Case Study Title: Data Analysis of a Video Game dataset and an Electric Vehicle Dataset

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INTRODUCTION

This entire assignment revolves entirely around data analytics, but firstly, what is data analytics? Data analytics is the process of using various techniques to properly analyse data and gain valuable insights to make proper decisions. Among the processes used involve inspecting, cleaning, transforming, modelling and interpreting the data to gain productive insights. There are various types of data analytics, but the main 4 types include Descriptive Analysis, Diagnostic Analysis, Predictive Analysis and Prescriptive Analysis, each of whom have their unique methods, goals and techniques to analyse various sets of data. Additionally, various tools and techniques are applied in order to provide the analysis for their stakeholders.

Thus, that brings us to our assignment, which is to apply proper data analytics techniques in order to process and analyse data to produce meaningful insights. The purpose of our analysis is to provide two separate insights for our stakeholder, a large multinational company aiming to enter various technological industries. In our case, our group would help provide insights into the video game and the electric vehicle industry. Thus, our group would proceed to find relevant, high-quality datasets and proceed to apply various data analysis techniques, using various data analytical tools to help analyse and crunch out as many insights as we can. In addition to that, our group would also proceed to discover what big questions to ask ourselves in order to help guide us on what analysis we should do so that we can provide a clear understanding of the key details within these two industries, with the hopes that our stakeholder will be able to make the right decisions to help achieve the companies' goals.

Our analysis would help our stakeholder make informed and meaningful decisions in these two industries. Additionally, the various other groups analysing data in various other industries will all help contribute in helping our stakeholder make evidence-based decisions in other industries too. This is one of the many importance of data analysis, as it helps companies and even governments make informed decisions, helping them to gain a competitive edge and help reduce unnecessary costs. Furthermore, data analytics also helps monitor resources and contributes a lot in research and development. Over the past decades, the growth in Data Analytics has only continued to increase more and more and has been instrumental in helping various companies and even governments to come up with strategies and decisions to help achieve success in their goals.

METHODOLOGY

In this assignment, many methods and processes were done in order to complete our assignment. Those include finding appropriate datasets, deciding which statistical methods best to apply to analyse our data, which analytical software's to use and what to analyse from our data. All of these processes will be described further in detail below to provide full detail and transparency on the methodology of this case study.

Our group first starts off with finding the appropriate datasets that are robust enough to provide us with enough data to make quality analysis. For that, our group would need to find a dataset that is complicated enough to have real-world data but at the same time, one that is understandable by all of us group members to make a proper analysis. Furthermore, having a high-quality dataset is absolutely crucial, and for that, we would need to find a relevant dataset from verified websites supplying datasets. Among the sources that all of us group members proceeded to do find our datasets from were Kaggle, Google Datasets, various government data portals (most commonly searched up were Data.gov of the U.S. Government and the Open Government Portal of Canada). As compared to other nations open databases, these two government websites provided the greatest number of datasets, and some which weren't too complicated. Zenodo and DataHub were other well searched sites by our group, along with the university repository website UCI Machine Learning Repository The majority of the dataset drafts that all of us members had suggested had come from these sources and each member found various datasets that they found to be of quality, proper relevance and rigorous enough in helping us with our analysis, sent them through our created WhatsApp group and together voted and decided on the two best datasets for our analysis. Both datasets that our group had chosen had over 15,000 rows and a ton of columns, which provided our group with ample of data to help with our analysis. In addition to that, both datasets had also provided us with outliers and a wide range of values, assisting us in giving more accurate analysis. In addition to that, the diversity in the various data's such as having data from different regions, car models and so on helps improve the quality of the two datasets and helps improve the analysis robustness, accuracy and generalization. Besides that, both datasets were also up-to-date within the past year, did not violate any legal or personal matters, both from trusted sources makes them the perfect datasets for our group to choose for our project. This is because with valid and trustable sources, our group believes that it can help our analysis become more reliable and trustworthy.

Once our datasets had been discovered, the next main goal was to analyse what big questions to ask ourselves before beginning our analysis. Those questions helped give more clarity to our team on what to analyse and provided us with clear objectives on what actions to take, such as which visualization techniques to use, which statistical formulas to use and when to use them. We also ensured that the data to answer all of those questions were readily available within the datasets. Our big questions will also depend on whom our stakeholders and target audience are and what they're goals are. Seeing that our stakeholder is a big multinational technology company whom is aiming to enter the video game and electric vehicle industries, this information will help our team gain a broader understanding of how we should shape our big questions as we can identify what the needs and priorities are to achieve the best analysis for our stakeholders.

After the big questions had been identified, our group now had to discuss and figure out the proper analytical techniques to be applied that can help our team provide the proper insights in answering those questions. The first, and most obvious answer to which analytical method to use was data visualization. Our group members had agreed upon coming up with various data visualizations, such as histograms, horizontal bar graphs, line graphs, map plots, stacked bar graphs, and mores to help answer our big questions because our group knew that data visualization does have the power to transform our dataset into meaningful insights and help us do better analysis. Furthermore, when the data are visualized, they help provide us with an easier and more direct glance of patterns, trends, outliers, correlations, inconsistencies and more which can help our group make better insights to help our stakeholders make better decisions. In addition to that, our group prioritised using visualizations as they help to better engage and communicate our data more efficiently, especially to non-technical people. Besides that, if we are comparing different data columns at once, visualizations help us to compare the various data categories very easily at a glance. Lastly, data visualization helps us to even make predictive analysis. Furthermore, another one of the methods that our team chose to use was the Exploratory Data Analysis, which is a method that involves data visualization and analysing those visualizations to provide communicate to out stakeholders the trends, relationships and patterns that can be noticed across the visualized data.

In an Exploratory Data Analysis, our group will also look for outliers, inconsistencies, examine the relationship between variables, display categorical data and analyse data over time. that can be found in those visualizations and then proceed to note them down for future references and eventual communications to our stakeholders. Additionally, our group had also decided to use Descriptive Statistics, which involve the use of Mean, Mode and Medians. We decided to use this method as well because it helps provide a summary of our data for easier understanding, researching its mean values too help in exploring patterns, trends and outliers accurately, medians help us to discover the central tendency as it can help provide a concise central value of our data which can be used for comparing or as a point of reference for analysis. Additionally, when we compare various data using descriptive statistics, they help us provide more clear details about the similarities, differences, and patterns for better comparisons.

Next, after the big questions have been discovered, our group must now choose the proper analytical tools which can satisfy our needs and provide us with the tools to match the analytical techniques that we want to apply. For that, our group had chosen to use two data analytics software's which are Tableau BI Public and Microsoft Power BI. Microsoft Power Bi is a very popular data analytics software which was developed by Microsoft. Similarly, Tableau is also a data analytics software and is also part of the company with the same name, but they specialize in visualizations. Both these software's helps turn datasets into proper data visualizations and provides us tools to help analyse the data. Additionally, they allow us to import dataset in various range of formats, be it Excel, PDF, JSON files and more, making them more convenient to use. Additionally, both these software's have good reputations of being two good data analytics options, have good ease of use such as their user-friendly interface, able to handle and manage large datasets and the tons of options available in terms of the charts available and the customisations available for the charts. Both of these software's are based on payment subscriptions but also have a free option for desktop downloads, which were the version that our group used. Though, it did require some amounts of time for our team to adapt and learn the various methods. Once the familiarity was gained, our group began analysing the data and answering all of the big questions, along with the sub questions.

The next step involved interpreting, collecting and typing down our results from the analysis. One of the most suitable ways that our group have decided to collect and record our results is by using a report format. With this method, we are able to convey our analysis more easily, in a simple, non-complicated, report that only provides the insights and analysis found.

In addition to typed down words, our group will also provide each visualization that was used accordingly. Our report will clearly state the analysis accordingly based on each sub question, which are based on each big question. Each answer will have its own visualization and typed down report explaining about the analysis, trends, patterns, relationships and more that we have discovered together using Exploratory Data Analysis. Each sub question, along with the visualizations and Exploratory Data Analysis will also have their respective Descriptive Statistics, which will clearly mention the mean, mode, median and their tables for better and clearer analysis. In addition to all of that, our report will contain various factors and causes to support our data. Meaning, our group will also provide extra information from external sources, to support and provide real-live reasons to help make better sense of the findings. For example, factors as to why electric vehicles are sold more in a specific region as compared to another, reasons as to why certain video game genres as more well sold as compared to other genres and so on. Additional information, from real world sources and references, to help provide clearer and better answers to help our stakeholders have a clearer understanding of the results and situation.

Once our report has been completed, our group will now approach the final, but also crucial step in the case study, the presentation and communication to stakeholders. This step helps our group to present these findings in a short and simplified manner. To ensure clear, progressive communication with our stakeholders, our group uses the same and common format for presentations, which start off with introductions to our team members, and proceeding to introduction and methodology of our project, to our dataset introductions which will then be followed by all of the analysis, which will answer all of the group's main questions. Our group follows a flow give our audience a clear view on what we are trying to analyse so that they too will understand the eventual processes that are about to be presented. As for the analysis, our group summarise and simplify all of the insights, without leaving out the important points, and try to communicate in the most effective, clear and direct way to our non-technical audience the findings and interpretations that we have discovered, with the assistance of the visualizations as well. Once that has been completed, we would provide our big thanks to our stakeholders and wrap up our project.

DATASETS

In this project, our group has taken up two distinct datasets to be explored and analysed. The first dataset dives into the realm of video games, specifically focusing on titles that have achieved remarkable success, boasting sales figures exceeding 100,000 copies. The dataset titled 'Video Game Sales' has 11 columns and 16,600 rows. This dataset provides us with a opportunity into the dynamics of the gaming industry and unravel the factors contributing to the triumph of these select titles. As for the analytical part, we have attached a screenshot of the dataset below, offering a glimpse into diverse data and information. For the second dataset, which focuses on the population of electric vehicles currently registered with the Washington State Department of Licensing (DOL). This dataset allows us to gain insights into the prevalence and trends of electric vehicle ownership in the state. To provide a visual preview of this dataset, we've included a screenshot that offers a glimpse into the registration details and distribution of electric vehicles. Together, these two datasets form the basis for our analysis, for the gaming industry's success stories and the growing presence of electric vehicles in Washington State.

Among the reasons we chose these datasets, with their substantial size and diverse content, are invaluable resources for our analysis. Their sheer volume ensures that our investigation can draw upon a wealth of data, reducing the risk of overfitting and enabling us to produce more robust insights. The video game dataset boasts over 16,500 rows, encompassing 11 distinct columns that cover crucial aspects of each game, from global sales and platform to genre and publisher. Meanwhile, the electric car dataset surpasses 143,000 rows, containing 17 columns that detail vehicle registration, location, electric range, and other essential attributes. This diversity in data allows us to explore a wide range of scenarios and conduct more comprehensive analyses.

Our selection of these datasets was deliberate and driven by several compelling reasons. Firstly, the choice of the video game dataset stems from its captivating subject matter, as the gaming industry has witnessed substantial growth and transformation over the years. By focusing on games with sales exceeding 100,000 copies, we aim to uncover patterns and factors contributing to the success of these titles through our analytical methods. In the case of the electric car dataset, the decision was motivated by the pressing global shift towards sustainable transportation. As electric vehicles gain prominence, understanding their registration trends, characteristics, and geographic distribution is pivotal.

This dataset allows us to explore the adoption of clean energy transportation in Washington State and gain insights into the factors influencing electric vehicle ownership.

Originating from VGChartz, the video game dataset is meticulously compiled, providing information on game sales per console, genre, and publisher. Both datasets comprise a mix of textual and numeric data, and they share the common challenge of missing values and outliers. Notably, some video games in the dataset exhibit exceptionally high or low sales figures, while certain electric vehicles boast extraordinary electric ranges compared to the norm.

Importantly, these datasets are freely accessible to the public, eliminating barriers for students like us who seek to learn from them without the need for accounts or payments. This accessibility underscores their suitability for our educational timeline. With these rich and extensive datasets at our disposal, our group is poised to embark on a journey of exploration and analysis that promises to yield valuable insights.

Furthermore, both datasets align with contemporary societal interests. Video games are a ubiquitous form of entertainment, while electric vehicles represent a significant step towards reducing carbon emissions and addressing environmental concerns. By analysing these datasets, we not only cater to academic curiosity but also contribute to the understanding of topics that have far-reaching implications for society, technology, and the environment.

The video game dataset we've chosen comes with some additional fascinating details. It was meticulously compiled based on estimates of video game sales, drawing from retail samples and national trends, which were then consolidated into specific regions like North America and Japan, as reflected in the dataset. Spanning an impressive timeframe from 1980 to 2016, this dataset covers over three decades of video game sales data. This extended range allows our group to conduct a comprehensive analysis, exploring how the trends in video game sales have evolved over the years, including aspects like console-based sales and whether there has been a progression in game sales over time.

The estimates in this dataset are rooted in the actual number of video games sold to consumers, providing a robust foundation for our analysis. The dataset's structure comprises five columns dedicated to sales data for different regions, all of which are of Decimal data type. Besides that, four columns, including Name, Publisher, Platform, and Genre, contain textual data, while the Rank and Year columns are of numeric data type.

Lastly, this dataset was last published on the 4th of January 2022, ensuring that we have access to relatively up-to-date information for our analysis. With these insights, our group is poised to delve into a comprehensive exploration of video game sales trends across the decades, backed by rich and reliable data.

However though, this video game dataset does also come with its weaknesses and cons. The video game dataset, while rich in content, does exhibit certain weaknesses that warrant consideration. Notably, it suffers from an uneven geographical representation. The column 8abelled "Other_Sales," encompassing regions beyond North America, the European Union, and Japan, lumps together video game sales data from a wide array of countries spanning every continent except North America. This aggregation obscures the distinct sales trends and behaviors of individual continents and nations, introducing an inherent bias towards specific regions while neglecting others.

Another limitation lies in the dataset's data source. Although it was retrieved from the VGChartz website, the exact origin of the sales data remains somewhat elusive. VGChartz did not officially disclose the specific publishers or developers from whom they obtained this information. Instead, they acknowledged reliance on retail samples and estimated trends from specific regions, as well as external sources like NDP, a market research company, and various video game magazines and news sites. This lack of clarity regarding the primary data sources raises questions about data accuracy, completeness, and potential bias, necessitating a cautious approach in our analysis of the video game dataset.

The next dataset that our group has selected was the electric vehicle dataset we've selected has several attributes. It originates from the U.S. State of Washington D.C. and has been made accessible through the Data.Gov website, renowned as the repository for the U.S. Government's Open Data initiatives. This affiliation lends the dataset substantial credibility, as it is sourced from agencies under various U.S. State governments and is intended to serve as a valuable resource for the public. What sets this dataset apart is its direct harvest into the website from the publishers themselves, ensuring data accuracy and reliability.

Published and maintained by the Washington State Department of Licensing, this dataset bears the imprimatur of a state agency entrusted with the oversight of such information. Moreover, it holds a distinct advantage in terms of currency, having been last updated in August 2023.

This recent update ensures that we have access to the most current and pertinent data, enhancing the relevance and reliability of our analysis. With this dataset, sourced from a reputable government entity and maintained for accuracy, our group is well-equipped to explore the evolving landscape of electric vehicle registration trends in Washington State.

However though, similar to the video game dataset, this dataset also comes with its cons. The electric vehicle dataset, has some weaknesses that warrant consideration. A significant limitation arises from the predominantly null values in the "Base MSRP" (Base Manufacturer's Suggested Retail Price) column. This absence of pricing data poses a challenge for our analysis, particularly when exploring correlations between electric vehicle prices and their electric range. Without access to suggested retail prices, we may miss valuable insights into the cost dynamics of these vehicles.

A few entries in the "Electric Range" column also contain null values. While this doesn't substantially affect the majority of electric vehicles, it has the potential to impede our analysis by limiting the accuracy and completeness of our results. These gaps in data may hinder our ability to draw comprehensive conclusions.

Besides that, the inclusion of the "State" column appears redundant, as every row uniformly contains the value "WA," indicating Washington State. This redundancy arises from the dataset's clear description, which already specifies that it pertains to electric vehicles registered in Washington D.C. This column serves no analytical purpose and could be considered extraneous. Despite these weaknesses, our group aims to leverage the dataset's strengths to glean valuable insights into electric vehicle registration trends in Washington State.

Dataset Links:

Video Game Dataset: https://zenodo.org/record/5898311

Electric Vehicle Population Dataset: https://catalog.data.gov/dataset/electric-vehicle-population-data

DATA ANALYTICS AND RESULTS

BIG QUESTIONS

Video Game Dataset

How has the sales of different genres evolved over time?

1) Which game genres have the highest total global sales?

2) Can we identify trends in genre popularity over time?

What are the trends and patterns across different platforms?

1) Which gaming platforms have generated the most and least sales globally?

2) Have there been shifts in platform popularity over the years?

What are the trends, patterns and preferences in different regions?

1) What is the top-selling video games in each region?

2) How do different publishers perform in different regions?

Electric Vehicle Dataset

What is the environmental impact of electric vehicles compared to traditional vehicles?

1) How does the electric range vary across different vehicle makers and models?

3) How does the electric range correlate with CAFV eligibility?

How does the geographic location impact electric vehicle ownership and charging infrastructure?

1) Where are the clusters of electric vehicles located based on postal code or census tract?

3) Which states have the most electric vehicles?

How is the electric vehicle market evolving over time?

1) Are there trends in the adoption of electric vehicles by model year?

2) How has the electric vehicle market been in terms of maker and model preferences?

VIDEO GAME DATASET

How has the sales of different genres evolved over time?

1) Which video game genres have the highest and lowest sales

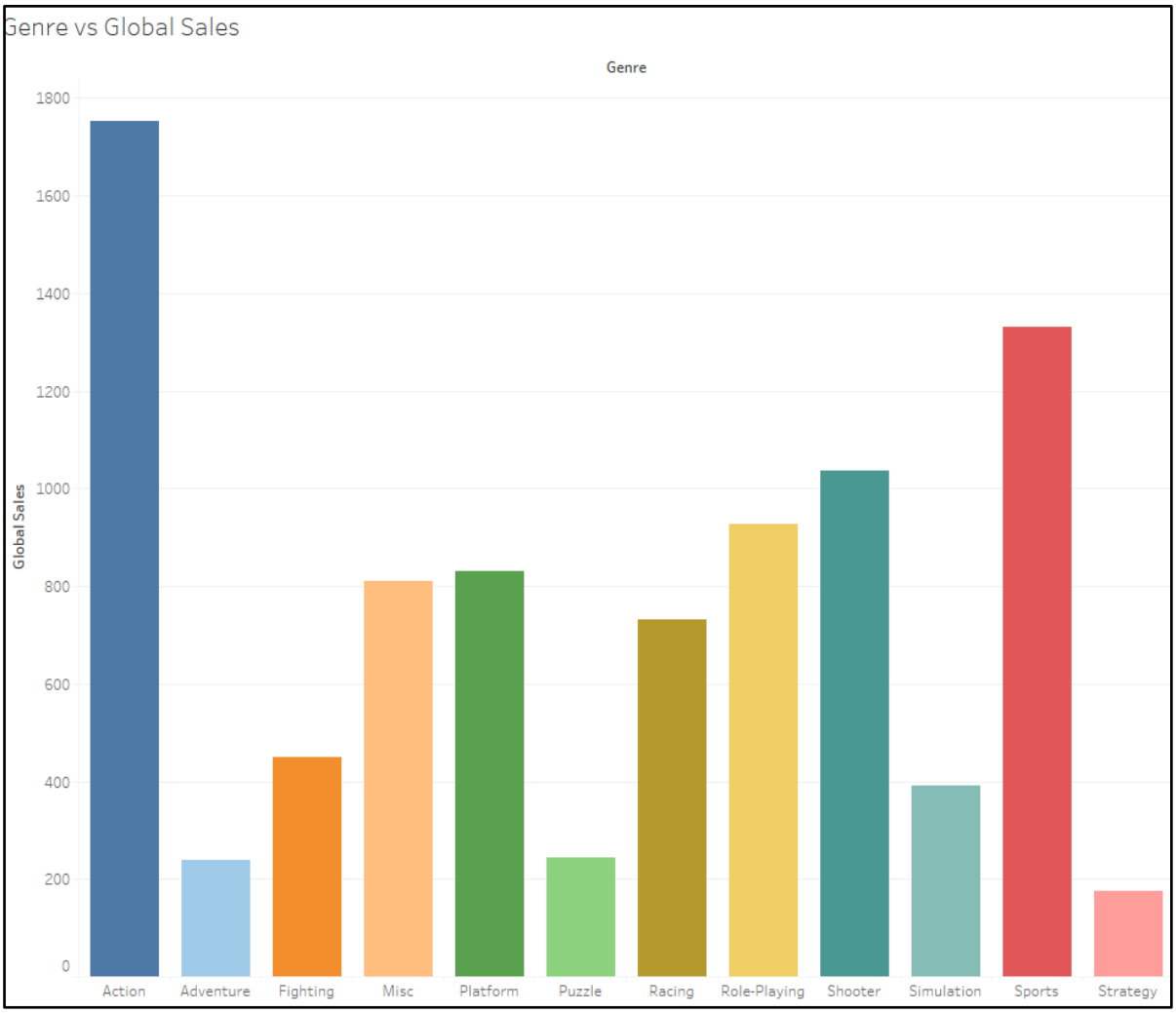

Figure 1: Histogram of genre sales using Tableau BI

This graph shows us which video game genres have the most global sales. The Y-axis shows the global sales of the video games and the X-axis shows the video game genres. The global sales in the Y-axis are in million units sold.

From the graph, it can be seen that the Action genre has the greatest number of sales. This suggests that there is a high demand and preference for action games among the consumers. Action genre video games have so much demand that this genre accounts for 17.1% of the total sales of all genres. The least demand and purchased video game genre is the strategy video game genre. The strategy video game genre accounts for nearly 2% of the total video game sales based on genre.

There is a positive correlation between the popularity and profitability of a genre, meaning that the more popular a genre is, the more profitable it is likely to be. Due to the large variation, such as around 150 million sales for action and only 20 million for strategy, this shows that there is a significant difference in the tastes and preferences of the consumers across different genres.

The worst five sold genres which are strategy, adventure, puzzle, simulation, and fighting have an estimated combined global sale of around 100 million units sold. This is less than one-fifth fifth of the total global sales of all the genres. All of these genres are then proven to have a weak appeal among potential consumers and they're demand is very less. The total sales of all genres from are approximately 8,779.4 million dollars. The average sales of all genres are 731.62 million dollars.

Among the factors that can influence the number of sales of video games based on their genres are the number of releases, as more releases of a video game from a certain genre can cause that particular genre to have more sales. Furthermore, if a particular genre consistently has a set of video games that receive bad or mixed reviews, then that genre will generally have a decreased number of sales. The sales may also be impacted by the platforms on which it is released. Exclusive games for popular gaming consoles or platforms may boost game sales indirectly by driving console sales. Multi-platform release can also increase a game's popularity by enabling it to reach a larger user base, thus driving up sales. With the growth of online gaming communities and streaming services like YouTube, players now have a platform to share and promote their gaming adventures. The popularity and sales of a video game can be greatly influenced by well-known streamers and creators. In particular for genres that lend themselves well to spectatorship, streaming gameplay, reviews, and discussions can expose a video game to a huge group of players, generating demand and sales.

Mode: Action Genre

Median: 3,942.27185, Platform Genre

Mean:

Genre	Mean
Action	0.5281
Sports	0.5673
Shooter	0.7919
Role Playing	0.6232
Platform	0.9383
Misc	0.4658
Racing	0.5861
Fighting	0.5294
Simulation	0.4524
Puzzle	0.4209
Adventure	0.1859
Strategy	0.2572

2) Can we identify trends in genre popularity over time?

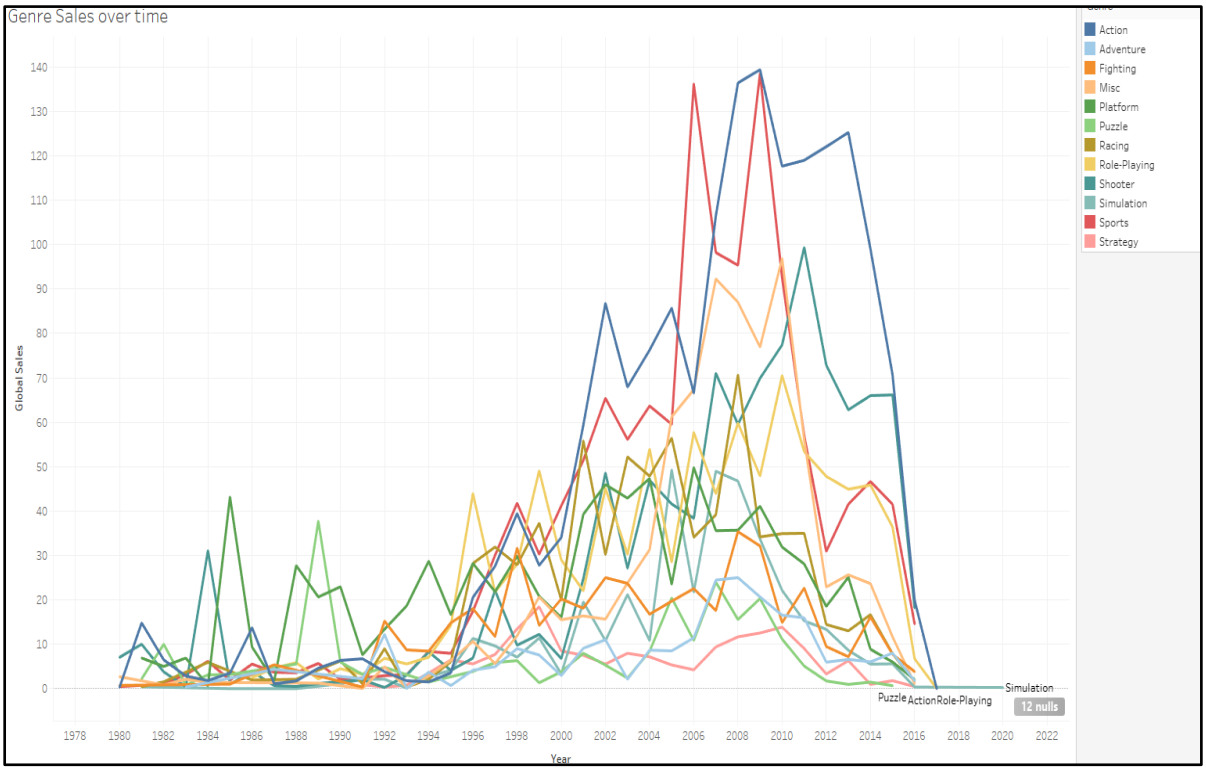

Figure 2: Line graph of genre sales over the decades using Tableau BI.

The graph shows the development of video game sales by genre over the years, providing insightful information about evolving consumer preferences. The X-axis of the graph measures global sales in millions while the Y-axis represents the years. This graph helps reveal how video game genre preferences have changed over the years.

Around the late 2000's, the sales of video games seemed to reach a peak when sales were at their peak. At the time, Action, Sports and shooter video game genre were the most popular types of games. This phenomenon might be caused by the fact that action games often require a lot of movement in the game environment, often in the form of shooting or other computationally intensive actions, and early consoles could not handle these processes.

However, there was a decline after those years in video game sales, but during this decline, the video game genres such as Role-Playing and simulation video games did not show much signs of decline as these two genres still maintained a steady increment. Despite the rise and fall of video game sales, certain genres have maintained consistency throughout the decades. For example, genres such as Action, Sports and Shooting video games have consistently maintained their sales numbers. This shows that these three genres, despite all the change in technology and cultural influences over the decades, have maintained a good appeal and demand among video game consumers.

On the other hand, sales trends for several game genres, such as adventure games, puzzle games and platform games, are particularly variable. These types of games are less consistently popular and their demand changes more frequently. These changes are largely influenced by external causes, such as sudden consumer demand and cultural influences. Video games like platformers and puzzles, for instance, were quite popular in the 1980s and 1990s but have now lost some of their appeal. People embraced these fascinating challenges throughout the 1980s, which were rife with opportunity to put their intelligence to the test. These puzzles offered them an opportunity to temporarily escape from reality as they completed each one, giving them a break from the monotony of daily life. Furthermore, due to the simplicity and clarity of the game principles, players of all ages and skill levels can enjoy these games.

Various other video game platforms, such as Action, Role-Playing, Simulation wasn't popular during those times but quickly gained pace in sales. These show that certain genres do gain show shifts and changes overtime, with some genres declining in sales and others increasing in sales over the years. Different genres have different patterns and cycles of sales. They may be influenced by different factors such as customer behaviour, product launches, marketing campaigns, technology, innovation, competition, customer preference, etc.

From the graph, the peak year for Action genre sales were at 2010 for about 15 million sales whereas the peak for the Puzzle genre was somewhere around 2008, at around 2.5 million units sold. Different genres also have different declining rates. For example, the decline rate for the action genre is -4.2%, which means that the sales of this genre decrease by 4.2% every year after 2010. Another example is the puzzle genre, which has a declining rate of -1.8%, which means that the sales of this genre decrease by 1.8% every year after 2008. Similarly, the growth rate for the sales of different genres also varies. The growth rate for the action genre is 8.7%, which means that the sales of this genre increased by 8.7% every year from 1995 to 2010. Furthermore, the growth rate for the puzzle genre is 4.2%, which means that the sales of this genre increase by 4.2% every year from 1995 to 2008.

Consequently, this means that they have different types of resilience in the market to be able to face challenges in the market. Different genres may also have different abilities, potential and demand in the market. Seeing that the action and sports genres have the highest growth rates and sales, it's possible to predict that these two will be the most in demand genre for video games in the near future as well.

Mode = Action in 2009 = 139.4 sales

Median =

Genre	Median Value
Action	0.2500
Sports	0.2800
Shooter	0.2400
Role Playing	0.2000
Platform	0.3700
Misc	0.1800
Racing	0.2100
Fighting	0.2400
Simulation	0.1925
Puzzle	0.1550
Adventure	0.1200
Strategy	0.0950

Platform games have the highest median global sales at 0.3700, reinforcing the idea that this genre tends to perform well in terms of sales. The median value being higher than the mean suggests that there are some high-selling platform games in the dataset.

Sports Games Follow Closely at 0.2800, indicating that, on average, sports games also tend to sell well. This aligns with the previous observation that sports games are popular and have a consistent level of sales success.

Action games have a median sales value of 0.2500, which is also relatively high. This suggests that action games have a competitive position in the market and can achieve good sales figures.

Shooter Games Remain Strong with a median of 0.2400 and are also consistently well performers. While the median is slightly lower than the mean, it's still a strong indication of the genre's popularity and sales.

RPGs and Fighting Games: Role-playing games (RPGs) and fighting games both have median values of 0.2000, indicating moderate sales success. These genres may not be as consistently high-selling as the top genres but still have a solid presence in the market.

Puzzle, Adventure, and Strategy: Puzzle games (0.1550), adventure games (0.1200), and strategy games (0.0950) have lower median sales values, indicating that these genres typically have lower sales figures. They may cater to niche audiences or face tougher competition in the market.

Mean of the year 2009 =

Genre	Mean
Action	0.51
Sports	0.75
Shooter	0.77
Role Playing	0.47
Platform	1.42
Misc	0.37
Racing	0.41
Fighting	0.61
Simulation	0.27
Puzzle	0.26
Adventure	0.15
Strategy	0.19

Platform Games Lead in Sales: Platform games have the highest mean global sales at 1.42, indicating that platform games tend to sell the most copies globally. This could be due to the

popularity of well-known franchises, such as the Super Mario Bros. video game which is an outlier in the dataset. Outliers can have a huge effect on the mean.

Closely behind are shooter games and sports games. This suggests that these genres are also very popular and consistently perform well in terms of sales. Games like Call of Duty in the shooter genre and FIFA in the sports genre are good examples of good selling games.

What are the trends and patterns across different platforms?

1) Which gaming platforms have generated the most and least sales globally?

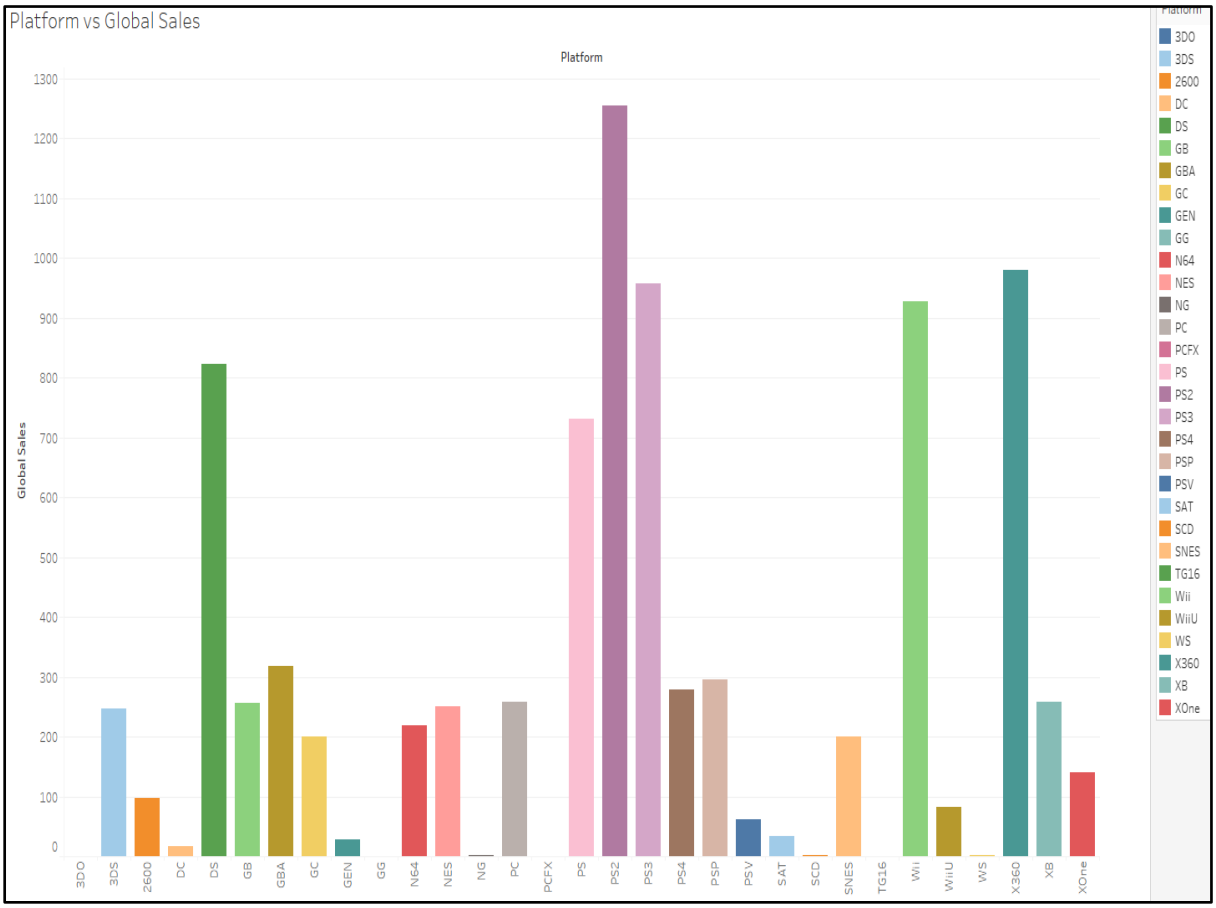

Figure 3: Histogram of platform sales using Tableau BI

The graph above has shown the global sales of video game platforms. From the graph can notice that the X-axis shows the global sales and the Y-axis shows the platforms. The graph covers a wide range of platforms, from the Atari 2600 released in 1977 to the Xbox One released in 2013.

It can be seen that the PS2 is, by far, the most successful video game platform to date. It has sold an approximate 120 million units (at the time this data was taken). In addition to that, from external research, it was also identified that the PS2 was the longest-running platform in video game history, from 2000 to 2013, contributing to its huge sales numbers. The reason why PS2 being best-selling console might be due to the ability to get a DVD player and a gaming system simultaneously. Multiple hardware variants of the PS2 were also released, with Sony launching the PS2 Slim a few years after the console's debut.

These additional features and new hardware updates offered a greater incentive than Sony's rivals. After the PS2, the second most sold platform was the Wii, with approximately 90 million units sold at the time the data was collected. The Wii was sold in 2006 and was discontinued in the year 2017. In addition to its lengthy run-time, the Wii also managed to attract lots of consumers due to its innovative controls. The motion-sensing controllers that the Wii brought revolutionised the video game industry. Players may physically engage with video games by swinging, pointing, and gesturing with the Wii Remote (Wii mote). This simple control design made gaming more approachable and enjoyable for a variety of players, including families and casual players.

Next most successful video game platform was the PS3. It sold roughly 80 million units and was being sold from 2006 to 2017. The PS3 attracted lots of customers mainly due to the popularity of Sony PlayStation, HD graphics which was new at the time, Blu-Ray video games and more. Besides that, the PS3 popularity may be ascribed to its outstanding game library, powerful hardware, and also global appeal. The PS3's widespread appeal was facilitated by Sony's strong brand recognition and global presence. It was successfully promoted in a number of areas, and its popularity spread to Asian markets in addition to those in North America and Europe.

However, as for the lowest sold video game platforms, the Sega CD, which launched in 1991 and was discontinued in 1996, only sold 2 million units. Sega CD flopped might due to the perceived lack of value and high-cost point. When Sega CD was first released in the US, the cost is $300, which was considered to be a high price. Compared to the Genesis console's basic model, many gamers believed the Sega CD to be an expensive add-on that didn't significantly improve gameplay. Potential purchasers were discouraged by this idea that the worth was restricted.

It has to be noted that this data was only up to 2018, thus, the full potentials sales of the PS4 and the XBOX One, or other consoles, could not be determined fully. It can be observed that platforms that were released back in the 80’s and 90’s had very less units sold because of the lack of popularity of video gaming at the time, however, there were still a few that had very high sales. One example was the NES which released in 1983 and had over 25 million units sold, which for its age, was considered good. Famous and iconic video games such as Zelda, Mario Bros, and Metroid were all first played on that platform.

Mode = PS2 = 1255.64 sales

Median = 8920.41/2 = 4460.205 = Nintendo DS

Mean ⟶

Platform	Mean	Global Sales
PS2	0.58105	1,255.64
X360	0.77467	979.96
PS3	0.72072	957.84
Wii	0.6994	926.71
DS	0.38025	822.49
PS	0.61092	730.66
GBA	0.38747	318.5
PSP	0.24425	296.28
PS4	0.82768	278.1
PC	0.2696	258.82
XB	0.31342	258.26
GB	2.60663	255.45
NES	2.56194	251.07
3DS	0.48617	247.46
N64	0.68614	218.88
SNES	0.83703	200.05
GC	0.35856	199.36
XOne	0.66225	141.06
2600	0.72992	97.08
WiiU	0.57245	81.86
PSV	0.14995	61.93
SAT	0.19416	33.59
GEN	1.05037	28.36
DC	0.30712	15.97
SCD	0.31167	1.87
NG	0.12	1.44
WS	0.23667	1.42
TG16	0.08	0.16
3DO	0.03333	0.1
GG	0.04	0.04

The Game Boy (GB) and the Nintendo Entertainment System (NES) have exceptionally high mean sales. This reinforces their historical significance and success in terms of game sales. The Xbox 360 (X360) and PlayStation 3 (PS3) also have relatively high mean sales. This suggests a strong market for games on these platforms during their respective time periods. Consoles like 3DO, TG16, and NG have very low mean sales. This indicates that very few games were sold per console for these less popular platforms. A higher mean ratio suggests that more games were sold per console. The GB and NES were released in earlier eras of gaming when the gaming industry was different. There were fewer competing platforms, and these consoles had strong libraries of games.. This combination of factors contributed to a high mean ratio for these consoles. The size of the game library for a console can also affect the mean ratio. If a console has a smaller library, each game's performance has a more significant impact on the mean ratio.

2) Have there been shifts in platform popularity over the years?

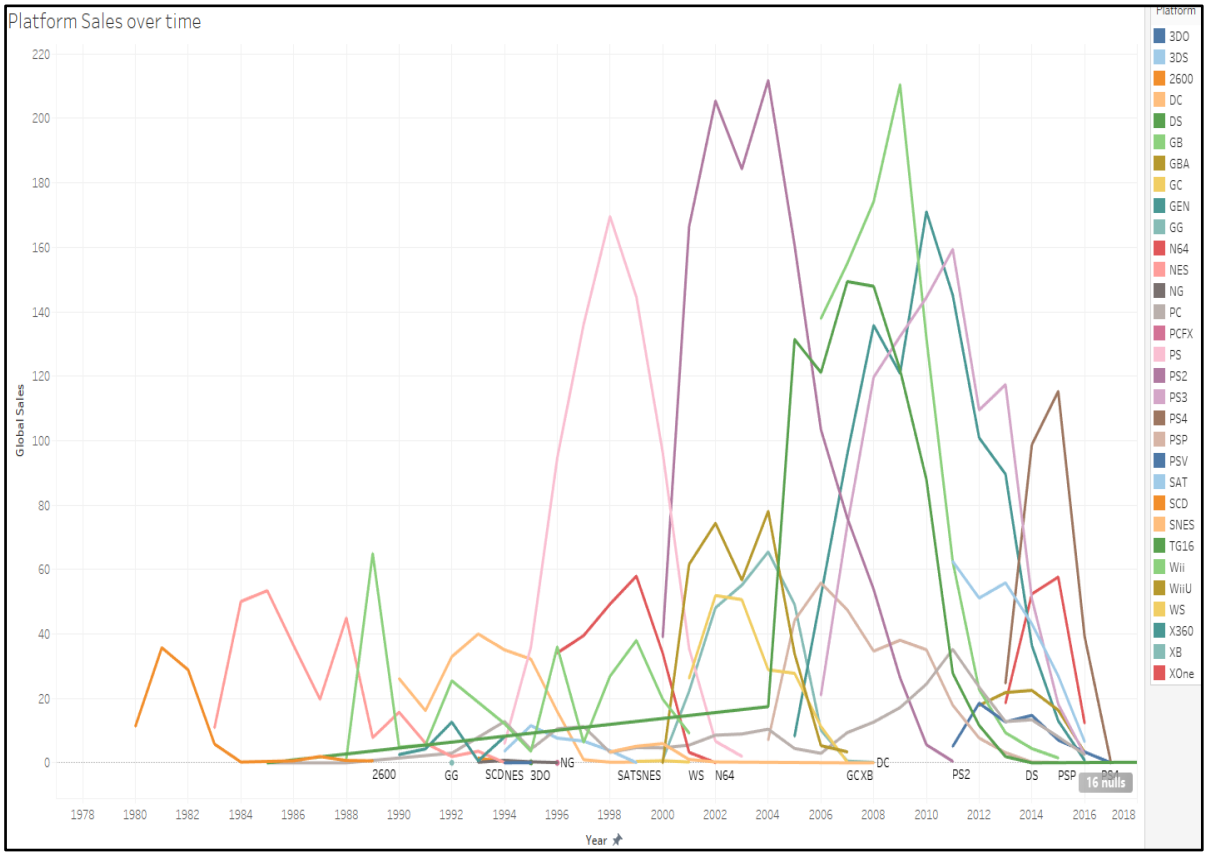

Figure 4: Line graph of platform sales over the decades using Tableau BI.

This graph shows the changes in platform sales over the years. The X-axis shows the year and the Y-axis represents the global sales in millions. Similar to previous graph, the graph covers a wide range of platforms, from the Atari 2600 released in 1977 to the Xbox One released in 2013.

This graph has many similarities with the previous graph as well in that this graph can also help reveal which are the highest and lowest selling video game platforms, however, this graph also shows us the change over time. One of the most notable observations is that the PC has had a consistent sales measure over the years. It isn't the most highly sold platform, but it has maintained consistency over the decades. Roughly 10 to 20 million PC units sold per year.

One of the reasons the PC can endure its consistency in sales over the decades is due to its ease in customisation, versatility and more. Compared to console gaming, PC gaming has the potential for better graphics and performance.

High-end graphics cards, processors, and other hardware components are available for players who demand outstanding visuals and smooth gameplay. On consoles, this level of customisation and optimisation is frequently not achievable. Besides, extensive online multiplayer features are available in PC. Players may effortlessly play multiplayer games with friends and other players. They can connect, share information, and discuss games on active online communities, forum, and social media sites. PC users also have the option to gradually upgrade specific system hardware. They might spend money on upgraded graphics card, CPU, or more RAM to keep their systems updated and lengthen the lifespan of their PC.

Besides the PC, the GB too can be seen having a long lifespan. There were also platforms which have had extremely short lifespans such as the Dreamcast, which only had 4 years of running time. Similarly, the DC platform too had a short lifespan.

The PS1 peaked in popularity during the late 90's, particularly in 1998 where it sold 100 million units. There are several factors that PS1 achieved remarkable popularity during this period. First, the PS1 had an extensive and varied game selection. It included iconic games that offered players enjoyable experiences that were memorable and innovative. Besides, the PS1 launched at the ideal time when CD technology was becoming more widely available and players were demanding for 3D gaming experiences. Compared to its competitors, the PS1 utilized CDs as its game medium which provided a greater storage capacity. The gaming experience was improved by the additional space, which made it possible to create larger game worlds with improved graphics and full-motion video. In addition, the PS1 is marketed as a cheap gaming console, making it available to a wide range of users. This competitive pricing approach attracted consumers who were on a tight budget.

It can be seen that both the PS3 and the Xbox 360 have had very much similar sales over the later years. With both platforms also having peaks at the same time around 2011. Both the PS3 and Xbox 360 were known for their stiff competition, with both also having HD graphic video games and being technologically advanced at the time.

Some platforms have also been observed to have had a very sharp decline in sales. For example, in 2013, the Wii U sold about 20 million units before dropping to 5 million units in 2016. One of the main issues is that the Wii U had a marketing problem. Many consumers initially mistakenly thought it was an accessory or add-on for the original Wii instead of a new console.

The similar naming scheme added to this confusion and prevented consumers from understanding the capabilities of the console and the benefits of upgrading. Nintendo failed to provide consumers with a strong argument for upgrading from the original Wii to the Wii U. The new Game Pad controller with its touchscreen was not successfully marketed as an important breakthrough.

By the time Wii U was released, there was greater competition in the field of video gaming. The Wii U was overshadowed by gaming on mobile devices, personal computers, and upcoming launches of new consoles. When compared to its competitors, the Wii U's initial price was comparatively expensive. Its pricing strategy reduced its appeal to consumers on limited budget who were searching for better alternatives at comparable price.

Towards the later years of the graph, the PS4 can be seen having a steady increment and slowly going above other gaming platforms, signalling that it would soon be the most sold platform.

Mode = PS2, in the year 2004

Platform	Mean
DS	0.02
PSP	0.024
Wii	0.74
OC	0.304
PSV	0.145
WiiU	0.726
X360	0.56
3DS	0.546
PS3	0.472
PS4	1.317

Mean of 2014

Platform	Mean
PSP	0.475
PC	0.337
DS	0.759
GC	0.348
XB	0.37
GBA	0.446
PS2	0.818

Mean of 2004

Platform	Mean
NES	0.11
NG	0.2
3D0	0.02
SAT	0.192
PS	0.354
GB	4.057
SNES	0.662

Mean of 1994

Game Boy (GB) stands out with a very high mean sale in 1994. This suggests that, games for the Game Boy were exceptionally successful in 1994. Other platforms, including NES, NG, SAT, PS, and SNES, have lower mean ratios. The NES, for example, had a low mean ratio, indicating that games for this platform had relatively lower sales per unit on average in 1994. In 2004, the PlayStation 2 (PS2) has the highest mean sales This indicates that, games for the PS2 were performing very well in terms of sales during that year. The Nintendo DS (DS) also had a relatively high mean suggesting strong game sales per unit. Other platforms like PSP, PC, GC, XB, and GBA also had good mean ratios indicating reasonably successful game sales.

The data highlights how the performance of game platforms can vary significantly from year to year.

What are the trends, patterns and preferences in different regions?

1) What are the top selling video game in each region.

Figure 5: Best-selling video games of each region using Tableau BI

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The graph shows the highest selling game in each region. The X-axis represents the video game name while the Y-axis represents the regions. The graph only considers video games that have sold more than 20 million units, which is done to help simplify and filter the thousands of games in the dataset, as well as to help us answer the question clearly. The graph covers total video game sales in North America, Japan, the EU, and other regions which excluding these four. Other regions include Rest of Asia, Africa, Oceania, South America, and Rest of Europe.

One of the key noticeable differences is that three regions all have the same highest selling video game, which is Wii Sports, the highest selling in the European Union, North America and other regions. In Japan however, the highest selling video game is Pokémon Red. In contrast, that Pokémon game wasn't sold very well in other regions.

Besides that, the video game Grand Theft Auto is also very well sold across the European Union, North America and other regions, except for Japan. Both Call of Duty games also sold well in every region, besides Japan. Consequently, the fact that Pokémon Red underperformed outside of Japan highlights the fact that Japan has different preferences and gaming cultures than the rest of the world.

Conversely, Mario Kart Wii and Wii Sports Resort, both of which were developed by Nintendo, were the video games that had the most consistent sales across all the regions. Wii Sports was renowned worldwide for its ease of use. With simple instructions, players of all kinds can play these games and get into the swing of things quickly. The family-friendly nature of these games and the allure of Nintendo appealed to a wide range of people, which is the reason that these games have been able to continue to sell well. On the other hand, it is believed that the reason for the poor sales of Wii Sports in Japan is that the game was not bundled with the Wii console.

Apart from that, regional differences in game preferences and sales can be attributed to a variety of factors, including demographic factors, cultural influences, and intellectual property rights. Despite the widespread belief that teenagers make up a large portion of the video game console business, age is the primary demographic element impacting this industry. Another consideration is gender. Female gamers account for a sizable portion of the video game console market, but their representation in the online gaming community is substantially lower. Besides that, the preferences people have for games are significantly influenced by cultural variables. Games that reflect the beliefs, customs, and interests of a specific area are more likely to be popular. Furthermore, in addition to the industry regulations mentioned above, legal issues in the country of sale include trademarks, copyrights, licensing, patent applications, online ownership and revenue recognition. Piracy and counterfeiting issues also need to be considered.

It is worth noting that despite being a very old game, the video game Tetris has stood the test of time and still become a well selling game across many regions, particularly in Japan and

North America. This is because of its ease of use, compelling gameplay, and general appeal, it has successfully crossed generational and cultural barriers to dominate the worldwide gaming industry.

Mode: Wii Sports sold in North America

Median:

Region	Median
EU	Mario Kart Wii
Japan	New Super Mario Bros.
North America	Grand Theft Auto V
Others	Call of Duty : Black Ops

Mean:

Name	Mean (EU)	Mean (Japan)	Mean (North America)	Mean (Others)	Mean (Global)
Call of Duty: Black Ops	1.9	0.118	3.518	0.672	6.206
Call of Duty: Modern Warfare 3	2.8225	0.155	3.895	0.8375	7.7075
Grand Theft Auto V	4.608	0.278	4.692	1.606	11.184
Tetris	1.475	3.015	13.085	0.345	17.92
Super Mario Bros.	2.44	3.48	16.24	0.495	22.655
New Super Mario Bros.	9.23	6.5	11.38	2.9	30.01
Pokemon Red/Pokemon Blue	8.89	10.22	11.27	1	31.37
Wii Sports Resort	11.01	3.28	15.75	2.96	33
Mario Kart Wii	12.88	3.79	15.85	3.31	35.82
Wii Sports	29.02	3.77	41.49	8.46	82.74

There are noticeable variations in mean sales figures across different regions. For example, "Wii Sports" has significantly higher mean sales in North America compared to other regions, while "Super Mario Bros." and "Tetris" have relatively higher mean sales in Japan. Games like "Grand Theft Auto V" and "Mario Kart Wii" have strong mean sales figures in Europe (EU). Games that have done well globally did not do well in specific regions, like Wii Sports, COD: MW3, GTA V, have done well globally, but not in Japan.

2) How do different publishers perform in different regions?

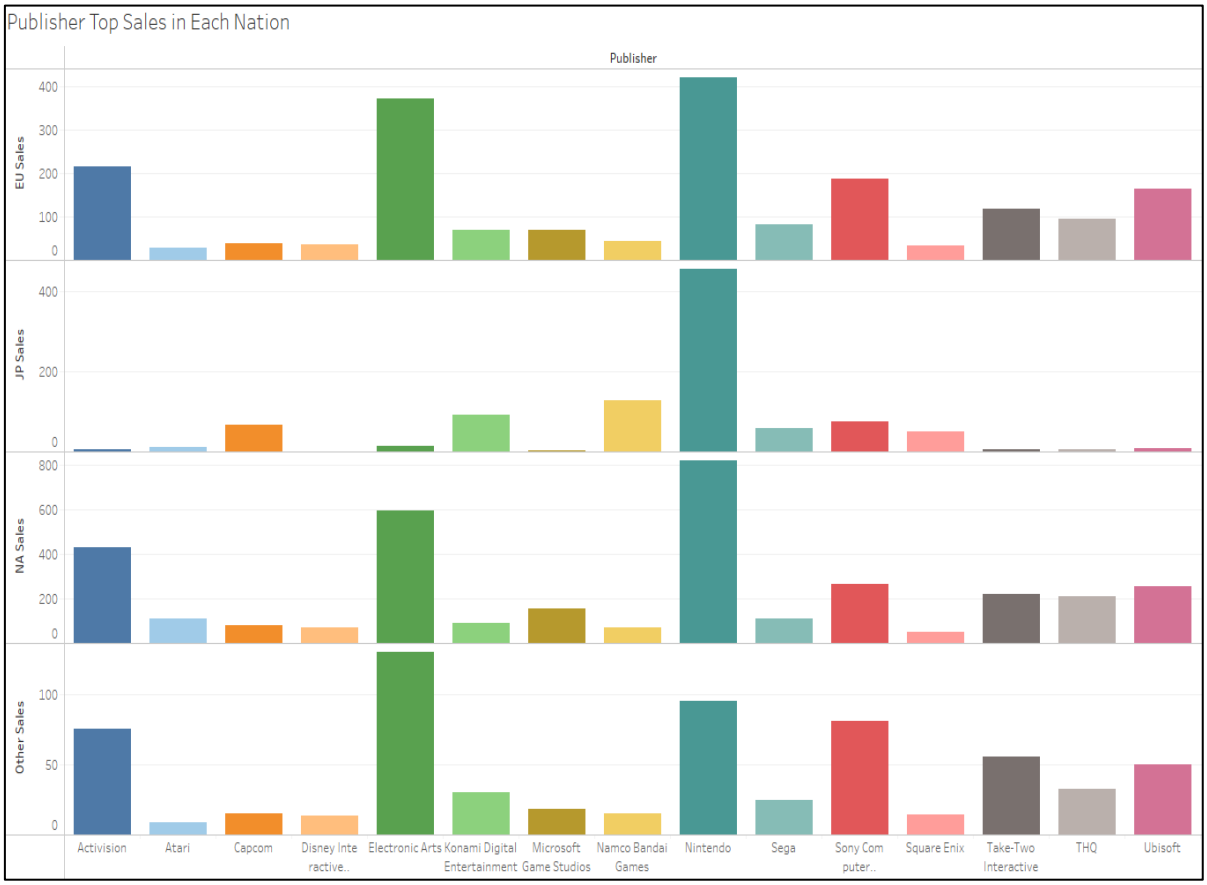

Figure 6: Best-selling video games publishers of each region using Tableau BI.

The graph shows the sales of video game publishers in each nation. The X-axis shows the games publishers while the Y-axis shows the total sales in millions of each region. The graph covers four regions which are Japan, North America, the European Union, and Other (Rest of World besides the mentioned nations) which include other parts of Asia, Africa, Oceania, South America, and other parts of Europe. The most obvious thing that can be observed is Nintendo, Activision.

And Electronic Arts are the video game publishers with the most sales in all regions.

Nintendo is the most sold video game publisher in the world, and particularly in Japan, it literally faces no competition as it is clearly on top with over 40 million in sales. Nintendo, being a Japanese company, is one of the main reasons for their popularity in Japan, with lots of loyal fans in their home nation. Nintendo is also known for the globally popular games such as Mario, Zelda, and Pokémon.

They’re also known for their family friendly games such as Animal Crossing and Wii sports. Nintendo also releases they’re set of platforms such as Wii, the DS and the Switch. Nintendo is well sold in other countries and especially in Japan is because that it is a Japanese firm with a long history in video game industry. The depth of its cultural origins and its close ties to Japanese gamers are both a result of why it is well-sold especially in Japan. Other than that, Nintendo is well-sold in other countries due to its capabilities on producing unique gaming experiences to user. For instance, the Nintendo Switch's adaptability as a portable and home console has been positively received by customers all around the world.

Different in other regions as it is the only region where Electronic Arts is more well sold than Nintendo. Electronic Arts is popularly known for their various sports and shooter games. Some of their most popular video games include the FIFA series. Electronic Arts is also very well sold in every other region besides Japan. Another factor that causes Electronic Arts to be so well loved is that it has its headquarters located around Europe, such as Switzerland, Germany, UK and Sweden. This enabling them to make games that are specific to particular geographies and cultures. It connects with gamers all around the world thanks to its global strategy. Furthermore, Electronic Arts is being widespread also because of the licensed content. They have obtained licences from famous properties including Star Wars, FIFA, and the NFL. This enables them to develop true-to-life, engaging video games based on these well-known properties.

In addition, the graph also shows that other publishers such as Activision and Sony have good global sales. They are known for popular video game series such as Call of Duty and Grand Theft Auto. The popularity of Activision has been greatly influenced by the Call of Duty series in particular. Call of Duty games typically provide an exhilarating first-person shooter gameplay, captivating storytelling, and rich multiplayer features. Activision has gained a sizable fan base and favourable reviews from gamers could be due to number of game genres that appeal to a broad spectrum of players with varying interests and preferences.

The Competitive Scene and the esports is also being a vital key for competitive element draws players seeking to compete at a high level as well as fostering a sense of community.

There are also certain publishers, such as Microsoft, Take Two, Ubisoft, THQ and more that have regional preferences. Thus, making them extremely lacking in popularity in certain nations. Microsoft is particularly known for their regional preferences.

When there are regional preferences, there will also be exclusive content released to certain regions that will not be released elsewhere. From my opinion, the reason why certain publishers do well in certain regions is due to the cultural relevance. For instance, Western publishers like Electronic Arts and Ubisoft pander to the interests of Western players, but Japanese publishers like Nintendo and Capcom specialise at making games that connect with the Japanese gaming culture. Publishers that create games that reflect the regional cultural preferences, beliefs, and sensitivities are more likely to be successful.

Mode: Nintendo (North America)

Median:

Region	Median
EU	Sony Computer Entertainment (1009.65)
Japan	Namco Bandai Games (488.69)
North America	Activision (1802.89)
Others	Activision (338.045)

Mean:

Publisher	Mean (EU)	Mean (Japan)	Mean (North America)	Mean (Others)	Mean (Global)
Nintendo	0.595647	0.647824	1.16198	0.135605	2.54134
Microsoft Game Studios	0.363016	0.017249	0.82196	0.098201	1.30048
Take-Two Interactive	0.286053	0.014116	0.53387	0.133753	0.96741
Sony Computer Entertainment	0.274846	0.108492	0.38832	0.117789	0.88946
Electronic Arts	0.274811	0.010392	0.44047	0.096055	0.82185
Activision	0.221056	0.006708	0.44072	0.077272	0.74611
Warner Bros. Interactive Entertainment	0.228966	0.004483	0.34991	0.08	0.66332
Square Enix	0.140858	0.214077	0.2088	0.059614	0.62309
Disney Interactive Studios	0.158899	0.002569	0.32725	0.060459	0.55028
Capcom	0.10294	0.178688	0.20627	0.03895	0.52727
Ubisoft	0.177329	0.008143	0.27517	0.054571	0.51544
THQ	0.13249	0.007007	0.29199	0.044951	0.4766
Atari	0.074711	0.029504	0.30314	0.024821	0.43311
Sega	0.128326	0.089249	0.17121	0.038372	0.42721
Konami Digital Entertainment	0.083762	0.109736	0.11077	0.03643	0.34091
Namco Bandai Games	0.04574	0.136341	0.07459	0.015762	0.27263

The mean values reiterate to us the similar insights we found from the visualization earlier, in which the data shows us regional variations in publisher performance. Some publishers may have stronger sales in specific regions. For instance, Nintendo performs well in both Europe and Japan, while Microsoft Game Studios perform better in North America. Sony Computer Entertainment and Capcom have higher mean sales figures in Japan, indicating a stronger presence in the Japanese market. However, some publishers, such as Ubisoft and Electronic Arts, have more balanced sales across regions, indicating a diversified market presence.

ELECTRIC VEHICLE POPULATION DATASET

What is the environmental impact of electric vehicles compared to traditional vehicles?

1) How does the electric range vary across different vehicle makers and models?

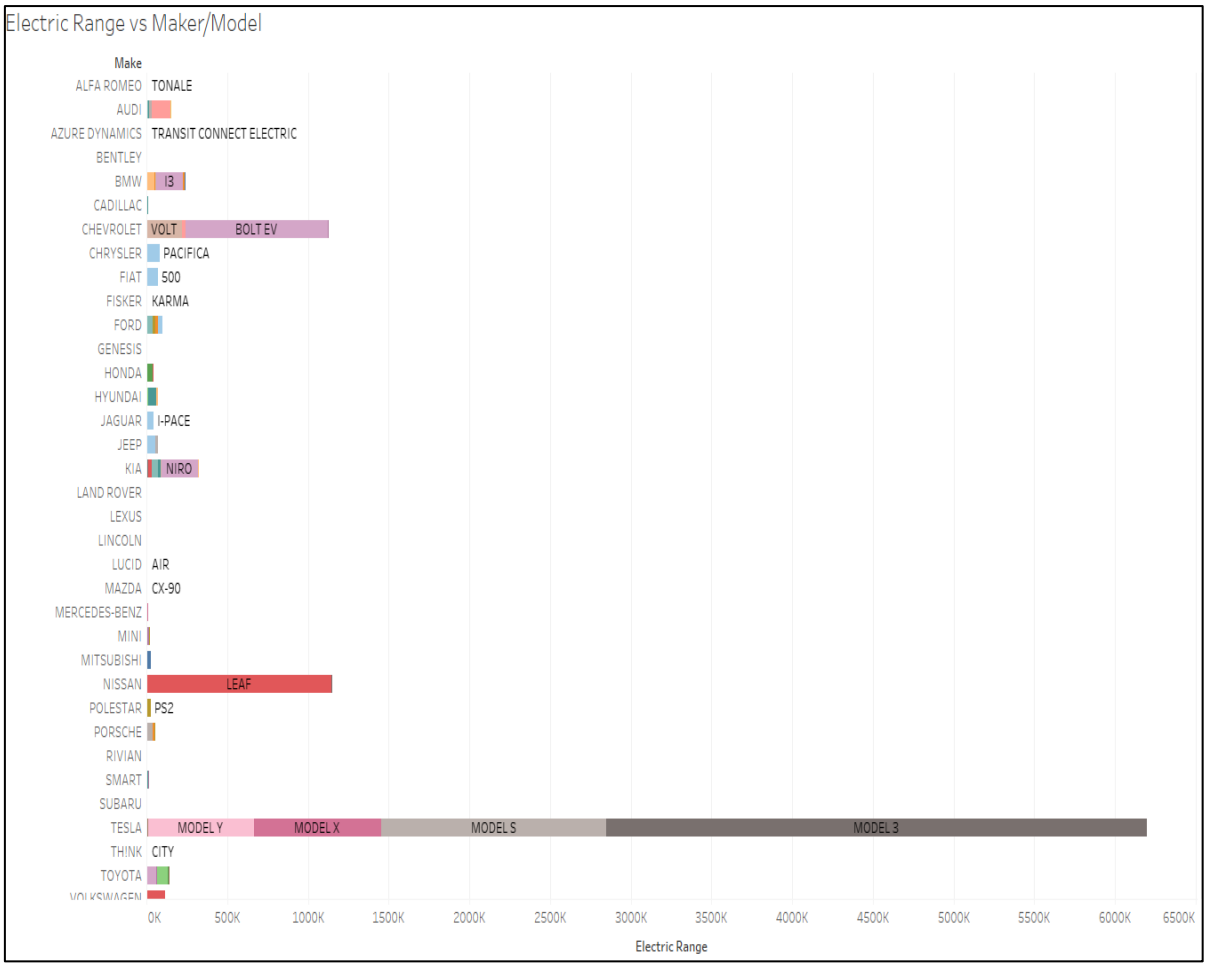

Figure 7: Horizontal Bars of electric ranges of electric cars using Tableau BI

The graph above shows the electric range of electric cars based on specific manufacturers and models. The graph Histogram presented is a stacked one, with each manufacturer on the x-axis and within each bar representing each manufacturer are their respective models. The electric range refers to the distance a car can travel before its battery needs to be recharged.

The graph reveals that the model with the highest electric range is the Tesla Model 3 with an electric range of 3,348,401 kWh. This car is a full-size sedan that was launched in 2012 and is one of the most advanced and luxurious electric cars in the world. Behind the Tesla Model 3 are the other Tesla cars, which are Model S (1,391,773 kWh) Model Y (657,951 kWh) and Model X (786,517 kWh). This observation also tells us that Tesla cars produce the electric cars with the highest electric ranges.

Among the reasons that Tesla cars have such good electric ranges are because of they're advanced battery technology. Their batteries are made with lithium-ion which has a very high energy density. This enables the battery to be able to store a significantly large amount of energy in it. In addition to that, the design of the Tesla vehicles also plays a role in why they're cars produce the have so good electric ranges, they're designs follow aerodynamics and energy efficiency principles. This helps make the cars a lot more efficient, which additionally will help the cars have more electric ranges. Furthermore, a very large battery and constant upgrades (including software updates) can all significantly increase they're electric ranges.

Besides the Tesla cars, among the other models that have got good electric ranges are Nissan and Chevrolet. The Nissan Leaf alone has got an electric range of 1,143,239 kWh and the Chevrolet Bolt EV has got an electric range of 883,554 kWh. However, some of the electric cars that have the lowest electric range include the Porsche 918 (12 kWh), Bentley Flying Spur (21 kWh), BMW 745LE (32 kWh), Audi A8E (34 kWh).

Additionally, many other models from well-known luxury car brands, such as Mercedes, Mini, Land Rover, all have very low electric ranges, signalling that not many electric cars, even the well-known ones, are capable of having high electric ranges yet due to further development on electric cars needed on their sides. Some of the reasons that these cars do not have as good as electric range as Tesla, Nissan or Chevrolet cars include the battery size, battery type, battery capacity, vehicle weight, vehicle aerodynamics, vehicle efficiency, and the ambient temperature.

Mode: 3348401 (Tesla Model 3)

Median: 10,122,906/2 = 5,061,453 (Nissan Leaf)

Mean (Top 20)

Make	Model	Mean (Electric Range)	Electric Range
HYUNDAI	KONA	258	52,632
TESLA	ROADSTER	235.104	11,285
JAGUAR	I-PACE	205.282	45,162
TESLA	MODEL S	184.536	1,391,773
CHEVROLET	BOLT EV	157.806	883,554
TESLA	MODEL X	157.241	786,517
TESLA	MODEL 3	125.099	3,348,401
AUDI	E-TRON	121.834	115,986
VOLKSWAGEN	E-GOLF	107.301	115,349
TOYOTA	RAV4	102.607	6,259
TH!NK	CITY	100	400
WHEEGO ELECTRIC CARS	WHEEGO	100	300
KIA	SOUL EV	97.718	22,182
AUDI	E-TRON SPORTBACK	95.456	16,132
KIA	SOUL	93	39,432
BMW	I3	89.01	169,653
NISSAN	LEAF	87.317	1,143,239
MERCEDES-BENZ	B-CLASS	87	7,569
FIAT	500	85.627	69,957
KIA	NIRO	82.229	227,282
CHEVROLET	SPARK	82	20,336
FORD	FOCUS	79.024	19,440
PORSCHE	TAYCAN	78.054	40,510
SMART	FORTWO ELECTRIC DRIVE	63.695	9,618
SMART	FORTWO	62.754	4,079

The data shows a wide range of electric vehicle (EV) models with varying mean electric ranges. The Hyundai Kona has the highest range while the Smart Fortwo Electric Drive has the lowest. This also shows Tesla Dominance as three tesla cars, the Model S, Model X, and Model 3 are among the top contenders in terms of mean electric range.

Mean (Bottom 20)

Make	Model	Mean (Electric Range)	Electric Range
FORD	FUSION	20.38	37,418
AUDI	Q5 E	19.729	11,936
FORD	C-MAX	19.178	29,477
LAND ROVER	RANGE ROVER SPORT	19	475
BMW	330E	17.711	7,474
BENTLEY	BENTAYGA	17.5	35
AUDI	A8 E	17	34
SUBARU	CROSSTREK	17	1,088
BMW	X3	17	4,862
BMW	745E	16	112
BMW	745LE	16	32
AUDI	A3	16	9,120
BMW	530E	15.882	6,321
PORSCHE	PANAMERA	15.52	1,940
BMW	I8	14.92	1,313
PORSCHE	CAYENNE	14.237	5,040
BMW	740E	14	406
MINI	COUNTRYMAN	13.322	2,771
HONDA	ACCORD	13	104
MERCEDES-BENZ	S-CLASS	12.909	142
PORSCHE	918	12	12
MERCEDES-BENZ	GLC-CLASS	11.853	2,252
MERCEDES-BENZ	GLE-CLASS	9.043	416
MERCEDES-BENZ	C-CLASS	8.188	131
TOYOTA	PRIUS PLUG-IN	6	5,604

2) How does the electric range correlate with CAFV eligibility?

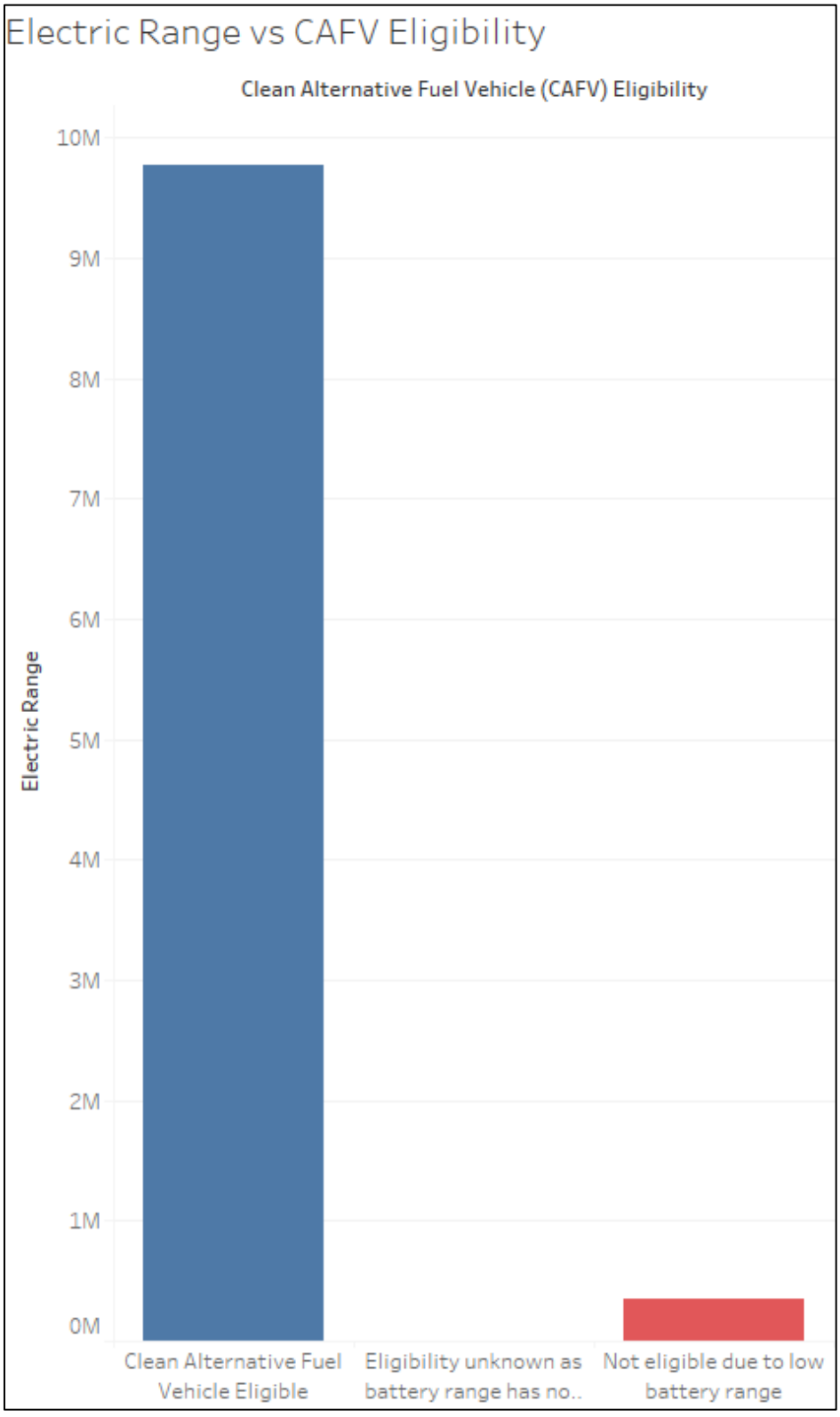

Figure 8: Histogram electric range with CAFV eligibility using Tableau BI

This graph shows us the correlation between the CAFV (Clean Alternative Fuel Vehicle) and the electric ranges. The X-axis represents which electric cars have CAFV as it is not included for all models. Thus, there are three values on the X-axis, those cars that do have CAFV, those that do not, and those cars in which their CAFV status is unknown.

This graph is important as it shows that the electric cars that do have CAFV tend to have very high electric ranges and the electric cars that do not, have very low electric ranges. This graph helps answer our question because this graph can give not only our stakeholders, but also our consumers a clear answer as to which electric cars are more environmentally friendly, especially if that buyer big factor in purchasing a car is an environmentally friendly one. Furthermore, this graph also helps reveal to us the trend of availability of CAFV in electric cars.

Electric cars with CAFV help further reduce greenhouse gas emissions and promote more cleaner transportation options, thus, this chart also helps buyers and stakeholders analyse the number of electric cars that do have CAFV. Furthermore, CAFV electric car alternative fuels and have lower emissions than conventional vehicles. The chart clearly shows us that those electric cars that do have CAFV have a very high electric range as compared to the ones that do not have CAFV. The graph shows that electric cars withy CAFV has electric ranges up to 9 million kWh, however, those electric cars that do no have CAFV only have an electric range of up to 1 million kWh.

Mode = 9777100 (Clean Alternative Fuel Vehicle Eligible)

Mean = (Clean Alternative Fuel Vehicle Eligible = 157.3, Not Eligible Due To Low Battery Range = 19.8)

Median = 10122906/2 = 5061453 = Clean Alternative Fuel Vehicle Eligible.

How does the geographic location impact electric vehicle ownership and charging infrastructure?

1) Where are the clusters of electric vehicles located based on city and county?

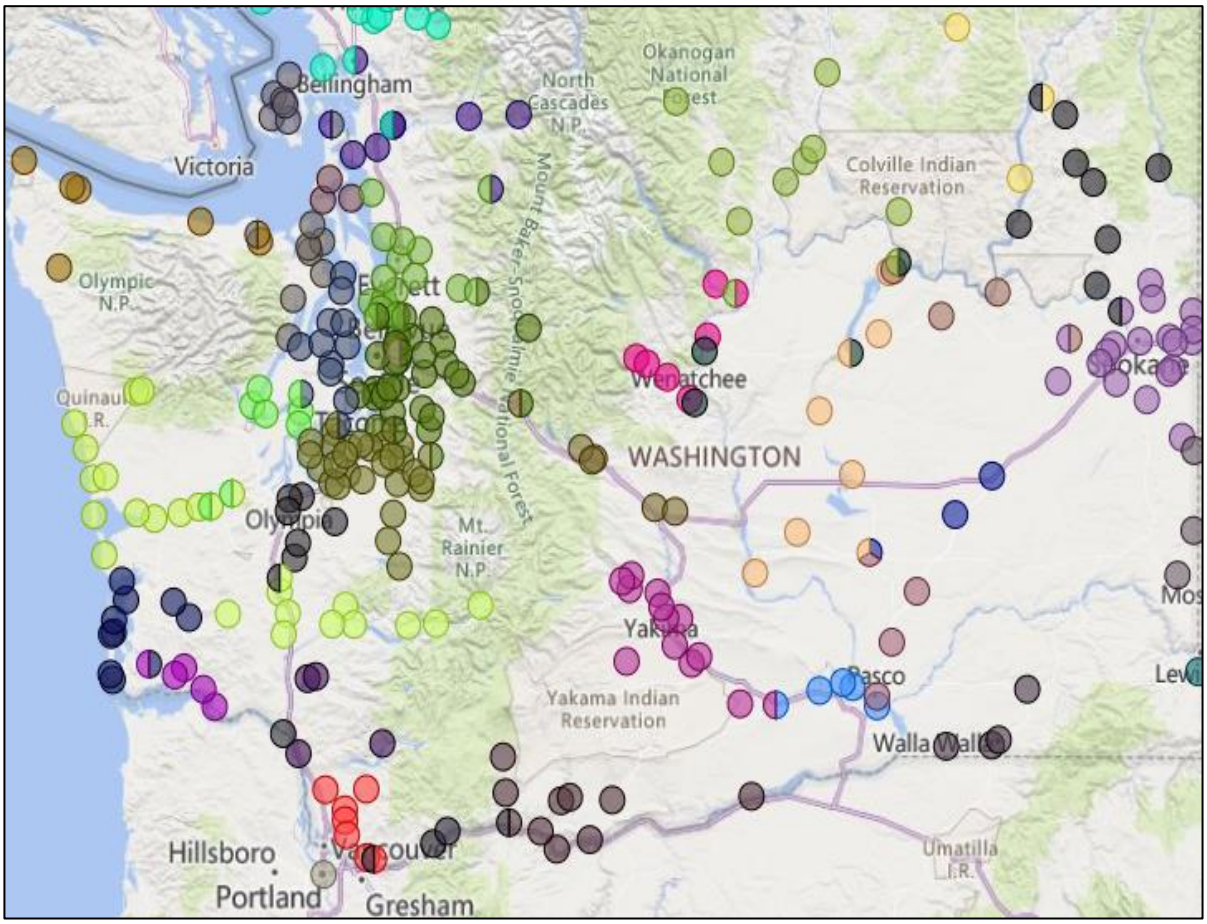

Figure 9: Map of electric car ownership in the state of Washington (based on City) using Microsoft Power BI

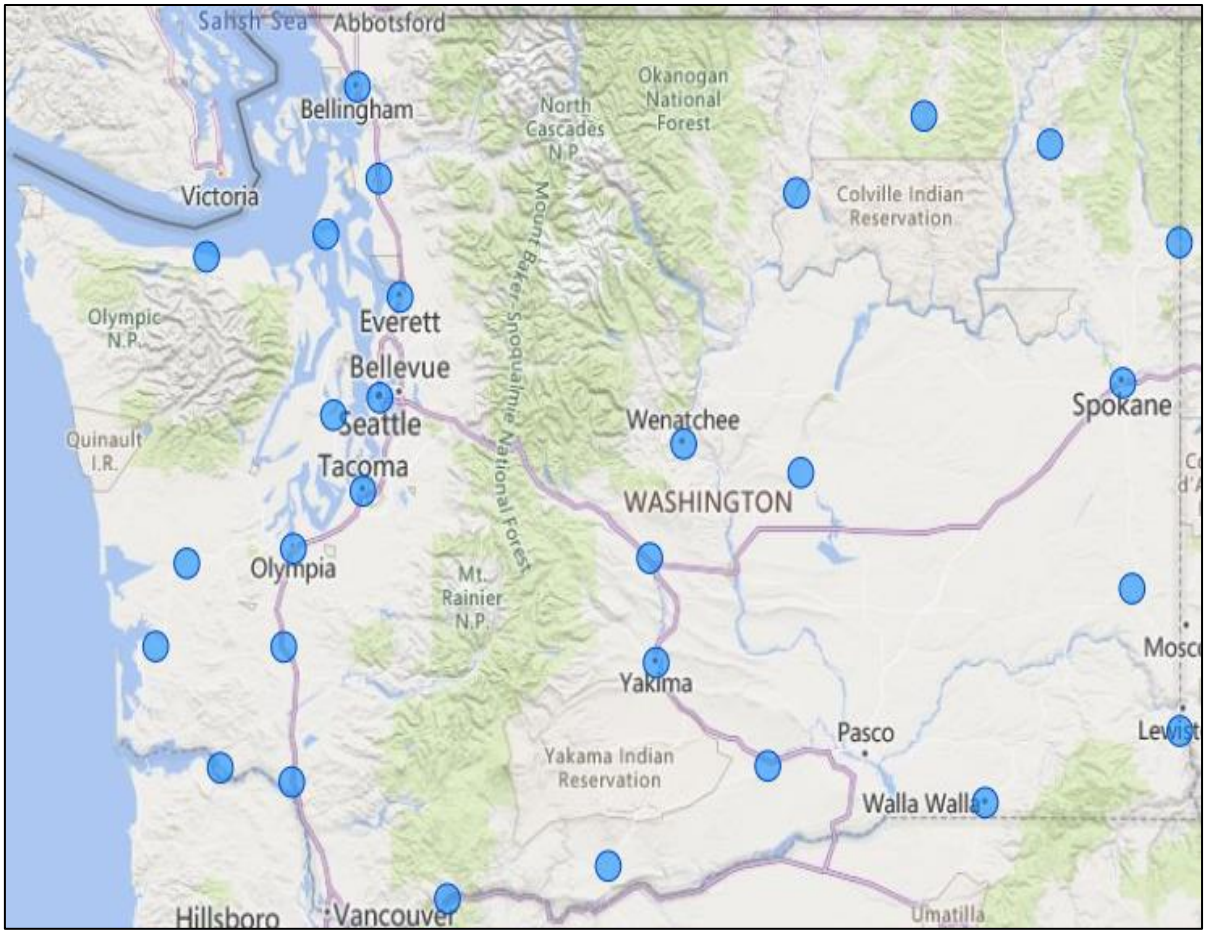

Figure 9: Map of electric car ownership in the state of Washington (based on County) using Microsoft Power BI

From the two images above, it becomes clear and obvious that the counties with the most population of electric vehicles is the King County. This is because the King County, which includes the popular city of Seattle, has high demand for electric vehicles, in addition to a huge awareness of the importance of using electric vehicles for our environment. Furthermore, it was also found that the King County has high levels of income levels, which means that the population there can afford electric vehicles and its services and infrastructure needed to own an electric vehicle. and various policies and incentives provided by their local government for the ownership of electric vehicles. The King County is also a very urbanised part of the state of Washington D.C., this also means that the county has got tons of electric charging infrastructure, making it more convenient and easier for electric vehicle owners.

However though, it should be noted that several other parts of Washington have got almost equal population of electric vehicle ownership.

Meaning the state of Washington is generally well represented by electric vehicles, but most of its clusters are situated in King County, particularly in Seattle.

2) Which counties and cities have the most and least electric vehicles?

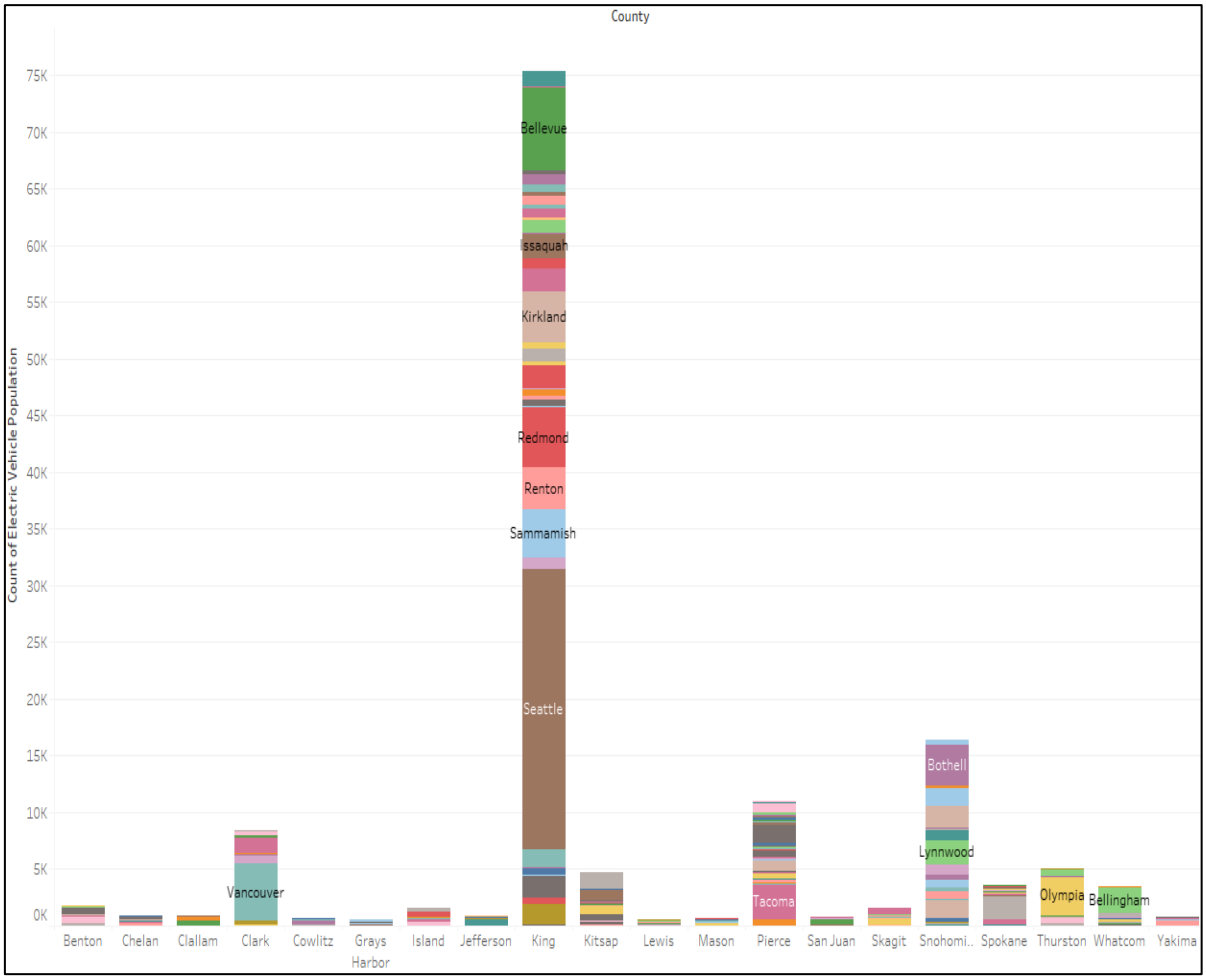

Figure 10: Stacked histogram of the cities and counties with their electric vehicle sales data using Tableau BI.

The graph above shows a stacked histogram with the X-values being the counties of the state of Washington D.C. and the respective stacks within each counties bar representing the city of that county. It has to be noted that the data present in this histogram has been filtered to total electric vehicle sales of 500 vehicles or more. This was done because the state of Washington has 39 counties, thus, this was done to help filter the data out to focus on the counties with proper sales to help better analyse the data and find trends. Furthermore, these counties provide more data points, which can help us lead to more accurate analysis.

The graph shows, similar to the proven map prior to this, reiterates that King County has got the greatest number of electric vehicle sales. This county is followed by the counties of Pierce and Snohomish.

These three counties alone account for more than 70% of the total EV population sales in the state. King County alone has more than 75,000 EVs, which is more than half of the total electric vehicle population sales data in the entire state.

As mentioned in the previous analysis where the clusters in the map were analysed, King County is a very Electric Vehicle-friendly County in the state with high incomes, proper government incentives, good electric vehicle infrastructures and public awareness.

In addition to that, the chart also shows that the county with the lowest electric vehicle population were the counties of Lewis and Mason, both of which just had around 500 registered electric vehicles. However though, there are solid reasons for this, and similarly for the extremely low electric vehicle population data in the other counties that weren't taken into the histogram due to its extremely low data. These counties identify as more rural areas within the state of Washington. Besides that, they too seem to be very small in size. Furthermore, these counties lack the infrastructure, services and awareness of electric vehicles.

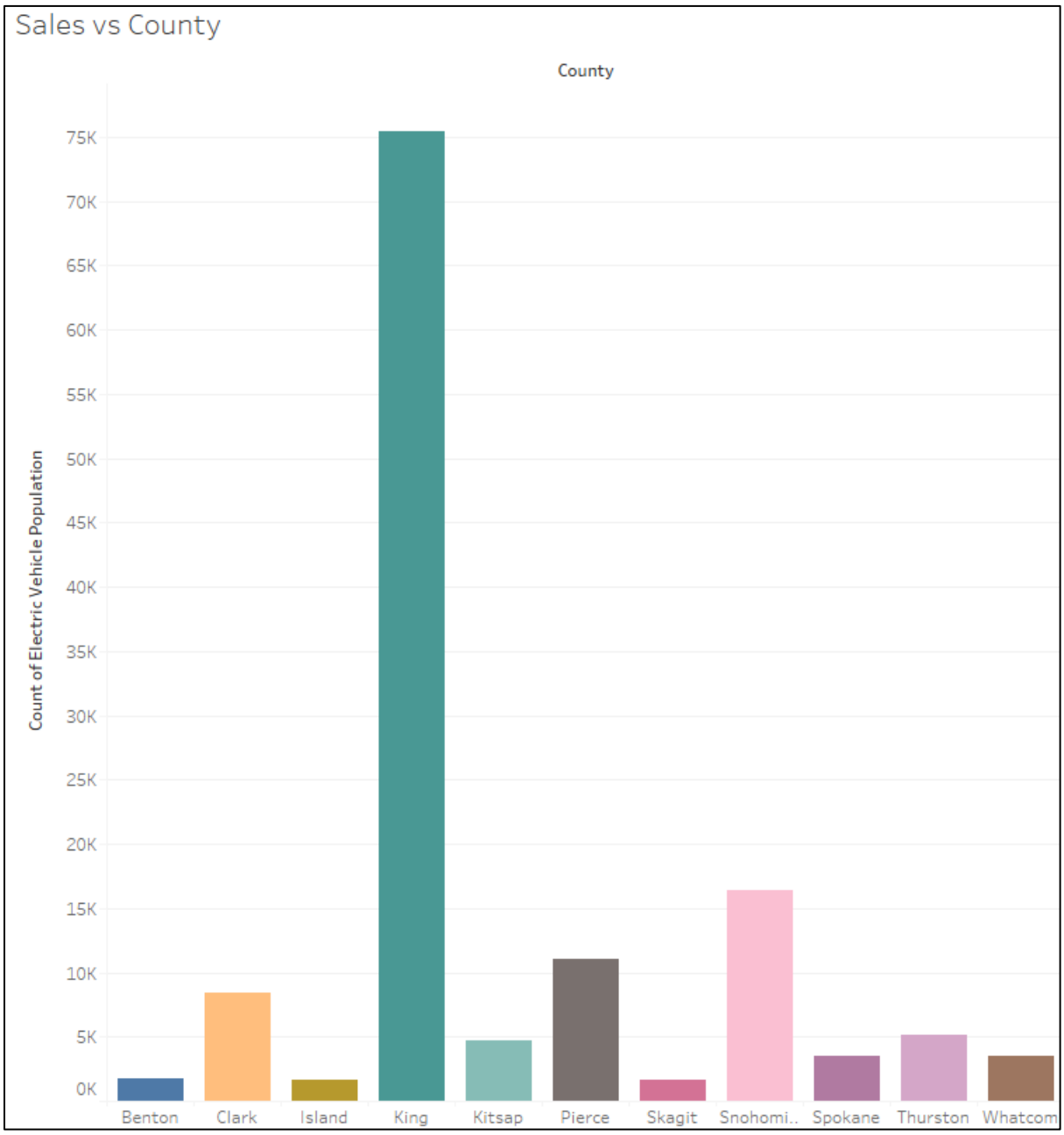

Figure 11: Histogram showing the population of electric vehicles based on counties in Washinton using Tableau BI.

Mean = 12,102

Mode = 75383, King County

Median = 133,126/2 = 66563 = King County

A county that has a higher number of vehicles sold than the mean is doing better than average, while a county that has a lower number of vehicles sold than the mean is doing worse than average.

For instance, an analysis that had been reiterated many times, King County has the highest number of electric vehicles sold which is way more than the mean. This means that King County is the most successful county in terms of vehicle sales. Additionally, King County is an outlier in the graph, as it has a much higher number of vehicles sold than any other county. On the other hand, Benton County has a very low number of vehicles sold which is less than half the mean. This means that Benton County is not successful county in terms of electric vehicle sales, and it may have less demand, supply, and diversity of vehicles than other counties.

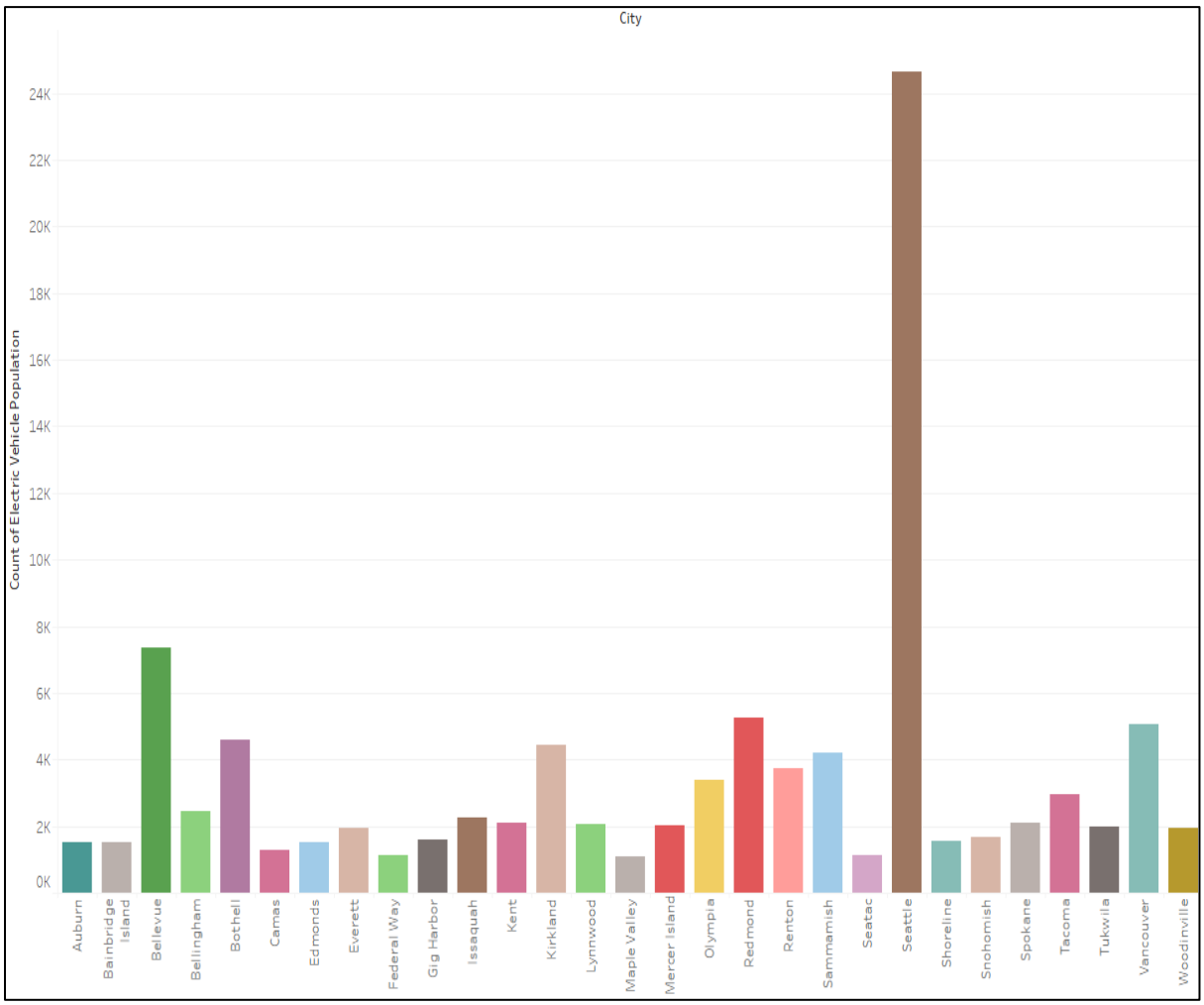

Figure 12: Histogram showing the population of electric vehicles based on cities in Washinton using Tableau BI.

Mode = 24,662 = Seattle

Median = Kirkland = 98615/2 = 49,307.5

Mean = 3,401

How is the electric vehicle market evolving over time?

1) Are there trends in the adoption of electric vehicles by model year?

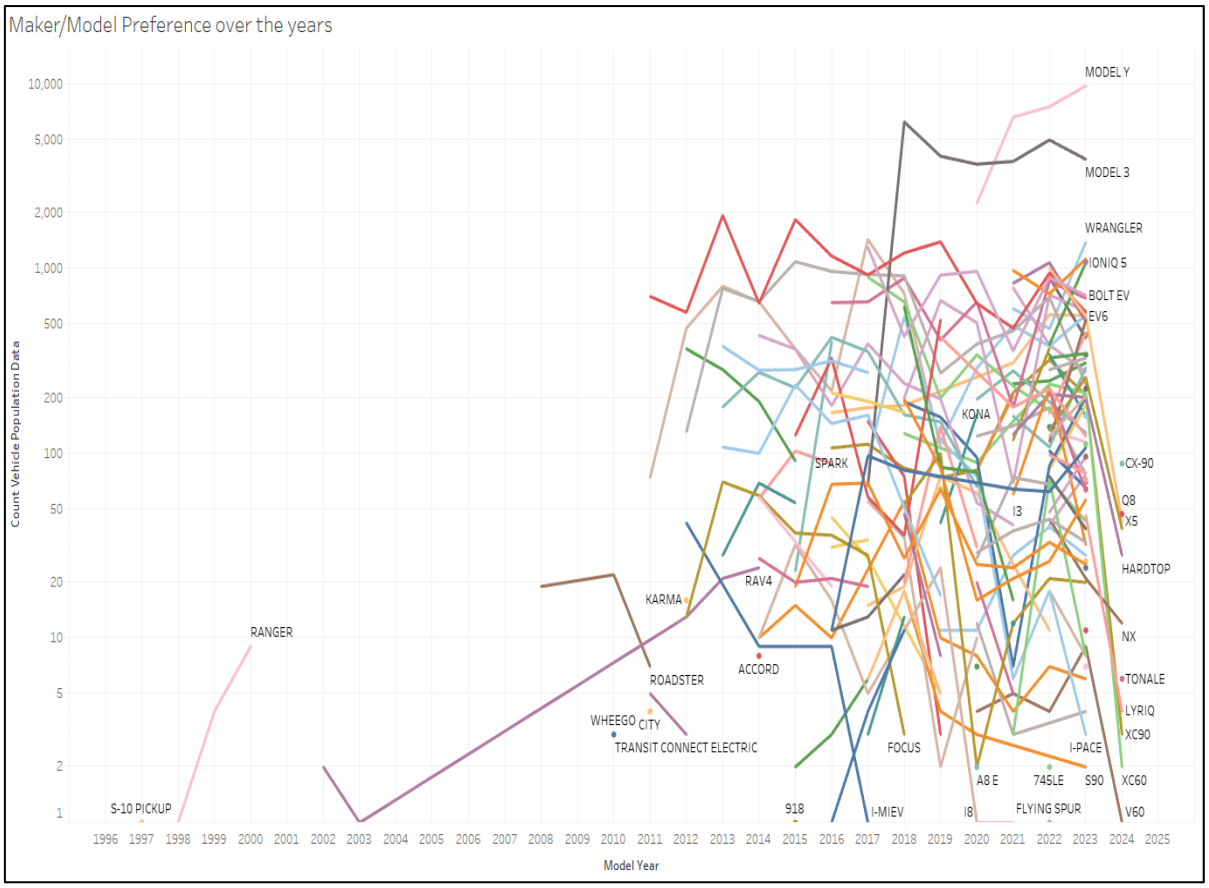

Figure 13: Line graph showing the change in sales of electric cars using Tableau BI

The graph shows the electric vehicle model and their manufacturers preferences from 1999 to 2018. The years are represented on the X-axis and the Y-axis is flexible which adjusted accordingly to help the graph look neater and simplified.

An interesting finding was that the popularity of the Tesla Model Y, which peaked at over 2,000 units sold in 2018, is the most notable trend in years. It is a very appealing choice due to its cutting-edge technology and very effective electric powertrain. One of the reasons the Tesla Model Y is such a bestseller is that it drives better than most of its competitors. The outstanding handling and quick acceleration of the Tesla Model Y provide for an exceptional driving experience. Thus, it is far ahead of the curve in terms of driving dynamics. Besides that, one of the largest charging infrastructures in the world is available for the Model Y.

Tesla is prepared to offer quick and convenient charging at its charging stations across the world, where it has more than 40,000 Superchargers.

Apart from that, certain cars have shown a very rapid increase in demand and preference over the years, such as the Tesla Model X, which rose from less than 100 units sold in 2015 to over 1500 sold in 2021.

The Tesla model 3 was also known to have very high sales with high presences. Advanced technologies like Autopilot and over-the-air software updates that enhance performance and introduce new capabilities are standard in Tesla vehicles. Technology enthusiasts and early adopters who are interested in cutting-edge technology are drawn to these aspects. The popularity of Tesla is partly influenced by its standing for excellence and dependability. Tesla automobiles consistently rate among the best in terms of reliability and owner happiness. This has contributed to the growth of a devoted customer base prepared to pay more for Tesla products.

The three Tesla cars, which are Model X, Model Y and Model 3 seem to have the highest growth rates, suggesting that among electric car sales, Tesla cars have the highest demand and attractiveness towards potential customers. Furthermore, the Tesla cars having rapid increases in the number of sales could also be because of a distinctive value proposition and a competitive advantage over its rivals. Furthermore, this data was collected in the USA, where Tesla is home to.

Prior to 2010, early adopters and enthusiasts who were open to embracing new technologies were the main consumers of electric vehicles. These early adopters favoured vehicles such as the Nissan LEAF and Tesla Roadster. When selecting an electric vehicle, early adopters encounter a variety of difficulties. Concerns about the limited driving range, the availability of charging infrastructure, and the higher upfront expenses compared to conventional gasoline-powered vehicles are a few of these difficulties. These early adopters, however, are driven by a hope for potential environmental advantages, lower operating costs, and the joy of operating a cutting-edge, high-performance car. However, a 60% increase from 2021, growing sales bring the total number of electric vehicles on the world's roads to 26 million. As in recent years, electric vehicles account for more than 70 percent of total annual growth.

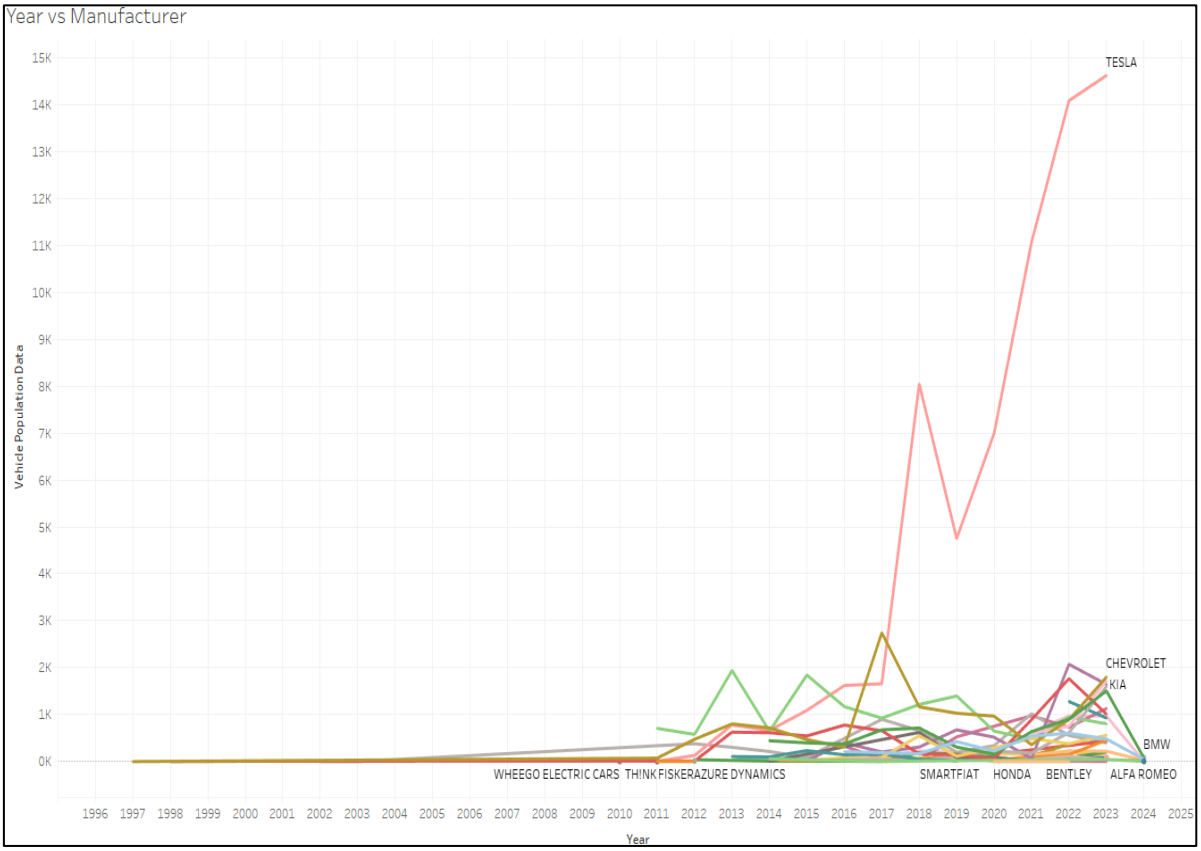

Figure 14: Line graph showing the change in sales of electric cars based on manufacturer using Tableau BI

This graph is to help the previous analysis above clearer, in terms of showing which manufacturers have had the best electric car sales.

Mode: Tesla (14615)

Median: (143,596/2 = 71798 = Jeep)

Mean (Top 10)

Maker	Mean
Tesla	4370
Kia	658
Ford	487
Chevrolet	844
Hyundai	357
BMW	564
Volvo	379
Audi	322
Nissan	1024
Volkswagen	564

Based on the mean sales figures, Nissan has the highest mean car sales, followed by Chevrolet and Tesla. This ranking can provide insights into which manufacturers are performing well in terms of sales volume. This data can also help our stakeholders identify which manufacturers are selling more cars on average and which ones are selling fewer.

2) How is the electric vehicle market in terms of maker and model preferences?

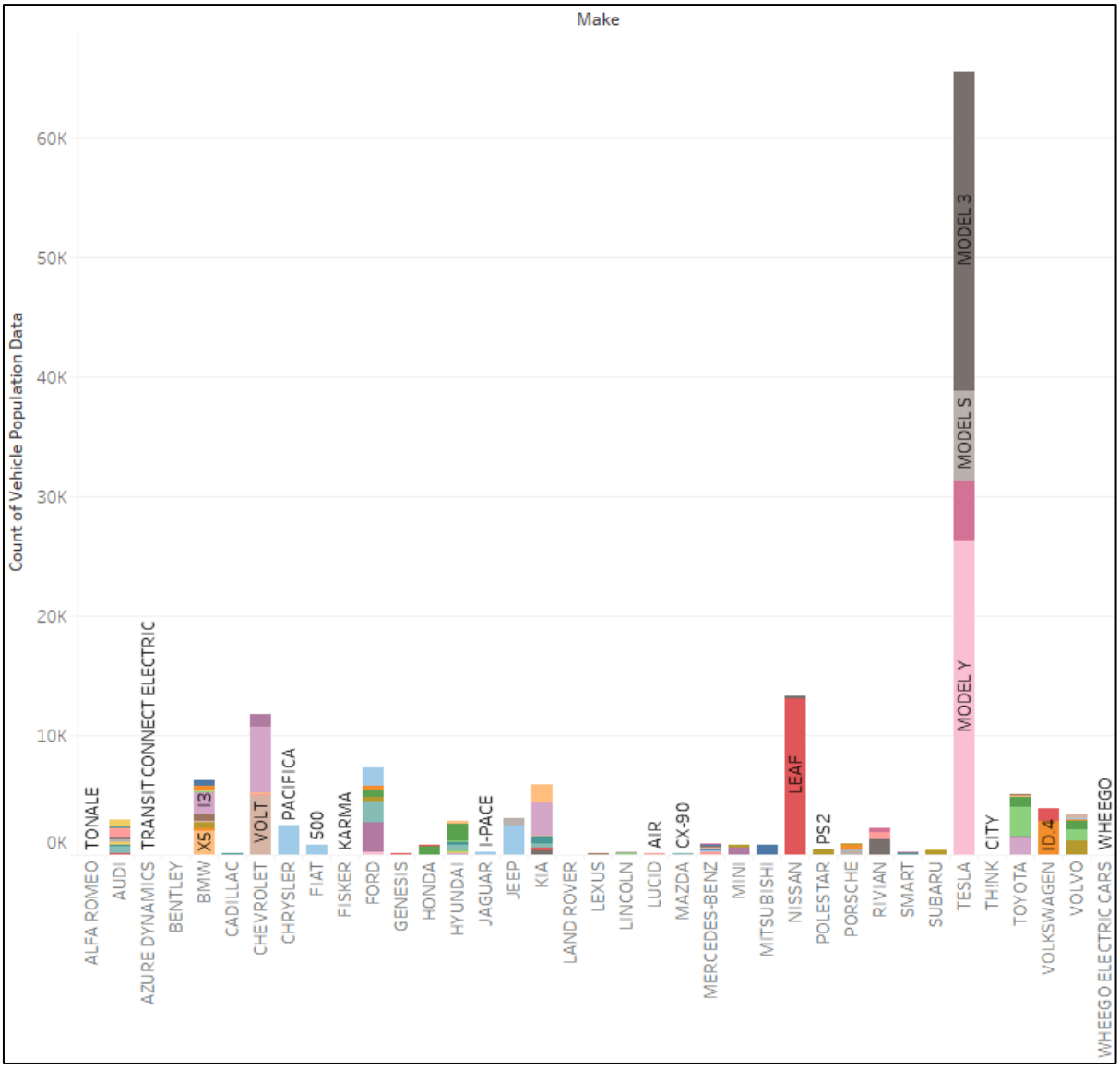

Figure 15: Stacked histogram showing manufacturer and model electric vehicle count using Tableau BI

The graph shows the total sales of vehicles by models and makers. The X-axis represents car maker (as in the car manufacturer) and y-axis represents total sales.

The graph reveals that Tesla sold the greatest number of cars with the Tesla Model 3 is the best-selling car in this graph, with other Tesla models too having a very high sales range. Behind Tesla, the next most well-sold car maker is the Nissan, with the Nissan Leaf single handedly contributing to most of its sales.

Some makers have produced a high number of electric cars and some makers haven't, showing that the rate of adoption of electric cars is still picking up. Factors such as market demand, the customer preference, the production cost, the environmental impact, and the competitive advantage.

There are also certain car manufacturers, such as Audi, Mercedes and Ford that have all produced a high count of electric cars, but have very low sales. For example, in this graph, Ford has produced 7 electric cars, Audi has 9, Mercedes has 6, but yet, all of them were not globally well sold. Whereas Nissan, for example, only has two models in this graph, but it outsold the other car manufacturers mentioned above with the Leaf alone. Nissans are well known for their quality for their price, they offer both electric and hybrid vehicles and are known for their consistency.

CONCLUSION

As a conclusion, our assignment yet again reiterates the importance of data analytics to the world. Without data analytics, so many of the progress that has been made today would not have been made possible. Data analytics brings progress, growth, and helps a company achieve success in their goals, which is what our group has hoped to bring with our analysis for our stakeholders.

Our group hopes that our analysis, which was relating to the video game and electric car industry, has helped our stakeholders answer crucial questions within their respective industries of interest. As for the video game industry, we hope that our stakeholders will now have a clear understanding of how the popularity of different video genres have changed over time, to which video game platforms have generated the most sales in different regions, how the video game platform demand has changed over time, and how consumers from different regions have different preferences for video games, such as certain games, platforms or genres being the best sold at certain specific regions and the reasons behind them as well. With this information, our stakeholders can make various decisions, such as which particular video games to distribute accordingly to which nation and on which platforms, which markets to give more focus on for video games distribution and so on.

As for our electric vehicle data, our group hopes that our analysis will help our stakeholders have clear understandings as well on topics such as what are the environmental impacts of electric vehicles as compared to conventional vehicles, how the electric ranges play a role in the decision making of consumers as well, what geographical demographics and infrastructures have an effect on the sales of electric vehicles, what are the trends in electric vehicle adoption over the years and which manufacturers and specific models sell the most and least electric cars and why? With all of these questions analysed, our group hopes that this will help our stakeholders make empowered decisions, such as which particular location is bestselling electric vehicles and what type of specifications are customers looking for in order to produce a well-selling electric car and so on.

We hope that our analysis contributes to the company's competitiveness and adaptability in the business world which is changing rapidly all the time. Our team had worked together across multiple sections, each handling their own analytics part and using various analytical tools to come together and help produce a larger, clearer scope of analysis from our discovered datasets and we hope that our analysis will help our stakeholders make the right decisions.

APPENDIX

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