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Continental Trends in Tractor Utilization: A Big Data Analytics Approach

D. R. Korade[1], P. R. Kolhe[2],R.N. Palte[3], G.G. Kadam[4], V.B. Anarase[5], A. A. Kale[5]

[1]*M. Tech, College of Agricultural Engineering and Technology, Dr. BSKKV, Dapoli Maharashtra, India*
[2]*Associate Professor (CAS), College of Agricultural Engineering and Technology, Dr. BSKKV, Dapoli Maharashtra, India*
[3]*Sr. Research Assistant (FMP), CAET, Dr. BSKKV, Dapoli Maharashtra, India*
[4]*Phd Scholar, College of Agricultural Engineering and Technology, Dr. BSKKV, Dapoli Maharashtra, India*
[5]*M. Tech, College of Agricultural Engineering and Technology, Dr. BSKKV, Dapoli Maharashtra, India*

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ABSTRACT
Big data analytics has revolutionized the agricultural sector by providing farmers and agribusinesses with real-time insights into crop conditions and soil health. Big data analysis on agriculture tractor users can provide valuable insights into various aspects of their usage patterns, efficiency, and potential improvements. By collecting and analyzing large datasets related to tractor usage, researchers and stakeholders can uncover trends, optimize farming practices, and make data-driven decisions. United States is at first rank for highest number of tractor of users for all times from year 1991 to 2000. After that Japan is at second rank for highest number of tractor users for all times from year1991 to 2000. Similarly, Italy nation was at third rank for year 1991 to 1996. Later that India gain position of third rank for highestnumber of tractor users from year 1997 to 2000.

Key words- tractor, continents, data analytics, dashboard, Microsoft excel, pivot table, pivot chart.

I. INTRODUCTION

Data Analytics is the study of analyzing unprocessed data to draw conclusions about such information. Using data analytics, a corporation can boost productivity, maximize profit, or make more strategic decisions. Companies can utilize data analysis to manufacture things, examine their advertising efforts, adapt content, and establish content strategy. By offering crucial insights and data, which are frequently displayed as charts, pictures, tables, and graphs, the technique assists to lessen the risks associated with decision-making. In order to

make Big Data applications more manageable in terms of data size and complexity, big data analytics is essential (Lidong et. al., 2014). The Big Data technology is the promising technological innovation to extract meaningful insights from an extremely huge data by applying the various analytics techniques (Waga and Kefa, 2014). Excel is utilized for Data Analytics in order to generate such insights

When it comes to analyzing and showing data, Microsoft Excel has long been the chosen tool for business professionals. When working with increasingly complex data, Microsoft Excel allows users to adjust the fields and functions that perform computations. It also allows for easy collaboration amongst numerous users at the same time. Microsoft Excel for Data Analysts just received a variety of new tools that can improve analytical applications (Powell et. al., 2004).

An agricultural tractor is a large vehicle that is used on farms to accomplish duties such as plowing, tilling, planting, and harvesting crops. Tractors are vital in modern agriculture because they boost farm productivity and efficiency. They are available in a variety of sizes and varieties, depending on the specific agricultural duties for which they are intended. The tractor industry is a critical component of the agricultural sector, providing essential equipment for farmers to cultivate and harvest crops. With the advent of data analytics, the tractor industry has undergone significant changes in recent years. Data analytics has enabled manufacturers to design and develop tractors that are more efficient, reliable, and cost-effective. Additionally, data analytics has enabled farmers to make informed decisions about when and how to use their tractors, leading to improved crop yields and reduced costs. In this context, data analytics has become an essential tool for the tractor industry, driving innovation and improving productivity in agriculture (Mohd et. al., 2022)

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II. REVIEW OF LITERATURE

Dr. S. Sasikala and Renuka Devi (2017) studied the ascendancy of big data analytics for agricultural competitiveness: the theoretical framework to augment the agricultural management system. They developed a theoretical framework to improve the agricultural management system. The goal of the suggested framework is to analyze agricultural data using big data analytics methods. Agriculture is made productive by maximizing production using the vast amount of currently available crop, soil, and meteorological data as well as by assessing fresh, nonexperimental data. The suggested work offers a conceptual framework for the use of data analytics to help various agricultural sectors and advance rural development.

S.I. Sandeepanie (2020) studied theBig Data Analytics in Agriculture. Almost every nation's economy depends heavily on agriculture. Agriculture is known to produce enormous amounts of data at high speeds and with a wide range of variability every second. Using conventional tools and approaches to analyze these data and make judgments based on the data is extremely challenging. Because of this, a lot of products, fertilizer, labor, and other resources are also squandered.

Lidong Wang, et. al., (2015) explored the Big Data and Visualization: Methods, Challenges and Technology Progress. In order to make Big Data applications more manageable in terms of data size and complexity, big data analytics is essential. Big Data can benefit from using visualization to gain a comprehensive understanding of the data and identify its values. The greatest results from big data applications require seamless integration of big data analytics and visualization. Big Data visualization is offered with new techniques, uses, and technological advancements.

III. MATERIALS AND METHODOLOGY

A. Materials

Microsoft Excel can carry out some big data activities even though it isn't typically thought of as a big data analytics tool, especially with the introduction of Power Query and Power Pivot. More datasets than it was previously able to connect to, clean up, and analyze are now accessible through Excel. Excel has limitations compared to specialized Big Data tools like Hadoop or Spark when working with massive datasets. Several examples of how Excel can be used for big data analytics are provided below: Data Analysis, Power Pivot, Data Visualization, and Power Query.

B. Methodology

Performing big data analytics on tractor users worldwide involves several steps to collect, process, analyze, and interpret the data effectively. Here's a generalized process followed for big data analytics on number of tractor users in countries differentiated by continents:

1. Define Objectives: Clearly state the goals of investigation, such as to comprehend tractor usage trends, deploy tractors more efficiently, or spot patterns in agricultural operations.
2. Data Collection: Assemble the information from a range of sources, such as tractor manufacturers, agricultural organizations, government publications, IoT sensors fitted on tractors, and crop management systems. As collected information is pertinent to goals of investigation and includes a representative sample of tractor users from various geographic areas.
3. Data Cleaning and Preprocessing: In this process, the data is cleaned to get rid of mistakes, missing numbers, and discrepancies. The data should be preprocessed to create a format that is appropriate for analysis.
4. Pivot Table generation: Enter the cleaned and ready data into a spreadsheet in a program that can support pivot tables, like Microsoft Excel. By clicking Insert > Pivot Table, one can create a pivot table by selecting the pertinent data range and the required variables for the rows and columns. On a new sheet, a pivot table will be created using the data at hand.
5. Data Integration, Data Exploration and Visualization: Create a centralized data repository or data lake by integrating data from many sources, making it available for additional analysis. Investigate the data using descriptive statistics and visuals (charts, graphs, maps) to get a general understanding of geographic distribution, tractor usage patterns, and other pertinent trends.
6. Data Analysis: Apply some analytical techniques to the tractor usage data, such as clustering, classification, regression, and time-series analysis, to draw out important trends and patterns.
7. Creation of Dashboard: In order to better understand the big data analysis on the number of tractor users in various nations and continents of the world, pivot charts of various continents created using pivot tables are pasted on new spread sheets and connected through slicers that fluctuate pivot charts for years between 1991 and 2000.

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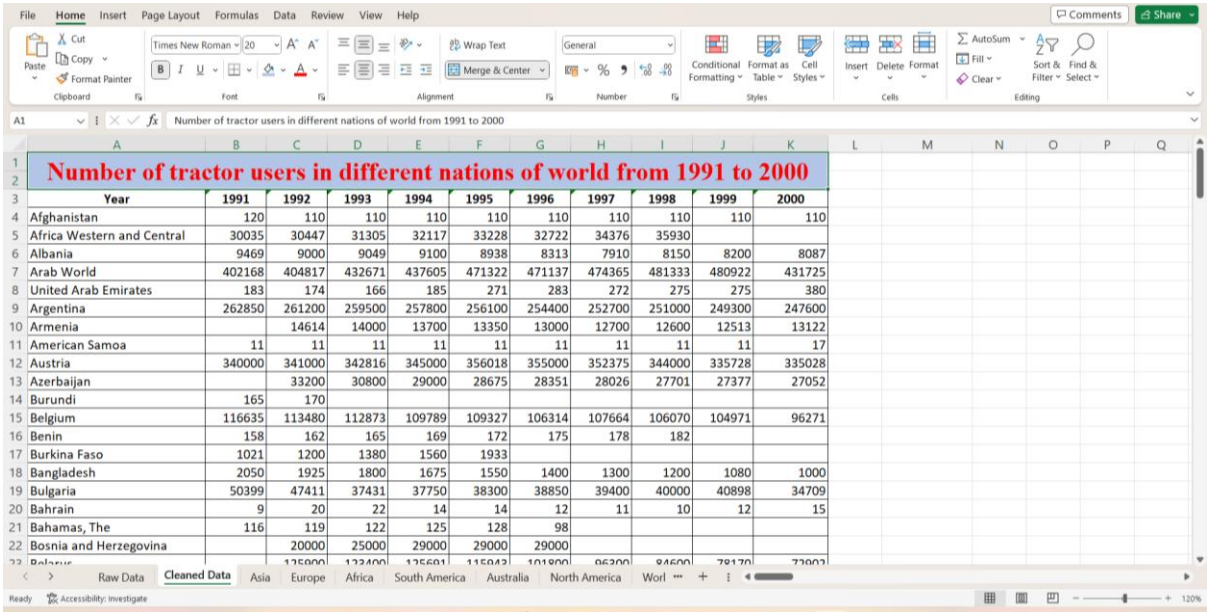
IV. RESULTS AND DISCUSSION

1. Collection of data: Gathered the pertinent information about the number of tractor users throughout the various continents from the World Data Bank website. A statistic relates to the number of tractors used in various nations between 1991 and 2000.



Number of tractor users in different nations of world from 1991 to 2000

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Afghanistan	120	110	110	110	110	110	110	110	110	110
Africa Western and Central	30035	30447	31305	32117	33228	32722	34376	35930		
Albania	9469	9000	9049	9100	8938	8313	7910	8150	8200	8087
Arab World	402168	404817	432671	437605	471322	471137	474365	481333	480922	431725
United Arab Emirates	183	174	166	185	271	283	272	275	275	380
Argentina	262850	261200	259500	257800	256100	254400	252700	251000	249300	247600
Armenia		14614	14000	13700	13350	13000	12700	12600	12513	13122
American Samoa	11	11	11	11	11	11	11	11	11	17
Austria	340000	341000	342816	345000	356018	355000	352375	344000	335728	335028
Azerbaijan		33200	30800	29000	28675	28351	28026	27701	27377	27052
Burundi	165	170								
Belgium	116635	113480	112873	109789	109327	106314	107664	106070	104971	96271
Benin	158	162	165	169	172	175	178	182		
Burkina Faso	1021	1200	1380	1560	1933					
Bangladesh	2050	1925	1800	1675	1550	1400	1300	1200	1080	1000
Bulgaria	50399	47411	37431	37750	38300	38850	39400	40000	40898	34709
Bahrain	9	20	22	14	14	12	11	10	12	15
Bahamas, The	116	119	122	125	128	98				
Bosnia and Herzegovina		20000	25000	29000	29000	29000				

Figure No. 1 Interface of data collection from World Data Bank website

2. Data cleaning and preprocessing: Removed the duplicates from the acquired data to clean it. Transformed the data so that it can be used for pivot table analysis, for example, by arranging it into a table with rows for observations and columns for variables.

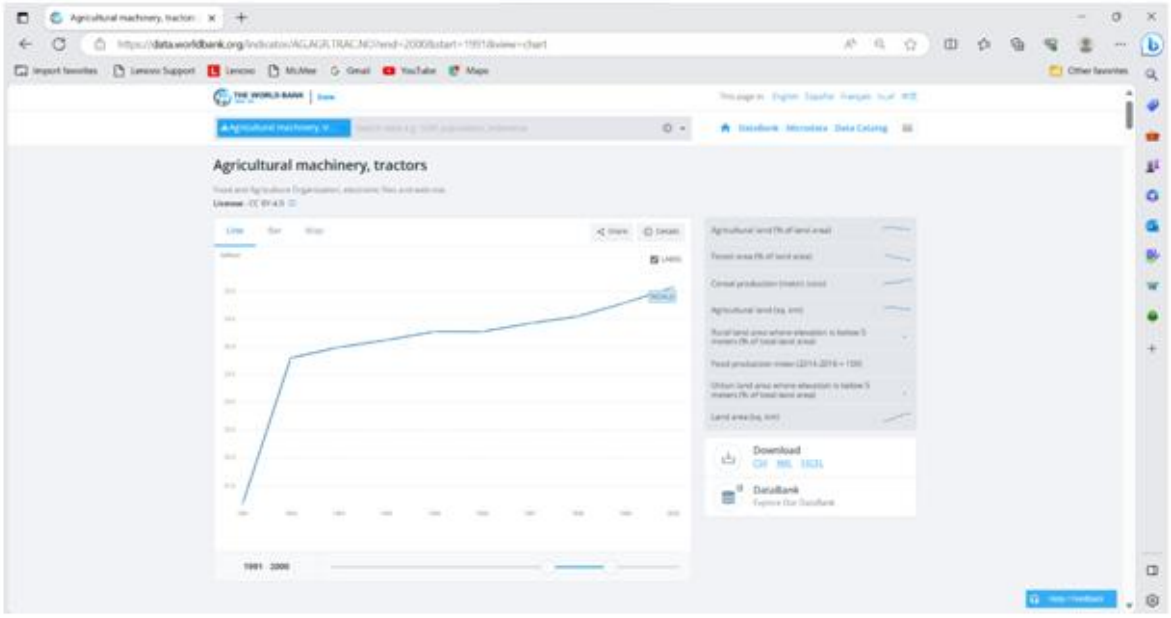


Figure No. 2 Interface of cleaned data need to be used for pivot table creation

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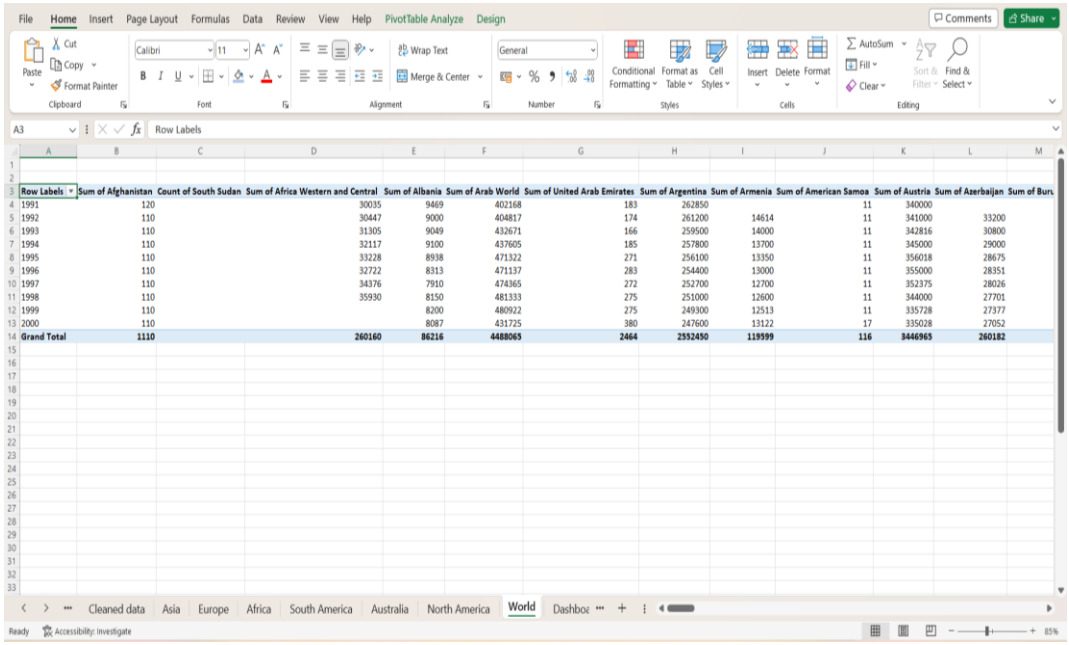
3.Pivot Table creation: Pivot table is created as shown in figure no. 3 by using cleaned data as shown in figure no. 2. in relevant data range and choosing the appropriate variables for rows, columns, and values.

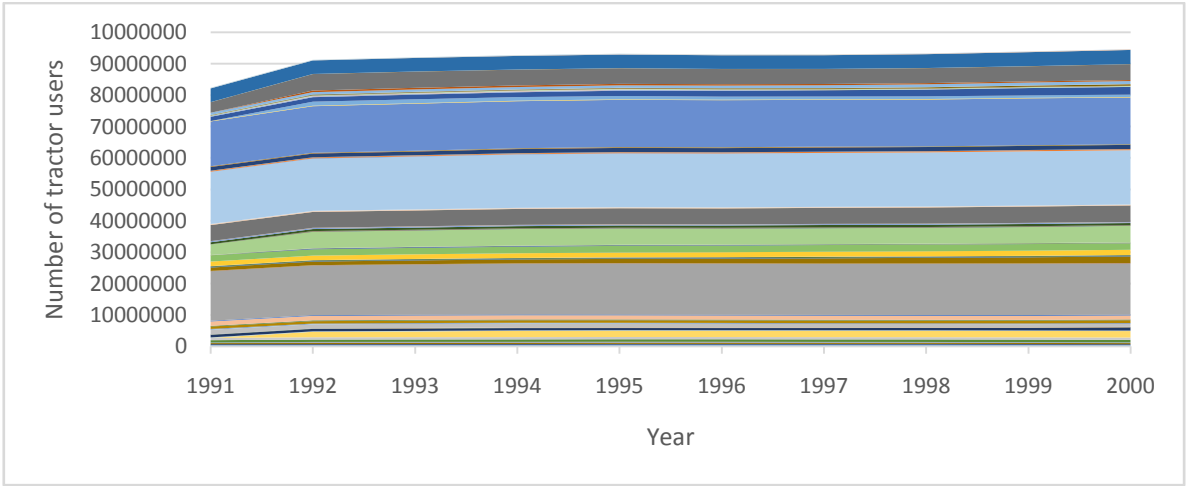


Row Labels	Sum of Afghanistan	Count of South Sudan	Sum of Africa Western and Central	Sum of Albania	Sum of Arab World	Sum of United Arab Emirates	Sum of Argentina	Sum of Armenia	Sum of American Samoa	Sum of Austria	Sum of Azerbaijan	Sum of Bur
1991	120		30035	9469	402168	183	262850		11	340000		
1992	110		30447	9000	404817	174	261200	14614	11	341000	33200	
1993	110		31305	9049	432671	166	259500	14000	11	342816	30800	
1994	110		32117	9100	437605	185	257800	13700	11	345000	29000	
1995	110		33228	8938	471322	271	256100	13350	11	356018	28675	
1996	110		32722	8313	471137	283	254400	13000	11	355000	28351	
1997	110		34376	7910	474365	272	252700	12700	11	352375	28026	
1998	110		35930	8150	481333	275	251000	12600	11	344000	27701	
1999	110			8200	480922	275	249300	12513	11	335728	27377	
2000	110			8087	431725	380	247600	13122	17	335028	27052	
Grand Total	1110		260160	86216	4488065	2464	2552450	119599	116	3446965	260182	

Figure No. 3 Interface of created pivot table

4. Data Summarization and analysis: Using the pivot table, can calculate various summary statistics, such as means, sums, counts, or percentages, to summarize the number of agricultural tractor users in different nation of world. The purpose of this stage is to quickly survey the data and spot any patterns or trends. Used pivot table features like filtering, sorting, or grouping to analyze the condensed data. This makes it possible to examine and contrast other subsets of the data.

5. Data Visualization: Using pivot table tools, such as charts or graphs, provide visual representations of the examined data. This process promotes decision-making in agriculture and aids in the efficient communication of the findings. The pivot charts for whole world and six continents like Asia, Europe, Africa, Australia, North America and South America were created as shown in following figures



a) World

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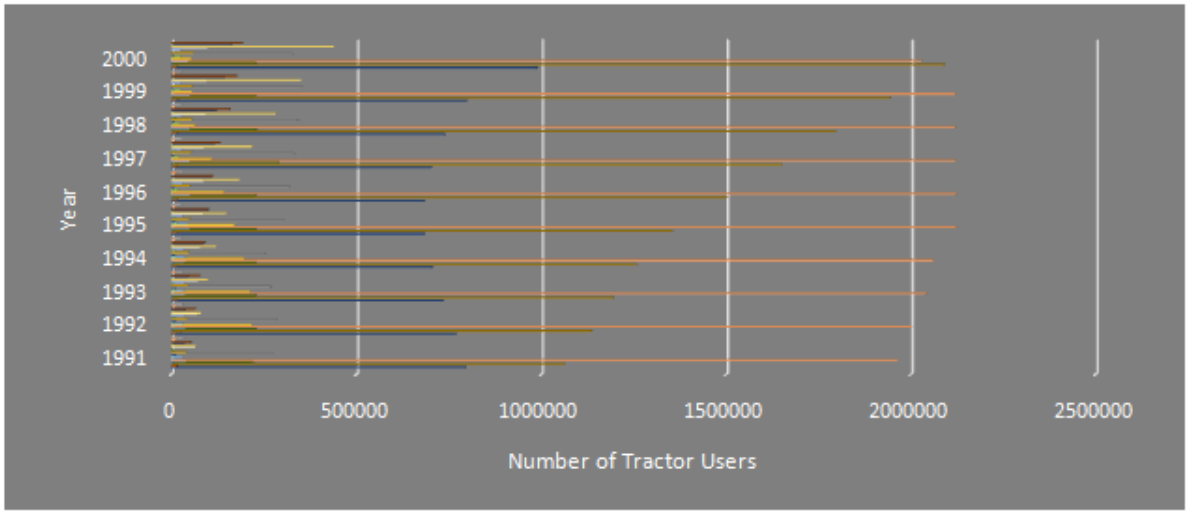
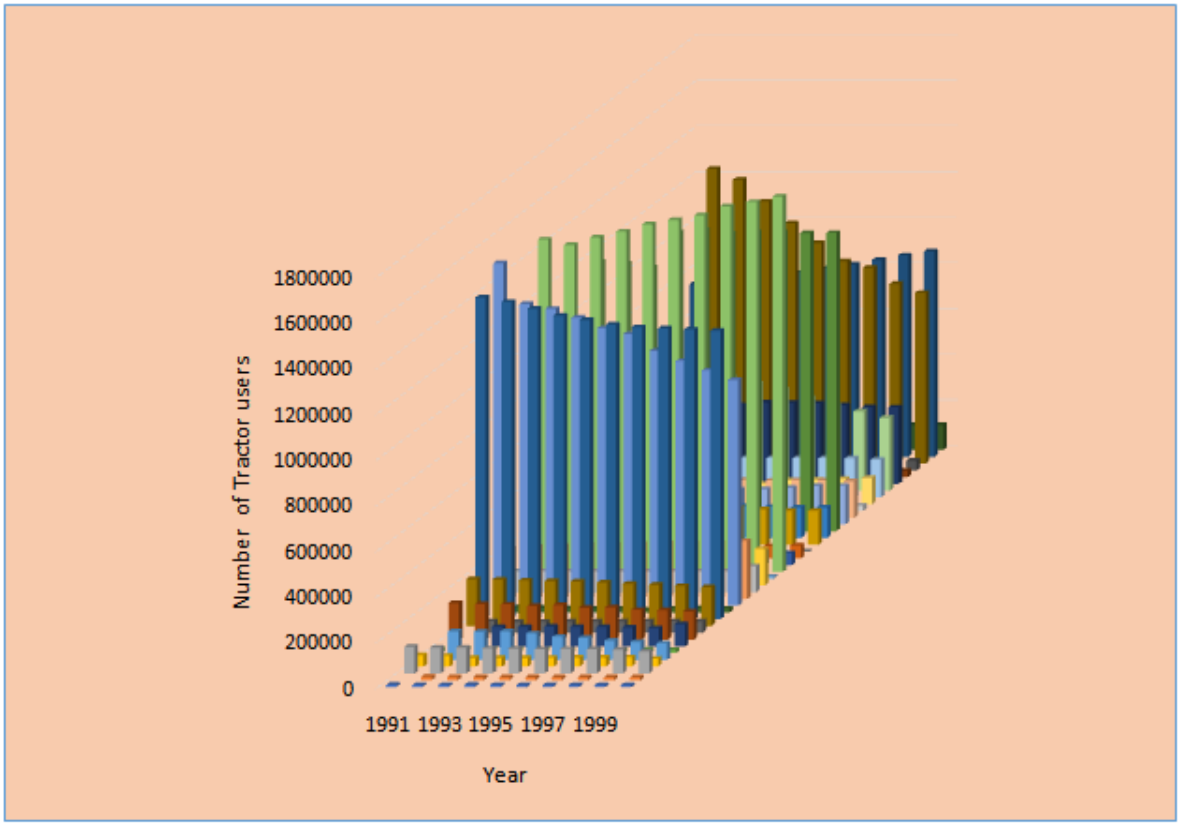


b) Asia



c) Europe

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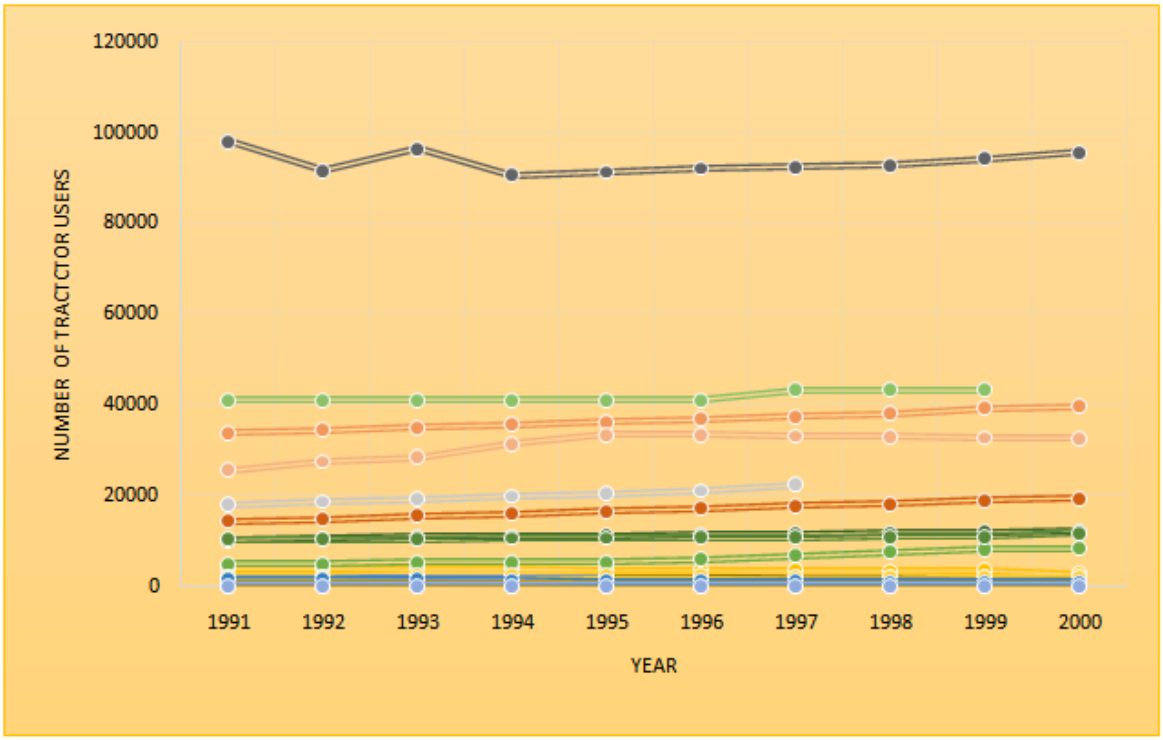
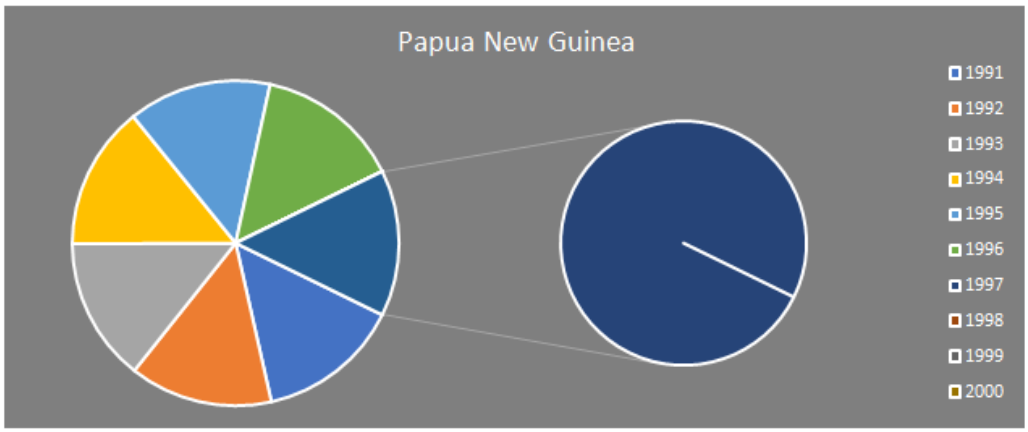


d) Africa



e) Australia

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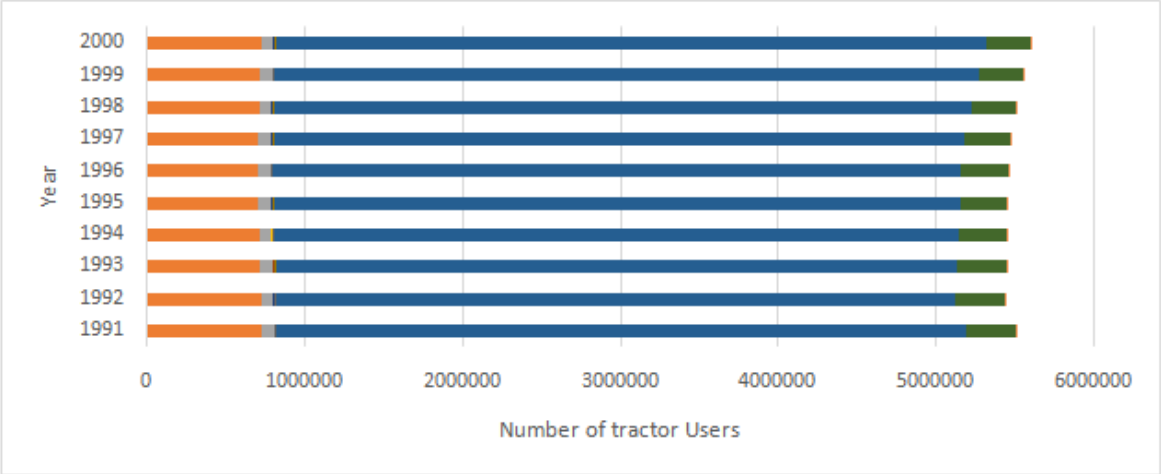
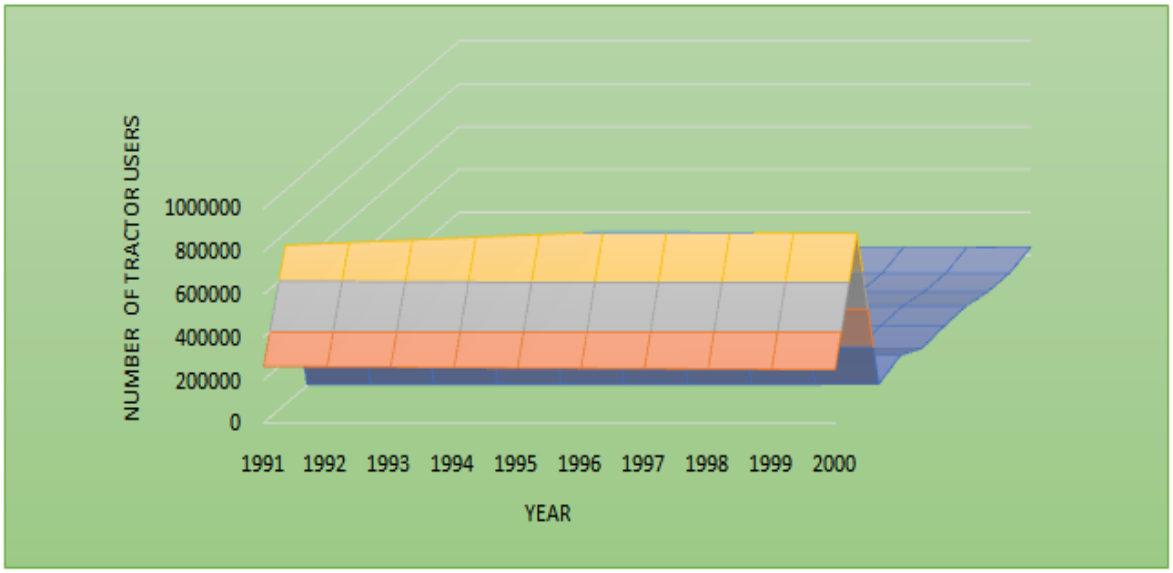


f) North America



g) South America

Figure No. 4 Graphical representation of data by picot chart

6. Interpretation and Insights: Interpret the results obtained from the pivot table analysis and derive meaningful insights. Big data analysis on agriculture tractor users can provide valuable insights into various aspects of their usage patterns, efficiency, and potential improvements. By collecting and analyzing large datasets related to tractor usage, researchers and stakeholders can uncover trends, optimize farming practices, and make data-driven decisions.

United Statesis at first rank for highest number of tractor of users for all times from year 1991 to 2000. After that Japan is at second rank for highest number of tractor users for all times from year 1991 to 2000. Similarly, Italy nation was at third rank for year 1991 to 1996. Later that India gain position of third rank for highest number of tractor users from year 1997 to 2000. Value of number of tractor users of top 3 countries is given in following table number 1.

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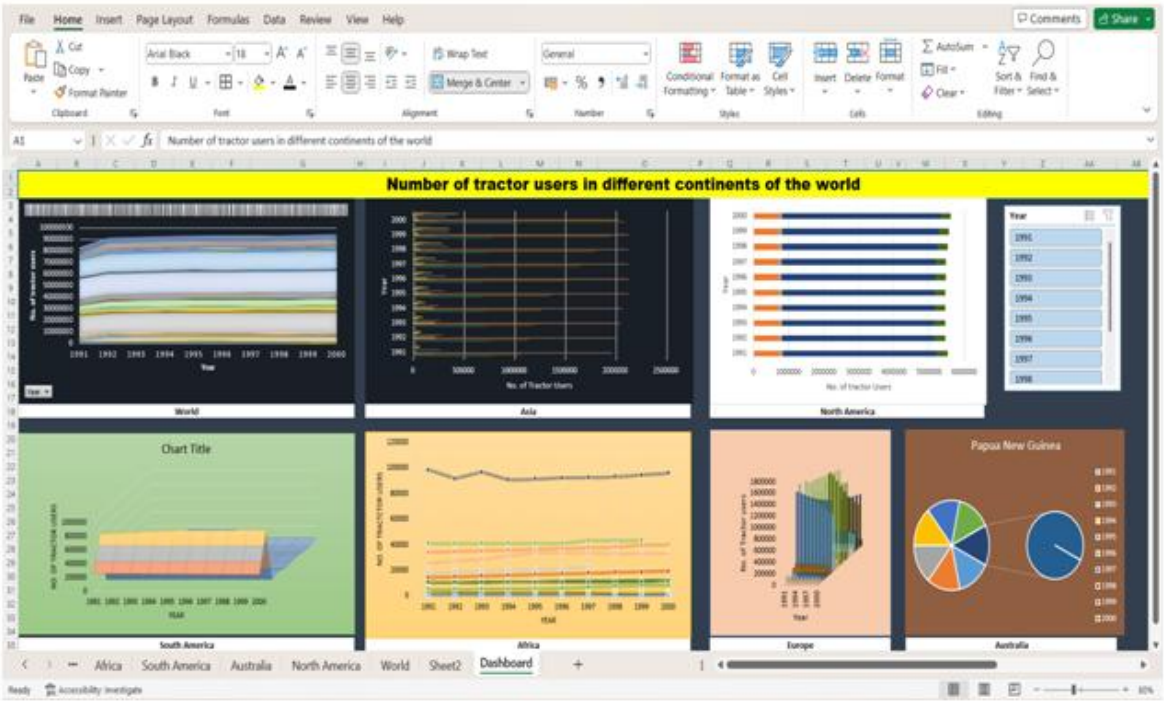
Table No. 1 Top countries with rank and number of tractor users

Sr. No.	Country Name	Rank	Number of Tractor users	
			1997	2000
1	United States	1 (1991 to 2000)	4357177	4503625
2	Japan	2 (1991 to 2000)	2122000	2027674
3	Italy	3 (1991 to 1996)	1541227	1643613
4	India	3 (1991 to 2000)	1502000	2091000

8.Create a Dashboard: At the last created a dashboard for easy to understand in which year different countries of mentioned six continents have highest number of tractor users. Figure number 5 shows the created dashboard for analyzed data of number of tractor users throughout the world.



a) Continent wise number of tractor users in the world

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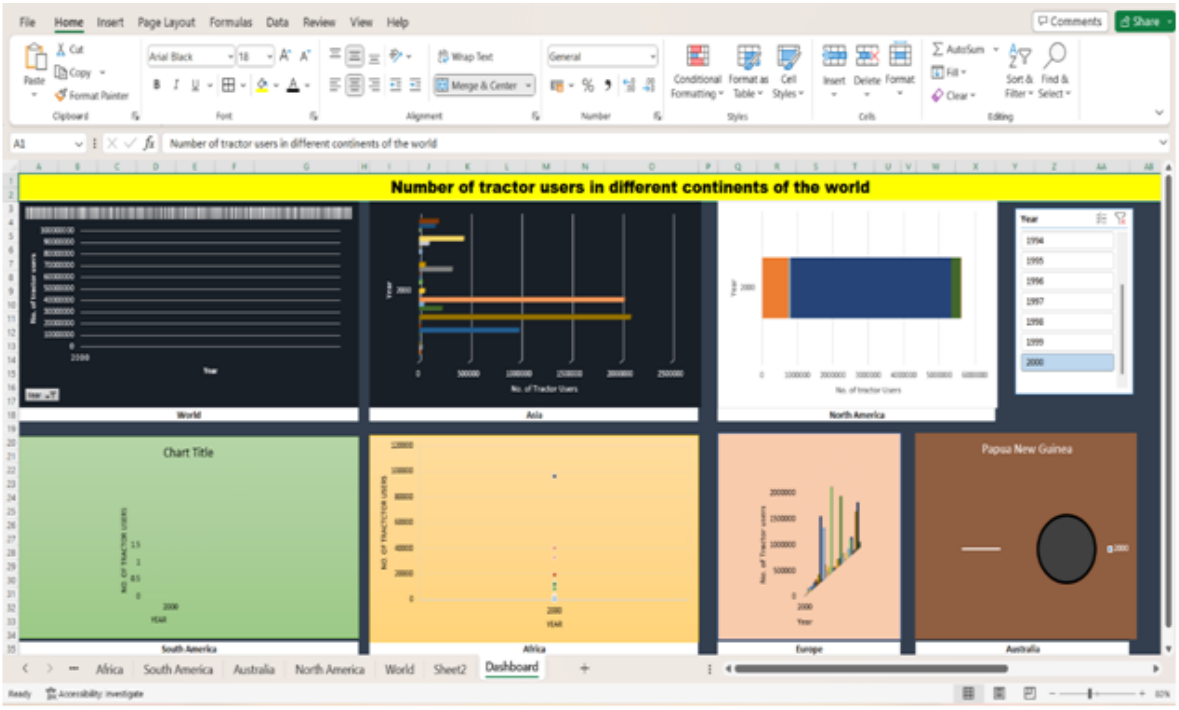

b) Number of tractor users in the countries of different continents as per selected year

V. CONCLUSION

This research provides valuable insights into the patterns and trends of tractor usage across different continents. The utilization of big data analytics allowed for a comprehensive analysis of factors influencing tractor usage, such as economic indicators, agricultural practices, and technological advancements. This research contributes to a better understanding of the dynamics shaping agricultural mechanization globally, aiding policymakers, researchers, and industry stakeholders in making informed decisions for sustainable agricultural development. The findings highlight the importance of adapting tractor utilization strategies to regional contexts and fostering innovation to address emerging challenges in the agricultural sector.

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