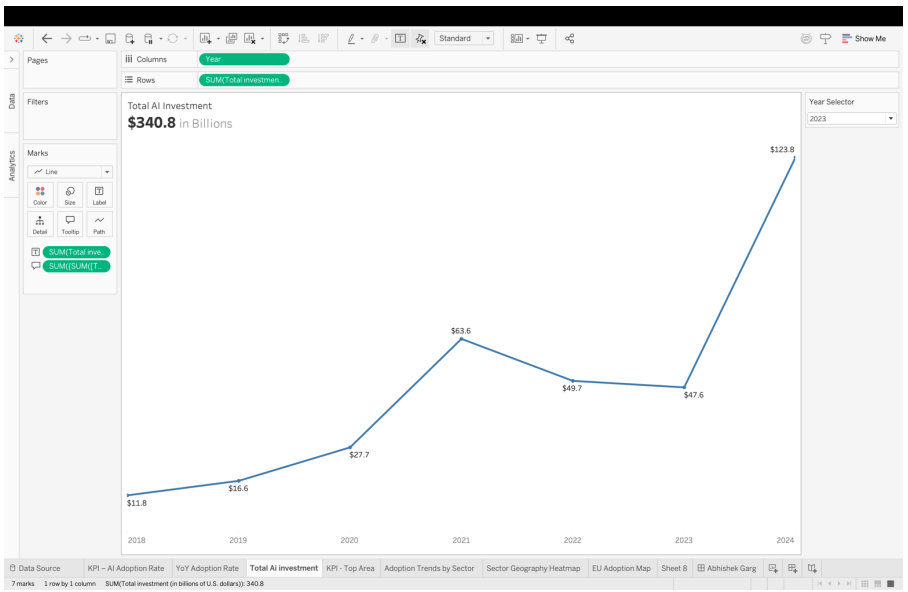


Figure 5 (Growth in AI investment)

4.2 Infrastructure Dominance: 45% of $123.8B investment in 2024 (37B) is allocated to AI infrastructure, which is an indication that individuals view the back-end technology as a key before I get to apps. Second place (Data Management $16.6B) supports that infrastructure-first strategy.

4.3 Adoption -Investment Divergence: Despite the massive capital flow, after all, only 16.6% of companies have implemented AI. The distance is due to the necessity of the appropriate infra, talent crunch, and internal change obstacles, thus there is plenty of space to develop in the future.

4.4 Sectoral Leadership: Info & Comm sector is on the top of the adoption, then Finance and Insure. The old players such as Wholesale Trade and Real Estate are catching up and with this early movers have an opportunity to differentiate and capture the wave.

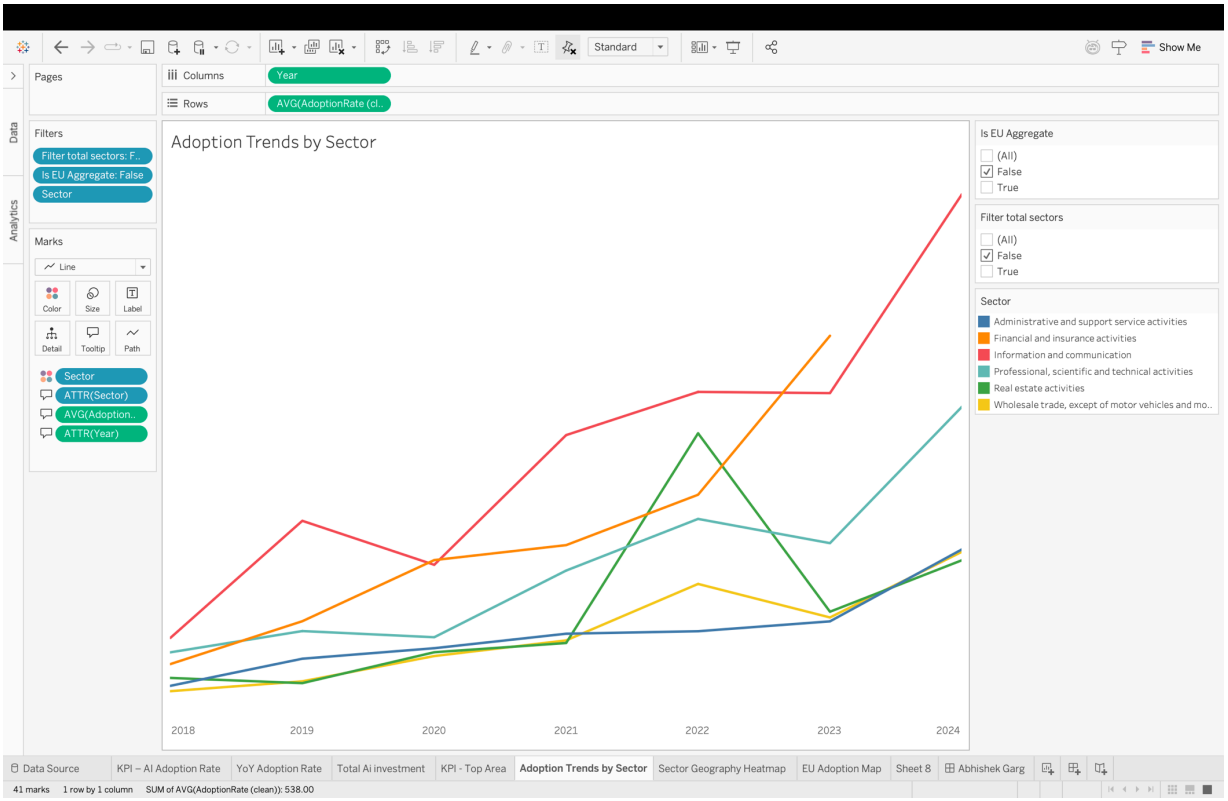


Figure 6 (AI adoption by sector)

4.5 Growth vs. Maturity Trade-off: Small bases (Robotics 1,600% YoY and Manufacturing 650% YoY) go hot, whereas mature markets (NLP customer support 16-18% YoY and cybersecurity 23-24% YoY) are growing at a niche.

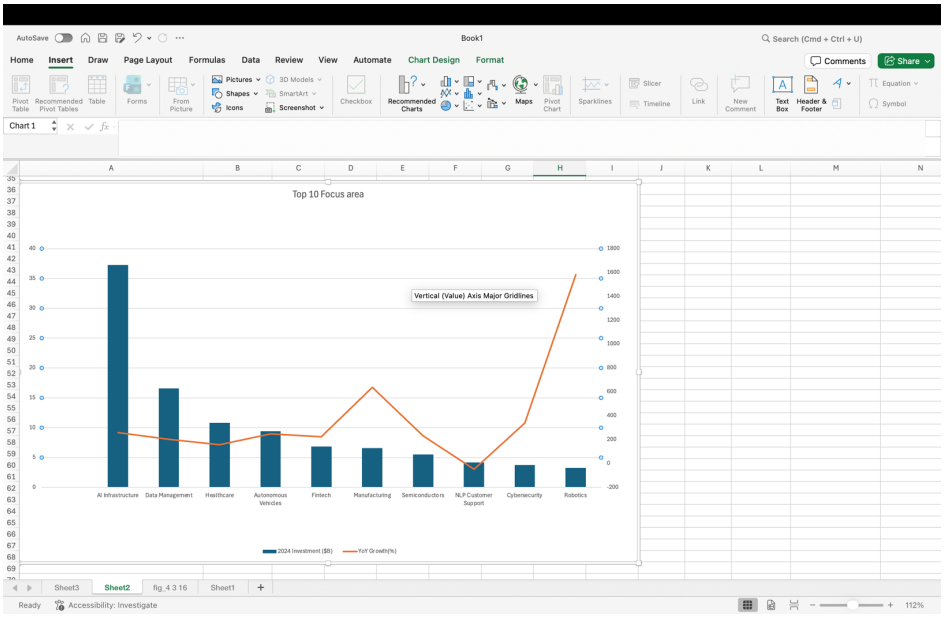


Figure 7 (Top 10 Focus area – Excel)

4.6 Geographic Patterns: Europe heatmap demonstrates that the adoption is not camped in the classical economic tables, with some Eastern regions of the EU performing significantly better than they should, which suggests that national strategies and talent pools can work better than GDP.

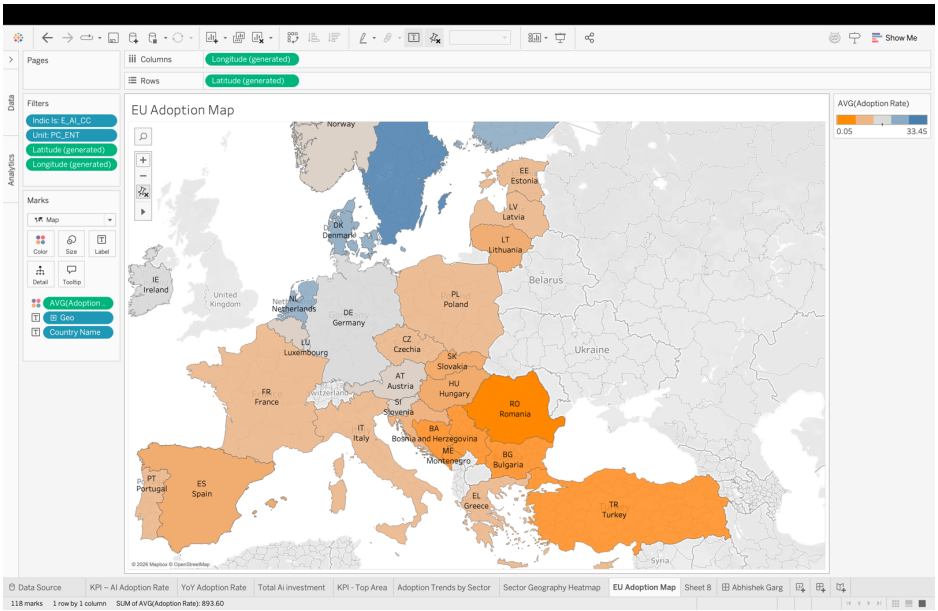


Figure 8 (EU AI Adoption map)

5. REFLECTION ON AI IMPACT

In my analysis, I found that one of the most interesting paradoxes in the transition of AI as an emerging technology to strategic imperative is the fact that it is a strategic technology. Even with the huge investment (340B+), 16.6 percent of organizations have implemented AI meaning that we are in the early majority inflection point-infrastructure development is made first before it can be applied widely. The winner-takes-most competition in the Information and Communication and Finance industries that I have seen and the application-specific AI (Robotics, Manufacturing) grow explosively the next value-generation wave will take place at the application layer instead of the infrastructure.

The pattern discovery that I needed was only made possible by the way my visualization-based style treated the data- raw data would show no pattern of the inverse relationship between investment size and growth rate, disparate adoption trends by sector, or geographic clusters. To the stakeholders, I came up with several implications, including that investors ought to distinguish infrastructure plays (stable, large) and applications (volatile, high-growth); enterprises in the traditional industry can still gain first-mover advantages, and talent development and regulatory clarity can be used by policy-makers to meaningfully contribute to regional competitiveness.

CONCLUDING REMARKS

In my in-depth study, I found out that AI has evolved to be not an experimental technology, but a strategic necessity, spending well over $340 billion during the last seven years, but with the adoption to date of 16.6% in organizations, there remains a lot more to come. My visualizations reveal that infrastructure investment (45 of 2024 total) is dominant, technology sectors are more likely to be adopted and traditional industries are slower in adoption and emerging applications exhibit explosive growth with small bases.

To the stakeholders, I found the following strategic implications: investors need to distinguish bets in steady infrastructure play-offs and high-growth application; enterprises are still able to take first mover advantage in old fashioned industry; and the technology implementation-adoption gap indicates the necessity of talent building and organizational transformation over and above pure acquisition of technology. Tableau is powerful because it can convert complex and multi-dimensional data into actionable insights by making use of interactive visualization, which is exhibited by my project.

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APPENDIX

The GitHub repository containing the full implementation and supporting files for this assignment can be accessed at:

https://github.com/AbhishekGarg0507/AI_Adoption_assignment