ST. XAVIER'S COLLEGE (AUTONOMOUS)

AHMEDABAD

2023-2024

RESEARCH PROJECT REPORT

ON

PREDICTIVE ANALYSIS OF ELECTRIC VEHICLE IN INDIA

ST. XAVIER'S COLLEGE (AUTONOMOUS)

ST. XAVIER'S COLLEGE (AUTONOMOUS)

AHMEDABAD

SUBMITTED BY

NAME: Praveen Choudhary, Khushi Jain

BATCH: 2020-2023

GUIDED BY

Dr. Sweta Patel

ST. XAVIER'S COLLEGE (AUTONOMOUS)

ST. XAVIER'S COLLEGE (AUTONOMOUS), AHMEDABAD

IN FULFILLMENT OF

UNIVERSITY GRANTS COMMISSION (UGC)

RESEARCH PROGRAM

Year 2023-2024

RESEARCH PROJECT REPORT

ON

PREDICTIVE ANALYSIS OF ELECTRIC VEHICLE IN INDIA

GUIDED BY

Dr. Sweta Patel
ASSISTANT PROFESSOR,
STATISTICS DEPARTMENT,
ST. XAVIER'S COLLEGE (AUTONOMOUS),
AHMEDABAD

SUBMITTED BY

Praveen C. ,Khushi Jain
T.Y. B. Sc.
STATISTICS
ROLL NO- 531 , 526

ST. XAVIERS COLLEGE (AUTONOMOUS), AHMEDABAD

IN FULFILLMENT OF

UNIVERSITY GRANTS COMMISSION (UGC)

RESEARCH PROGRAM (2023-2024)

CERTIFICATE

Mr. Praveen Choudhary has submitted his research project report entitled "PREDICTIVE ANALYSIS OF ELECTRIC VEHICLE IN INDIA" This research project has been guided by Dr. Sweta Patel, Statistics Department, St. Xavier's College (Autonomous), Ahmedabad and the signature which appear below have been given after final approval with reference to its contents and form.

This report is an acceptance of successful completion of research program.

Dr. Nandita Chritsy	Fr. Dr Vinayak Jadav, S.J.
Head of Statistics Department	Principal
St. Xavier's College, Ahmedabad	St. Xavier's College, Ahmedabad

ST. XAVIERS COLLEGE (AUTONOMOUS), AHMEDABAD

IN FULFILLMENT OF

UNIVERSITY GRANTS COMMISSION (UGC)

RESEARCH PROGRAM (2023-2024)

CERTIFICATE

Mrs. Khushi Jain has submitted his research project report entitled "PREDICTIVE ANALYSIS OF ELECTRIC VEHICLE IN INDIA" This research project has been guided by Dr. Sweta Patel, Statistics Department, St. Xavier's College (Autonomous), Ahmedabad and the signature which appear below have been given after final approval with reference to its contents and form.

This report is an acceptance of successful completion of a research program.

Dr. Nandita Chritsy
Head of Statistics Department
St. Xavier's College, Ahmedabad

Fr. Dr Vinayak Jadav, S.J.
Principal
St. Xavier's College, Ahmedabad

DECLARATION

I hereby declare that this project report entitled "PREDICTIVE ANALYSIS OF ELECTRIC VEHICLE IN INDIA" is a presentation of my own research work and has not been submitted to any other university or college for any award. Wherever contributions of others are involved, every effort is made to indicate this clearly with due reference to the literature and acknowledgement of collaborative research and discussions.

Student Name

Khushi Jain

Praveen Choudhary

ACKNOWLEDGEMENT

I cannot express enough thanks to my department for their continued support and encouragement. Dr. Nandita Christy our head of department, Dr. Sweta Patel our mentor, Dr. Shraddha Bhatt, Dr Aruna Pandya and Dr. Kirtan Parmar. I offer my sincere appreciation for the learning opportunities provided by my department. Your encouragement when the times got rough are much appreciated. It was great comfort and relief to know that you were willing to provide management of our lecture while we completed our work. My heartfelt Thanks.

TABLE OF CONTENT

Introduction

India now ranks as the fourth-largest vehicle market in the world and is expanding quickly. India is the greatest producer of tractors, buses, two- and three-wheelers in the world, as well as the second-largest maker of buses.

The national electric mobility mission plan, FAME-I and II, the national mission for transformative mobility and battery manufacturing, and the phased manufacturing program are just a few of the new policies and initiatives that the central government and state governments are constantly introducing to promote electric vehicles in India and to adopt the full EV Environment. Electric cars provide a number of advantages for the environment and for reducing pollution. The automobile industry currently contributes about 49% of India's manufactured GDP and the country's overall GDP. This suggests that the economy of the country will suffer. This indicates that as they follow the trends, many auto ancillaries and allied businesses would grow alongside the EV industry in the upcoming years.

This article presents a polynomial regression model for forecasting sales in the electric vehicle (EV) industry in India from 2023 to 2027. Utilising historical sales data from 2017 to 2022, the model incorporates sales indicators and market trends as key variables. The results of the regression analysis highlight the predictors' significance and impact on sales. Statistical measures such as root mean square error (RMSE) and coefficient of determination (R-squared) assess the model's accuracy.

We choose a polynomial regression model idea and use it to create a relationship between years and sales based on AIC and Adjust R square. Smaller is better for AIC. Larger values of adjusted R-squared are preferable. The model with the extra terms does not significantly lower the error sum of squares over the reduced model, according to a non-significant p value for the extra sum of squares test comparing model a to model b. In other words, a non-significant p-value implies that the model with the extra terms is not superior to the reduced model. This paper is concentrated on the polynomial regression model, which is useful when there is reason to believe that the relationship between two variables is curvilinear. Parameters of the model were estimated using a least square method. After fitting, the model was evaluated using some of the common indicators used to evaluate accuracy of the regression model.

To determine the most suitable regression model for predicting sales for the years 2023 to 2027 based on the given data, we can perform a trend analysis and evaluate the pattern exhibited by the data.
Making ecologically responsible decisions is crucial to reducing global warming and averting climate change. EVs are one such environmentally responsible option. The global car industry is undergoing a paradigm shift as it tries to switch to alternate, less energy-intensive solutions. According to the Ministry of Road Transport and Highways, there were 1435029 electric vehicles (EVs) in total on Indian roads as of August 2022. By 2030, there will likely be 45–50 million additional EVs on the road.The National Electric Mobility Mission Plan (NEMMP), which aims to reduce the use of liquid fuel and regulate the sale of hybrid and electric vehicles in India, was unveiled in 2013.

According to a study by Mordor Intelligence, the top five companies with 53.49% of the Indian electric vehicle market are TATA Motors, Audi AG, Hyundai Motor India, Mahindra & Mahindra Ltd., and MG Motor India Pvt. Ltd. Also take notice that the two-wheeler category holds 25% of the market share for EVs in India, with the three-wheeler segment accounting for the remaining 75%. The remaining 5% is made up of various other items, including vehicles; this market is about to take off.

The Indian government reaffirmed its support for the EV industry in its budget for 2022–2023. To enhance the market share of EVs in India, the government put up a number of policies.

History of Electric Vehicles in India

1994-The first EV producer in the nation was the Reva Electric Vehicle Corporation (RECC), founded in Bangalore by Chetan Maini. One of the first businesses in the world to make electric vehicles for general use was RECC. RECC introduced the Reva, their first electric vehicle, in 2001.

1996 –The Three Wheeler VIKRAM SAFA was the first electric vehicle created and constructed by Scooters India Pvt Ltd, Lucknow, and it was marketed in about 400 units. A lead-acid battery with a voltage of 72 volts powered the automobiles.

2000 –In this year, BHEL produced an electric bus with 18 seats. It was powered by a 96V lead-acid battery pack and an AC induction motor. 200 electric vehicles were built and put into service in Delhi with the assistance of MNES. These cars' lack of co was its primary flaw.

2001 –In order to produce and market electric cars, Mahindra & Mahindra Ltd. founded a new company, Bijlee, with headquarters in Coimbatore, in 2001. The lack of demand led to the closure of MEML in 2004. In order to meet consumer demand, Mahindra restarted production at the Haridwar factory in 2006.
A three-seater electric rickshaw was also on show in the same year by Bajaj Auto Ltd. in Pune. The car has cutting-edge PMSM driving technology. This product hasn't yet been commercialised, though.
Additionally, REVA Bangalore made their entry into the electric vehicle industry in 2001 with a car made by an American company called Amerigon. In all, roughly 3200 automobiles were sold, with 1500 of those sales occurring in India, primarily in Bangalore.

2007 – Hero Cycles and ULTRA Motor of the UK collaborated in 2007 to create a series of two-wheelers. Hero Electric, TVS Motor, Electrotherm India, and other businesses also produce and market their goods. Battery and hybrid electric cars are now being sold in India by TATA Motors, Maruti Suzuki, Toyota, and several other companies.
reliability, a brief battery life, and astronomically expensive battery prices.

2005 – 2015: The industry had a period of severe setbacks due to a number of problems, most notably inadequate government funding, a weak support system, and inadequate infrastructure for EVs.

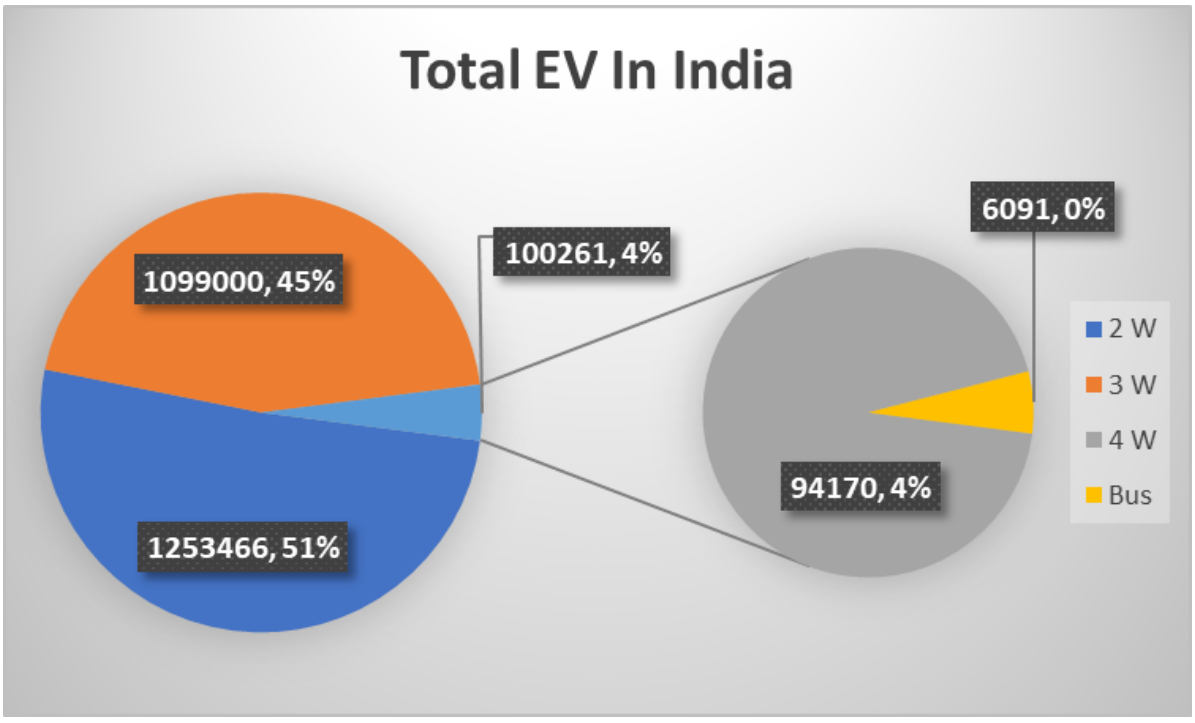
2016-2017–The market was dominated by electric rickshaws because of their great appeal. Approximately 500,000 e-rickshaws were sold in India in 2016–17. It was a huge help to those who had daily commutes. These rickshaws are currently mostly utilised in the Delhi NCR reg

The Present

In order to increase the adoption of electric cars, the government is now concentrating its efforts on extremely polluted cities. FAME, or "Faster Adoption and Manufacturing of Electric and Hybrid Vehicles in India," is a program that will subsidise the introduction of electric buses, taxis, and e-rickshaws in 11 cities. The status of transportation electrification in India is not much praiseworthy. Initially, in the year 2017, India planned to be a fully EV nation by 2030. But later, the central government realised that the plan was too ambitious and India was not completely prepared to be a fully EV nation by 2030. As a consequence, they abandoned the aforementioned plan, and now India plans to be a 30% EV nation by 2030. The government’s unclear plans and policy shifts in EV have affected the EV sales and the status of transportation electrification in India. Based on the sale status of net EV (including two-wheelers, three-wheelers, and four-wheelers) in India during 2019–2020.

To refute the idea that electric cars are excessively costly, fast forward to 2021, when businesses are scrambling to manufacture inexpensive electric vehicles. For instance, E-Trio seeks to increase everyone's access to electric automobiles. They specialise in cars as well as other products including electric LCVs, electric motorcycles, and electric three-wheelers.

The EV sale in India is bleak compared to developed nations. Further, the EV sales are uneven across all the 29 states in India, the highest sales of EV in 2022 were Maharashtra State with 34,013 cars, followed by Gujarat State and Uttar Pradesh State.



The above pie chart denotes the number of electric vehicle kinds all over India

Two - Wheelers Bike

Ola EV

Ola is one of the biggest ride-sharing startups in India and was launched in 2011 by Bhavis Agarwal. OLA plans to transition to the full usage of electric vehicles as a result of its reliance on fossil fuels and the negative effects of fuel combustion.

The Ola S1 electric scooter, which was introduced in August 2021, is one of a number of EVs that Ola Electric has produced. The company also intends to introduce other EVs, such as e-bikes and electric cars.

Ola Electric is attempting to create a network of charging stations across India in addition to its EV fleet. By 2025, the company intends to install more than 100,000 charging stations in 400 Indian cities. Ola Electric has also made plans to establish a "hypercharger network" that will allow EVs to be charged in as little as 18 minutes.

In general, Ola Electric is one of the top EV businesses in India and is trying to advance eco-friendly transportation options all around the nation. However, the demand for Ola Electric vehicles and other EVs in India will likely increase in the next few years due to the Indian government's push towards electric mobility and growing awareness about the advantages of EVs.

Ampere

The company was established in 2008 and is based in

Coimbatore, Tamil Nadu. The Zeal, Reo, and Magnus models are just a few of the electric scooters offered by Ampere Electric. These scooters have battery backup systems, digital screens, and LED lights because they are made for urban transportation.

With more than 300 dealerships spread over more than 240 Indian cities, the firm has been growing its presence across the nation. Customers have reacted favourably to Ampere Electric's reasonably priced and effective electric vehicles, which are ideal for many people's urban commuting requirements.

As the demand for electric vehicles grows in India, Ampere Electric appears to be in a position to continue growing its sales.

Hero

India's top producer of electric vehicles (EVs) is Hero Electric. Since its establishment in 2007, the business has grown to rank among the biggest producers of electric two-wheelers worldwide.

For both personal and professional use, Hero Electric offers a variety of electric bikes and scooters. The performance, dependability, and affordability of the company's goods are well-known.

In FY 2021-22, Hero Electric sold 89416 electric two-wheelers, which represented a significant increase from the previous fiscal year.

The Optima,Flash,Photon , and NYX models are just a few of the electric scooters offered by Hero Electric. Overall, Hero Electric vehicles are a great choice for people who are looking for an affordable and sustainable mode of transportation.

TVS

An global motorcycle producer based in India, TVS Motor Company also creates electric cars. There are now two electric scooter types made by TVS that are offered in outlets:

Several electric two-wheelers, including the TVS iQube and TVS Jupiter Electric, have been launched by TVS Motor Company to the Indian market.

In addition, TVS Motor Company has a broad distribution network in India, with more than 5,000 dealers and maintaining facilities. The company's wide-ranging network has made it easier for it to connect with consumers across the country and give them simple access to sales and support services.

TVS has made plans to introduce a variety of electric two-wheelers in India over the coming few years as part of its goal of producing more electric cars in the future.

Ather Energy

Electric vehicle (EV) company Ather Energy is headquartered in Bengaluru and focuses on the development and production of advanced electric scooters. In 2013, Tarun Mehta and Swapnil Jain launched the business with the goal of creating ecologically friendly, technologically cutting-edge, and visually pleasing electric automobiles.The Ather 450X electric and Ather 450 Plus scooter are the company's flagship products.

In India's luxury electric scooter industry, Ather Energy has been gradually expanding its sales and market share. Over 43847 electric scooters were sold by the firm in 2022, an improvement from the prior fiscal year.

Bajaj auto

An Indian producer of two- and three-wheeled vehicles, Bajaj Auto, recently entered the electric vehicle (EV) market. The

Chetak electric scooter, built by Bajaj Auto, is the brand's first electric vehicle.

Other two-wheeler vehicles from Bajaj Auto are also being developed as electric variants. across the upcoming years, the firm aims to launch a portfolio of electric cars across all market sectors

India's market for electric two-wheelers has expanded quickly in recent years. Only 17,000 electric two-wheeler units were sold in India in 2014. Over 200,000 units have been sold by 2022. The increased popularity of electric cars, government incentives for them, and the expansion of the infrastructure for charging them were some of the reasons that contributed to this rise.

In 2022, Hero Electric, Okinawa Autotech, and Ampere Vehicles were the top three electric two-wheeler producers in India. Hero Electric had the majority of the market, with a share of more than 40%. The second-largest manufacturer, Okinawa Autotech, with a market share of more than 20%. The third-largest manufacturer, Ampere Vehicles, with a market share of more than 10%.

The market for electric two-wheelers is anticipated to expand in the upcoming years. By 2030, the Indian government wants to sell only electric two-wheelers. Even if this goal is lofty, it can be reached with the correct policies and incentives.

The growing understanding of the advantages of electric cars In recent years, awareness of electric vehicles' positive environmental effects has grown. Due to this, there is an increase in demand for electric vehicles, particularly two-wheelers.

Subsidies supplied by the government for electric vehicles: In recent years, the Indian government has provided subsidies for electric automobiles. As a result, electric car prices have decreased for customers, which has increased sales.

Infrastructure for electric vehicle charging is becoming more widely available. This situation has improved recently. Customers now find it simpler to purchase and drive electric vehicles as a result.

4-wheelers Cars

Tata Motors

In recent years, Tata Motors, a major automaker in India, has taken a leadership role in the development of electric cars (EVs). In the Indian market, the business has released a number of electric vehicles under the brand names Tata Nexon EV, Tata Tigor EV, and Tata Altroz EV.

One of the most well-liked EVs in India is the Tata Nexon EV, an all-electric SUV with a range of up to 312 km on a single charge.

The compact sedan Tata Tigor EV has a range of up to 306 km on a single charge.

A luxury hatchback called the Tata Altroz EV is about to be introduced in India. It is projected to have a greater range than any other EV now offered in India, up to 500 kilometres on a single charge.

MG Motors

The British manufacturer MG Motor creates a variety of cars, including electric vehicles. MG offers two electric different kinds at the moment:

The MG ZS EV is a small SUV that is totally powered by electricity. With rapid charging capabilities, the battery can be charged to 80% capacity in only 40 minutes, giving it a range of up to 263 miles (WLTP) on a single charge.

MG5 EV: The MG5 EV is a completely electric estate vehicle with a 214-mile (WLTP) range among charges. There's plenty of ability inside for both people and freight.

Both of these electric cars are built with performance and the environment in mind, making no emissions and generating a small carbon impact.

Kia Motors

Over the past few years, Kia Motors has been aggressively developing electric cars (EVs). The 2018-released Kia Niro EV is one of their most noteworthy EV innovations.

A practical option for each day commuting and extended road trips, the Kia Niro EV is an all-electric crossover SUV with a range of up to 239 miles on a single charge. It drives by an electric motor that generates 201 horsepower and 291 lb-ft of torque and a 64 kWh lithium-ion polymer battery pack.The corporation is aiming to improve the efficiency and accessibility of its EVs while also investing in battery technology.

Overall, Kia Motors' innovations in electric vehicles demonstrate the company's dedication to sustainability and innovation in the automotive industry.

Hyundai Motors

One of the top automakers, Hyundai Motors, has been working hard to produce electric cars (EVs) in order to meet the growing demand for environmentally friendly transportation. The Hyundai Kona Electric, which was initially introduced by the firm in 2018, is their flagship electric car.

An electric motor and a lithium-ion battery pack power the Kona Electric, a small SUV. It can go up to 258 miles on a single charge and sprint from 0 to 60 mph in under 6.4 seconds. Using a 100 kW fast charger, the vehicle's battery can be charged up to 80% in just 54 minutes.

The company's dedication to sustainable transportation and lowering its carbon footprint is shown in large part by Hyundai's electric vehicle range.

Mercedes-Benz

For a while now, Mercedes-Benz has led the way in the design and manufacture

of electric cars (EVs). In reality, the Mercedes-Benz B-Class Electric Drive, the company's first electric car, was introduced in 2014. Mercedes-Benz has since kept up the pace of innovation in the EV market with the release of new models like the EQC SUV and EQS premium sedan.

Mercedes-Benz has made major contributions to the electric car sector, including the advancement of battery technology. The company's most recent electric vehicle models are powered by strong batteries that provide greater driving ranges and faster charging times than previously.

Mercedes-Benz has also made significant investments in infrastructure for electric vehicle charging, and it aims to set up thousands of charging stations across Europe in the ensuing years. The availability of charging stations, which is one of the key worries that many people have about EVs, would benefit from this.

In general, the industry's shift away from fossil fuels has been greatly aided by Mercedes-Benz's dedication to the development of electric vehicles.

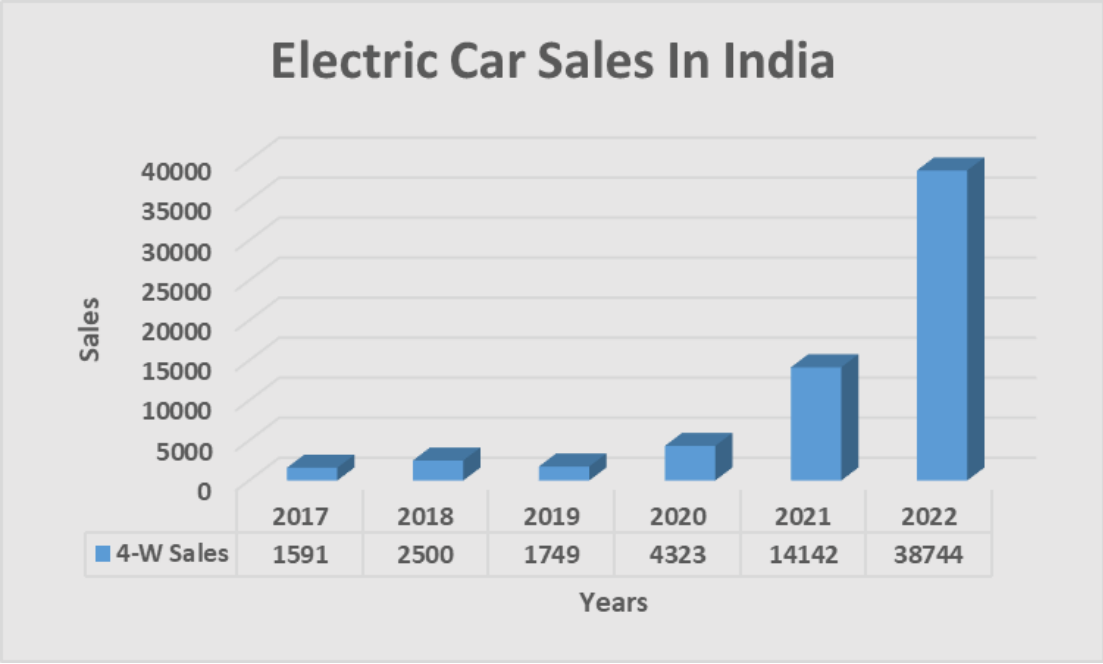
Mahindra & Mahindra Limited

A division of the Indian multinational Mahindra Group, Mahindra Electric has been developing electric cars for a number of years. One of their major achievements is the 2013-released Mahindra e2o electric vehicle in India.

An electric vehicle with four seats is called the e2o. Its 48-volt lithium-ion battery may be charged using a typical 15-ampere home outlet and takes around 5 hours to completely recharge. Additionally, it includes a rapid charging feature that can fully recharge the battery in just one hour, up to 80%.

Mahindra Electric, the company behind the e2o, has also created several electric cars, including the Mahindra e-Verito sedan and the Mahindra eSupro electric van.

Generally speaking, Mahindra Electric's innovations in the sphere of electric cars have been focused on offering long-term and environmentally responsible transportation options.

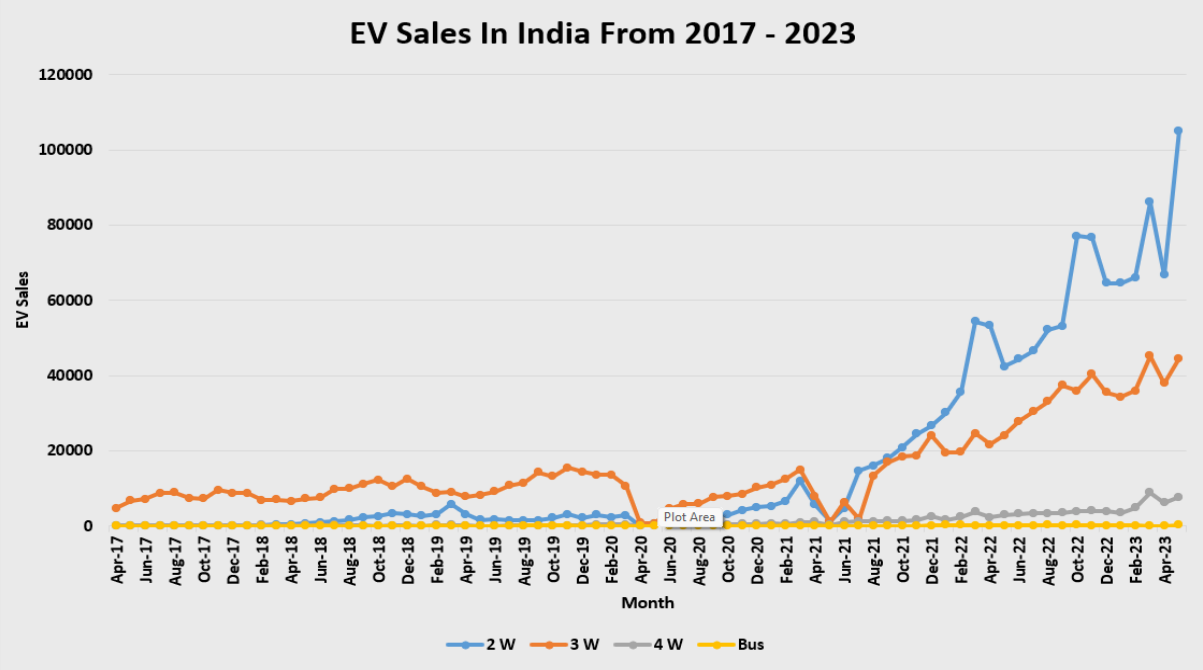


EV Sales From 2017- 2023

YEAR	2 W	3 W	4 W	BUS	TOTAL
Apr-17	96	4748	198	0	5042
May-17	91	6720	215	2	7028
June-17	137	7178	149	1	7465
Jul-17	116	8775	120	0	9011
Aug-17	99	8905	137	0	9141
Sep-17	109	7414	193	0	7716
Oct-17	160	7250	214	0	7624
Nov-17	214	9598	186	11	10009
Dec-17	189	8719	179	0	9087
Jan-18	176	8750	210	29	9165
Feb-18	156	6904	258	88	7406
Mar-18	461	7009	183	18	7671
Apr-18	486	6593	214	68	7361
May-18	681	7276	262	69	8288
Jun-18	956	7556	288	94	8894
Jul-18	1217	9844	278	91	11430
Aug-18	1573	9990	198	49	11810
Sep-18	2257	11130	172	54	13613
Oct-18	2557	12305	90	21	14973
Nov-18	3374	10517	193	87	14171
Dec-18	3168	12501	154	12	15835
Jan-19	2745	10533	86	17	13381
Feb-19	3126	8786	230	97	12239
Mar-19	5866	9000	242	86	15194
Apr-19	3078	7888	124	44	11134
May-19	1666	8256	63	48	10033
Jun-19	1757	9187	60	40	11044

Jul-19	1569	10746	117	81	12513
Aug-19	1506	11527	108	100	13241
Sep-19	1561	14340	180	147	16228
Oct-19	2136	13261	195	157	15749
Nov-19	3144	15543	222	186	19095
Dec-19	2235	14422	122	90	16869
Jan-20	2941	13553	389	9	16892
Feb-20	2353	13622	496	19	16490
Mar-20	2883	10706	428	7	14024
Apr-20	85	870	3	0	958
May-20	558	668	84	0	1310
Jun-20	1511	4662	295	0	6468
Jul-20	1488	5871	359	0	7718
Aug-20	2115	5937	371	0	8423
Sep-20	3089	7747	340	1	11177
Oct-20	2951	7946	462	8	11367
Nov-20	4190	8537	570	34	13331
Dec-20	4948	10242	526	10	15726
Jan-21	5319	10931	657	39	16946
Feb-21	6581	12550	627	186	19944
Mar-21	11963	14931	907	95	27896
Apr-21	5694	7951	1080	156	14881
May-21	1243	1048	262	85	2638
Jun-21	4671	6338	1041	70	12120
Jul-21	14671	1853	1260	49	17833
Aug-21	16046	13309	1202	80	30637
Sep-21	18032	16964	1361	79	36436
Oct-21	20812	18497	1419	84	40812
Nov-21	24528	18690	1681	34	44933

Dec-21	26622	24118	2645	223	53608
Jan-22	30121	19548	1587	331	51587
Feb-22	35708	19621	2474	278	58081
Mar-22	54402	24606	3770	143	82921
Apr-22	53258	21626	2310	166	77360
May-22	42417	24100	3007	167	69691
Jun-22	44372	27846	3280	146	75644
Jul-22	46606	30489	3454	208	80757
Aug-22	52196	33055	3417	228	88896
Sep-22	53210	37404	3589	204	94407
Oct-22	77137	35889	3950	243	117219
Nov-22	76700	40403	4027	118	121248
Dec-22	64598	35542	3879	151	104170
Jan-23	64649	34308	3490	98	102545
Feb-23	66033	35995	4850	99	106977
Mar-23	86194	45225	8852	89	140360
Apr-23	66755	38016	6193	84	111048
May-23	105154	44615	7736	283	157788



This graph indicates the Electric vehicle sales in India from 2017-2023.

According to the graph, two-wheeler sales were at their lowest between 2017 and 2020 due to batteries and technology, and they were at their highest between 2021 and 2023 due to the fact that two-wheelers are typically less expensive than cars and buses, making them accessible to a larger segment of the population. The cost of operating is also reduced for electric two-wheelers. Three-wheelers, often known as auto-rickshaws, have long been a common form of transportation in India.When comparing the monthly average sales of 9661 in 2017–2021 and 32252 in 2022–2023, the rise in 3 wheeler EV sales is almost 333%. Similar variables that affect two-wheelers are also driving the transition toward electric three-wheelers. Three-wheelers are mostly employed for commercial purposes, such as passenger transportation and cargo delivery. Drivers and operators can save money by using electric three-wheelers since they use less gasoline and require less maintenance. In comparison to the previous year's sales, four-wheeler sales have started to rise by 963% in the next few years. The most costly kind of electric vehicle is a bus. This is because buses are enormous, batteries are expensive, and specialised charging infrastructure is required.Electric buses still have a short range. Since buses frequently need to travel across great distances, this is a significant obstacle to their acceptance.Electric buses still have a short range. Since buses frequently need to travel across great distances, this is a significant obstacle to their acceptance. These are the factors that contribute to India's lowest electric bus sales. The sales of EVs were insignificant during COVID-19 and had a market share of little about 58%.

The Future:

The Indian government intends to have put plans in place and offered incentives by 2024 so that more people would be encouraged to buy battery electric vehicles, which are expected to make up 25% of all new auto registrations. In India, the percentage of electric car registrations is now 0.29 %. To do this, a two-pronged technique must be used. India must first develop the necessary infrastructure and technology to enable the production of electric vehicles in order to be genuinely EV-ready. Second, infrastructure must be created to allow for the conversion of old cars into hybrid electric cars, which will aid in lowering pollution levels.

India's current position and long-term goals in the EV industry

The Indian automobile sector is worth around %222 billion, and the country's EV market is anticipated to reach $2 billion in sales by 2023 and $7.09 billion by 2025. Additionally, 8% of all exports from the country come from the automobile sector. 40% of the $31 billion in global research and development expenditures [Research and Development (R&D wing)] are accounted for by this industry.
The automobile industry now employs over 37 million people, and by 2030 it hopes to create 50 million direct and indirect employment.

Between 2022 and 2030, the EV market is projected to develop at a compound annual growth rate (CAGR) of 49%, reaching 10 million annual sales.

The industry received $32.84 billion in equity inflows from FDI between April 2000 and March 2022, or 6% of all FDI in stocks during that time.

Both the economy and the environment could benefit from India's EV sector:

Over the last decade, the global Electric Vehicle (EV) sector has expanded substantially. China has been the leader in the EV industry with great developments in battery manufacturing capabilities, charging infrastructure, new EV model developments. China can produce EV's at a lower rate due to its large manufacturing capacity.

India, on the other hand, is behind other markets in terms of the market penetration of Electric Vehicles. The country has a low acceptance rate when it comes to Electric Vehicles. Considerable work remains to be done in terms of model types, infrastructure available for charging, and financial incentives given to EV manufacturers. One of the primary drivers behind India's recent measures to accelerate the transition to e-mobility is the increase in prices for oil imports, rising pollution, and international pledges to battle global climate change. As a result, India committed to an aspirational goal of having at least 30% of private automobiles as EVs by 2030

Government schemes and accomplishments in this domain:

First, in order to increase EV demand and achieve the aspirational objective, numerous traditional automotive players and oil firms are making significant investments. To name a couple, Indian Oil Corporation announced its ambitions to build 22,000 EV charging stations over the course of three to five years, and Skoda disclosed its intention to develop EVs domestically in India starting in 2021.

secondly, the Indian government has been putting in place a number of programs to support the expansion of electric mobility, such as 100% FDI through the automotive route in the EV space, incubator programs, shared facilities for prototyping and small-scale manufacturing, financial support through the Credit Guarantee Scheme for Start-ups (CGSS), tax breaks, and consumer subsidies.

Thirdly, in 2021, funding for EV startups increased by around 255% to a record-high $ 444 Mn. For instance, the EV companies that obtained the most funding in 2021 were Ola Electric ($253 Mn), Blusmart ($25 Mn), Simple Energy ($21 Mn), Revolt ($20 Mn), and Detel ($20 Mn). The Indian EV ecosystem consists of over 500 firms that span the whole EV value chain, with 63% of these startups being purely focused on manufacturing.

Fourth, the manufacturing Linked Incentive (PLI) program for the automotive sector (with a $3.5 billion budget) recommends financial incentives of up to 18% to promote local manufacturing of high-tech automotive goods and attract capital to the industry's value chain. The PLI program encourages indigenous EV battery production and reduces dependency on imports. As a result, EV prices will drop significantly, and the EV sector will have the infrastructure it needs to thrive.

In the EV industry, India has already met one of the standards. Through the successful commissioning of 20 Solar Based EV Chargers, Bharat Heavy Electricals Limited (BHEL) has made the route between Delhi and Chandigarh the first in the country to be e-vehicle friendly. In the financial year (FY) 2022, India's total number of charging stations increased by 285% year over year; aggressive government action is anticipated to hasten the expansion to 4 lakh stations by FY 2026.

Electricity consumption in future:

Ever pondered how India's need for power would be affected by the use of electric vehicles? Many business experts predict that over the next one to two years, the domestic market will grow to a whole new level as a result of the country's rapid electrification of transportation.

Even in the most optimistic scenario of 100% EV sales by 2030, the sector's power demand will be 97 terawatt-hour (TWh), according to a 2019 analysis by Brookings India. Electricity demand would be 37 TWh in a more probable scenario in which EV sales would represent 33% of total sales. In the meanwhile, Brookings predicts that India would produce 2074 TWh of power by 2030 in a conservative scenario and 2785 TWh in an ambitious scenario. In both the best and worst case scenarios, the share of EVs in total power demand would be no less than 1.3 percent and no more than 4.8 percent.

India's energy consumption is predicted to double by 2040, while that for electricity may treble as a result of rising appliance ownership, according to the NITI Aayog's energy policy study.

Challenges for electric vehicles in India:

India has made significant progress in the transition to alternative modes of transportation because to the unexpected growth in the number of electric cars there. It's time for the government and citizens to transition to green mobility and address the significant hurdles for electric cars in India given the country's rising pollution levels, of which transportation is a big source.

The cost of EV technology is greater, hence the price of electric vehicles in India may be a major deterrent. The average cost of an ICE (internal combustion engine) automobile in India is between 5 and 6 lakhs, while the lowest cost of an electric car is approximately 10 lakhs, which is too expensive for the vast majority of middle-class Indians.

EV firms that have not yet entered the Indian market have made significant advances in EV technology. Customers have a fixed attitude of restriction due to the lack of options, which is a major concern for the sector.

For EV manufacturers, overcoming the wait time for charging might be a significant challenge. Flash charge technology is not included in every car that has been introduced thus far. Public transportation is a significant form of transportation, and passengers dread waiting while they are traveling for a recharge.

EV firms that have not yet entered the Indian market have made significant advances in EV technology. The lack of options forces consumers to adopt a fixed attitude of constraint, which is a significant barrier for the industry.

An enormous challenge for EV manufacturers to overcome is the length of time required to charge an electric car. Not all automobiles that have been released to date include flash charging technology. The primary mode of transportation is public transportation, which detests waiting while traveling for a recharge.

It is quite difficult to locate a skilled individual for the repair and maintenance of EVs due to the lack of understanding about electric vehicle systems among repair experts in India. The vehicle's high level of technology makes local repair shops nearly impossible and dangerous.

Due to India's subpar EV infrastructure, Indian customers have a predetermined attitude of range anxiety. A significant obstacle to the country's adoption of electric cars is the unavailability of models with strong 300+ km ranges. The models that are now available have a range of 150–200 km within cities.

Modern electric vehicles are increasingly using lithium-ion batteries because of their great performance and capacity for quick charging. Recent studies and advancement in the EV sector are a result of the domestic production of lithium-ion batteries for use in Indian 2-wheelers and 3-wheelers. Due to a lack of lithium sources, India does not develop any lithium-ion batteries for use in EVs.

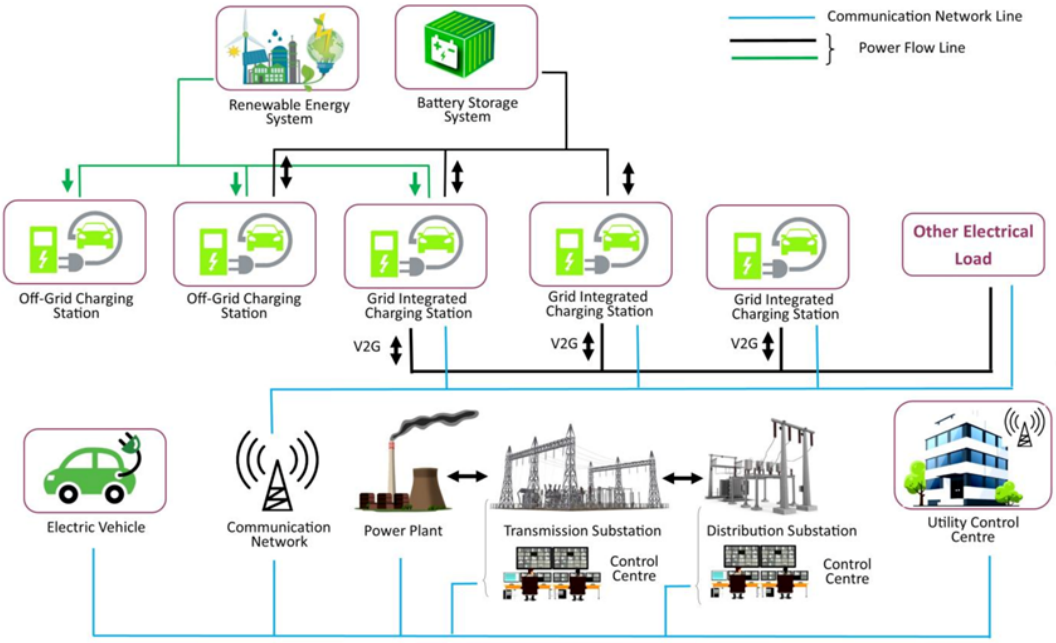
The cost of purchasing electric car batteries is extremely high due to India's lack of lithium sources and the necessity of importing it from other nations. In India, an electric car battery typically costs roughly 2.1 Lakhs.The cost of owning an EV in India at the moment is quite high due to the necessity to change batteries every 3–4 years.

Charging technology

The ability to shift charging has a significant impact on emissions even when EV load may be tiny in comparison to the overall system load. The lack of standard charging infrastructure and the scarcity of charging infrastructure causes EV owners to worry about finding a charging station for a top-up, even if one is available, and about whether the connector type at the charging station matches their vehicle type or not. In truth, there is a lack of compatibility since three technologies with various connections and communication protocols now account for the majority of the EV and EV Service Equipment (EVSE) industry. Connecting EVs to the electrical grid is made possible by charging technology, which is divided into three major categories, especially conductive charging, inductive charging, and battery swapping.

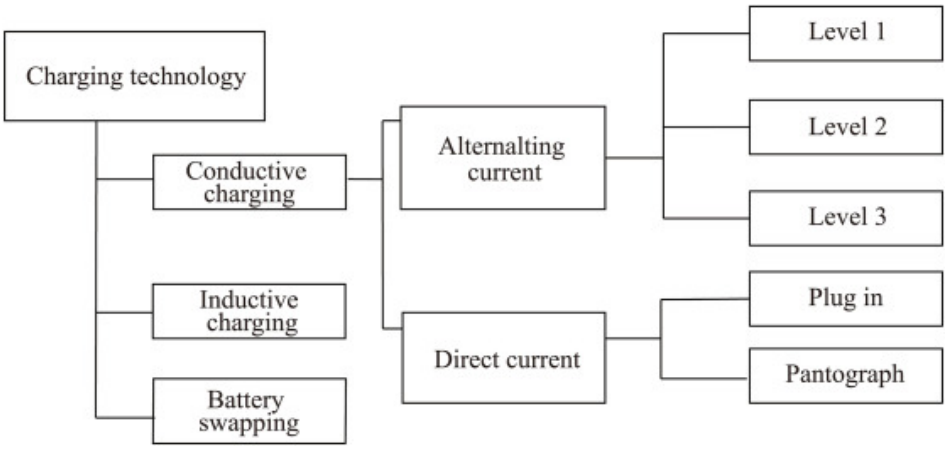
Basic electric vehicle (EV) charging infrastructure
Generalised layout of charging infrastructure for electric vehicles.

Conductive Charging



In conductive charging, the EVs are charged by alternating current (AC) or direct current (DC). An EV battery can be recharged by conductive AC charging if the EV possesses an on-board charger that can convert supplied AC to DC.

Parameter	Classification of conductive charging		
	Level 1	Level 2	Level 3
Specification	Utilises a standard 120 V AC electrical outlet, and a standard 3-prong plug.	Charging at a permanently fastened charging facility at a fixed spot, 240 V.	Also known as DC fast chargers, utilises a 480 V DC.
Charge time	8–30 h to completely charge an EV.	4–10 h to completely charge an EV subject to the size of the battery.	25–30 min to charge a battery electric vehicle to 80%.
Installation cost	None	1000–5000 USD	50,000–100,000 USD



Level 1:

- Specification: A regular 3-prong connector and 120V AC electrical outlet are used for Level 1 charging. It is the simplest and most typical type of EV charging accessible.
- Charge Period: It normally requires 8 to 30 hours to fully charge an EV using Level 1 charging. The battery capacity of the car determines the precise time.

Level 2:

- Specification: Level 2 charging entails utilising a charging station that has been permanently established and is connected to a fixed location. It needs a 240V power supply, which is frequently delivered via specific charging apparatus.

- Charge Time: When compared to Level 1 charging, Level 2 charging considerably shortens the charging time. Depending on the size and capacity of the battery, it typically takes an EV between 4 and 10 hours to charge completely.
- Installation Cost: The upfront cost for installing Level 2 charging infrastructure generally ranges from $1,000 to $5,000 USD. Depending on elements like the installation's complexity and location, the precise costs may change..

Level 3:

- Specification: The quickest charging method for EVs is level 3 charging, sometimes referred to as DC fast charging. It makes use of powerful charging stations that provide 480V direct current (DC)..
- Charge Period: Level 3 charging allows for quick charging, enabling EVs to reach 80% of their capacity in around 25 to 30 minutes. It allows drivers on the go the ability to quickly top off.
- Cost of installation: Level 3 charging infrastructure is more complicated and expensive. Due to the specialist equipment and increased power needs, installation costs generally vary between $50,000 and $100,000 USD.

Depending on their charging requirements, convenience, and time limits, EV owners have a variety of alternatives thanks to these three levels of conductive charging. The choice of the charging level is influenced by a number of variables, including the infrastructure that is available, the required charging speed, and financial constraints.

UNION BUDGET 2023-2024 Recommendations by Society of Manufacturers of Electric Vehicle (SMEV)

Taxation: GST Uniformity -

While the car is subject to 5% GST, there is no clarification regarding the tax on replacement components, therefore the industry is forced to pay 28% (apart from batteries). Therefore, it is requested that all EV spare components be subject to a standard 5% GST.

Basic Customs Duty on Cells-

Given that Lithium-Ion cell production in the nation is still in its infancy, I would ask that the GoI examine the proportion of customs duty for cells used in EV manufacture. Reduce customs taxes to 0% till cells are produced in India, also due to a significant rise in price as a result of AI 156.

FAME Subsidy:

On March 31, 2024, FAME II will no longer be valid. Since we haven't yet achieved the penetration the subsidy was designed to catalyse, we think FAME's validity has to be extended. Instead of being time-based, the new FAME II plan should be connected to E-mobility conversion. Market trends indicate that E Mobility, in particular E2W, has the ability to expand until it reaches 20% of the whole 2W market. After that, the subsidy may be reduced. Provisions for transferring the subsidy to the customers directly should be included in the FAME II program.

Financing of the EVs:

Support lowering the interest rates imposed on EV users. Extend the guarantee provided by the World Bank and NITI Aayog through SIDBI to include commercial four- and six-wheelers.

Contribute to lowering the interest rate on loans taken out to establish EV production facilities by pure EV OEMs. A vast network of charging infrastructure must be made possible in order for EVs to become more widely used. A 50% CAPEX subsidy from the government is required to be provided in order to install charging infrastructure across the nation.

To guarantee that more funding sources are opened up, EV finance will be incorporated into priority sector loans.

Reduction on GST for BaaS and EaaS Models from 18% to 5%:

Customers now pay an 18% GST fee for each transaction they make at an EV charging station and for each battery switched at a battery swap station.

Retail customers do not have this choice and must pay the tax as a cost; corporate customers can get an input tax credit on the GST paid during this transaction.

Statement of the Problem :

Due to a variety of circumstances, such as the slowing economy, the disruption of supply chains, and the lack of government incentives, the sales of electric cars (EVs) in India plummeted by over 1463% during the COVID-19 epidemic in April 2020. However, EV sales have increased dramatically after the epidemic in march 2021. This is brought on by a variety of causes, such as growing public knowledge of the environmental advantages of EVs, the implementation of new government incentives, and the accessibility of more reasonably priced EVs.

The following elements can be responsible for the variations in the data and outliers:

- Pandemic COVID-19
- new government incentives being implemented
- the presence of more reasonably priced EVs
- The shifting consumer tastes

Before beginning any data analysis, it is crucial to exclude outliers from the data. Outliers might distort the analysis's findings and make it challenging to draw reliable conclusions.
Researchers can obtain a more accurate view of the patterns in EV sales in India by eliminating the outliers. This data may be used to guide policy choices and hasten the adoption of electric vehicles in India.
Data points known as outliers diverge dramatically from the rest of the data. They can bias statistical analysis results, making it challenging to derive reliable conclusions.
Outliers in polynomial regression may be eliminated by examining the 95% of the data set that is within two standard errors, and if the projected residuals are bigger than two standard errors, they are deemed outliers. The standard error serves as a gauge for the range of the projected values. The residuals represent the variation between actual and expected values.

Large residuals in a data point are frequently used to identify outliers. This indicates that the outlier's anticipated value differs greatly from its actual value.
Twelve outliers in all have been found and eliminated from the data set. The polynomial regression model's accuracy will benefit from this.

Regression :-

Regression is a statistical technique used in finance, investing, and other fields that aims to ascertain the nature and strength of the relationship between a single dependent variable (often represented by Y) and a number of other factors (referred to as independent variables).The most used variant of this method is linear regression, which is also known as simple regression or ordinary least squares (OLS). A line of greatest fit is used in linear regression to determine the linear connection between two variables. There are other non-linear regression models, although they are far more difficult.
In this article we share the 3 most commonly used regression models in real life ;

1.Linear Regression
A regression model that depicts the connection between one or more predictor variables and a numerical response variable is fitted using linear regression.

2.Logistic regression
A regression model that depicts the connection between one or more predictor variables and a binary response variable is fitted using logistic regression.

3. Polynomials Regression
Regression models that explain the connection between one or more predictor variables and a numerical response variable are fitted using polynomial regression.

4. Multivariate Regression
By taking into account several independent variables to forecast the dependent variable, multiple regression expands on linear regression. It can manage scenarios when several different elements have an impact on the result.

Methodology

The main objectives of this study are as

-To analyse the Electric Vehicle Sales growth in future in India

Hypothesis:

1. There is a significant relationship between Year and Sales data in India

H0: $p = 0$ (no significant correlation)
H1: $p \neq 0$ (Significant correlation)

2. Regression Analysis of Sales Data on Year in India

H0: it's possible that future electric vehicle sales will not follow the current trend of growth.
H1: It is reasonable to expect that the trend of increasing electric vehicle sales will continue in the future.

Correlation:-

Using statistical correlation, one can measure the relationship between two or more variables in a data collection. It helps us understand the nature and direction of the relationship between these variables. The most popular method for calculating correlation is the Pearson correlation coefficient, which ranges from -1 to 1.

To ascertain the linear relationship between two continuous variables, the Pearson correlation coefficient, commonly abbreviated as "r," is utilised. This formula is used to compute it:

r = (Σ[(xi - x̄)(yi - ȳ)]) / (n * sx * sy)
Where:

- Σ represents the summation symbol, which means to sum up all the values.
- xi and yi are individual data points of the two variables.
- x̄ and ȳ are the means of the two variables.
- n is the total number of data points (sample size).
- sx and sy are the standard deviations of the two variables.

	Years	**Total**
Years	1	0.825247
Total	0.825247	1

"Years" and "Total" have a correlation coefficient of almost 0.825. This shows that there is a strong positive linear relationship between these two variables since the value is positive and close to 1. This implies that the "Total" variable tends to rise when the "Years" variable increases, and vice versa. The strength of the positive linear link between the two variables increases as the correlation coefficient approaches 1.

Polynomial Regression Analysis:-

An nth degree polynomial in x is used to model the connection between the independent variable x and the dependent variable y in polynomial regression. A nonlinear connection between the value of x and the associated conditional mean of y, denoted E(y |x), can be fit via polynomial regression. Despite fitting a nonlinear model to the data using polynomial regression, the regression function E(y|x) is linear in the unknown parameters that are estimated from the data, making polynomial regression a linear statistical estimation issue.

The formula for polynomial regression is:

y = β0 + β1x + β2x^2 + β3x^3 + ... + βnx^n

When there is no linear relationship between the independent and dependent variables, polynomial regression is performed. For instance, a polynomial regression model with a degree of 2 can be used to fit the data if the relationship between x and y is quadratic.
Numerous issues may be resolved with polynomial regression, including:

A potent technique for simulating complicated interactions between variables is polynomial regression. Prior to fitting the model, it is crucial to thoroughly examine the data since polynomial regression can be sensitive to outliers.
Overall, polynomial regression is an effective technique for simulating intricate connections between variables. Before utilising it, it's crucial to understand its constraints.
Additional formulae for polynomial regression analysis include the following:
Sum of squared errors (SSE), a metric for gauging how well a model fits the data, is used. The formula is as follows:

SSE = Σ(y - y^)^2

where:

- y is the dependent variable's actual value.
- y^ is the dependent variable's anticipated value.
- The summation operator is in Σ
- The amount of variance in the dependent variable that the model is able to account for is expressed as the coefficient of determination (R^2). The formula is as follows:

R^2 = 1 - SSE/SST

An effective approach for simulating intricate interactions between variables is polynomial regression analysis. However, polynomial regression may be a useful tool for researchers who are trying to understand the relationship between variables. It's crucial to be aware of its limits before utilising it.

This study is based on the secondary data collected from various sources like research papers, websites, articles, reports, etc.
Methods of data analysis

$y = 37.619*X^2 - 1536.9*X + 21013$

Summary :-

Regression Statistics	
Multiple R	0.960095635
R Square	0.921783629
Adjusted R Square	0.919132226
Standard Error	8712.469364
Observations	62

A polynomial regression model with a multiple R of 0.98 demonstrates excellent ability to explain variance in the dependent variable. The more closely a model fits the variance in the dependent variable, the closer the multiple R is to 1.

A multiple R of 0.98 indicates that the independent variables in the model account for 98% of the variation in the dependent variable. This is a very high number, indicating that the model does a great job at forecasting the value of the dependent variable.

An R-squared score of 0.92 implies that 92% of the variance in the dependent variable is explained by the polynomial regression model. This indicates that the model fits the data well and may be applied to generate reliable forecasts.

An improved fit between the model and the data is shown by a greater R-squared value. It is crucial to remember that the number of variables in the model might have an impact on R-squared, which is not a perfect measure of fit. This implies that 92.17% of the variation in the dependent variable can be explained by the model.

The polynomial regression model provides an excellent match for the data in this instance, as shown by the R-squared value of 0.92. The model may thus be used to create precise projections regarding the future sales of electric vehicles in India.

R-square that has been "adjusted" takes into consideration the number of independent variables in the model. An improved fit of the model is shown by a greater Adjusted R Square. The Adjusted R Square in this instance is 0.919132226, indicating that even after accounting for the model's large number of independent variables, the model still exhibits excellent data fit
.
The standard error serves as a gauge of how accurately the model predicts the future. The predictions of the model are said to be more accurate when the Standard Error is smaller. The Standard Error in this instance is 8712.469364, indicating that the model's predictions were fairly accurate.

The amount of data points that were utilised to fit the model is called observations. There were 62 observations in this instance.

Overall, the polynomial regression model's statistical terms imply that the model has a good fit to the data and makes somewhat accurate predictions.

ANOVA

	df	SS	MS	F	Significance F
Regression	2	52779572310	26389786155.20	347.66	2.25051E-33
Residual	59	4478520223	75907122.42		
Sales	61	57258092533			

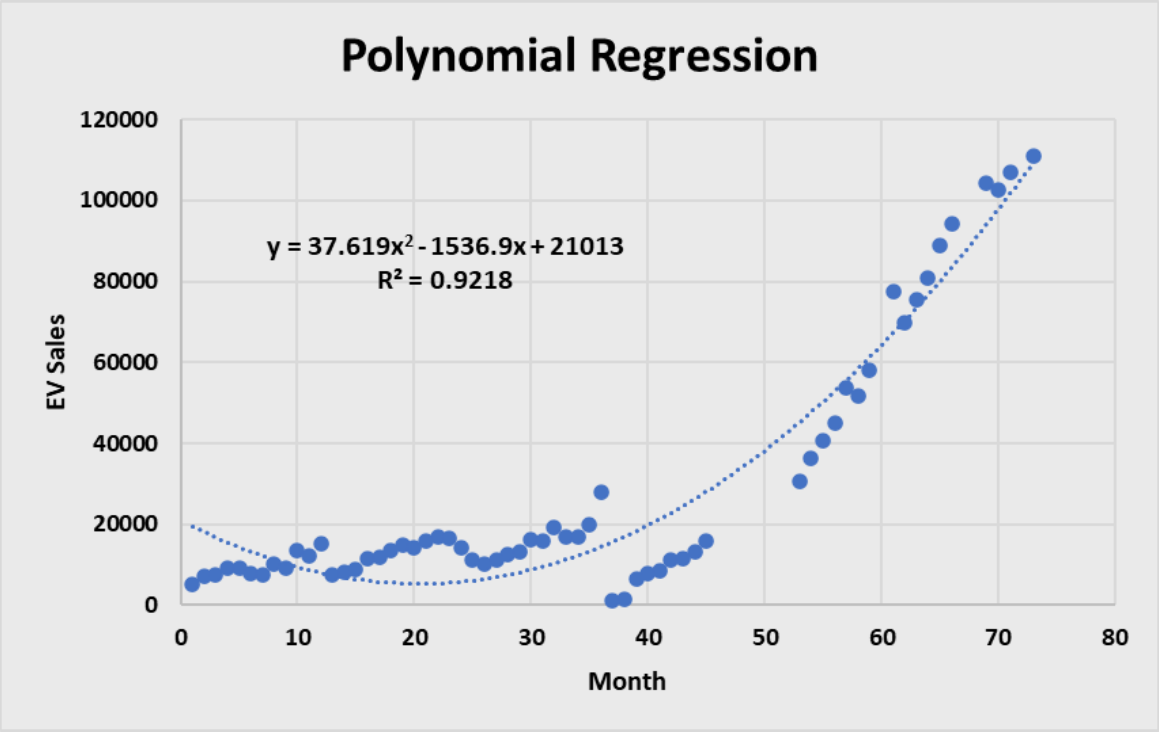
The residuals are displayed in the Residual row of the ANOVA table for a polynomial regression model. The residuals' degrees of freedom are displayed in the DF column. The residuals' sum of squares is displayed in the SS column. The residuals' mean square is displayed in the MS column. The residuals' F-statistic is displayed in the F column.

F represents the polynomial regression's significance. The likelihood that observed variations between the predicted values and the actual values are the result of chance is quantified by an ANOVA table. A high significance F means that the model is a strong match for the data and that the differences are unlikely to be the result of chance.

By dividing the mean square regression by the mean square error, the significance F is computed. The difference between the anticipated and actual values is measured by the mean square regression and the mean square error, respectively.

A p-value is often used to express the importance of F. There is less than a 5% probability that the observed differences are the result of chance when the p-value is less than 0.05, which is the threshold for statistical significance.

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	21013.2556	3229.54273	6.50657	1.84053E-08	14550.95	27475.55574
Years	-1536.9200	209.852437	-7.3238	7.65004E-10	-1956.83	-1117.00633
Year^2	37.6190732	2.79155766	13.4760	1.16207E-19	32.03	43.2049672



The value of the dependent variable when the independent variable is equal to zero is known as the intercept value in a polynomial regression model. It is, in other words, the mean value of the dependent variable when the independent variable is constant.

The intercept value of 21013.25 indicates that when the year is equal to zero, the mean price of electric car sales in India is 21013.25. Given that electric vehicles have been marketed in India since 2017, this estimate is unrealistic. The polynomial regression model's intercept value, nevertheless, might still be helpful in understanding the model's findings.

P-value: If the null hypothesis (the coefficient being equal to zero) is correct, then there is a chance that a t statistic as severe as the one computed will be seen. The coefficient is statistically significant if the p-value is low. The p-values in this situation are all extremely low (for example, 1.84053E-08), showing strong evidence against the null hypothesis.

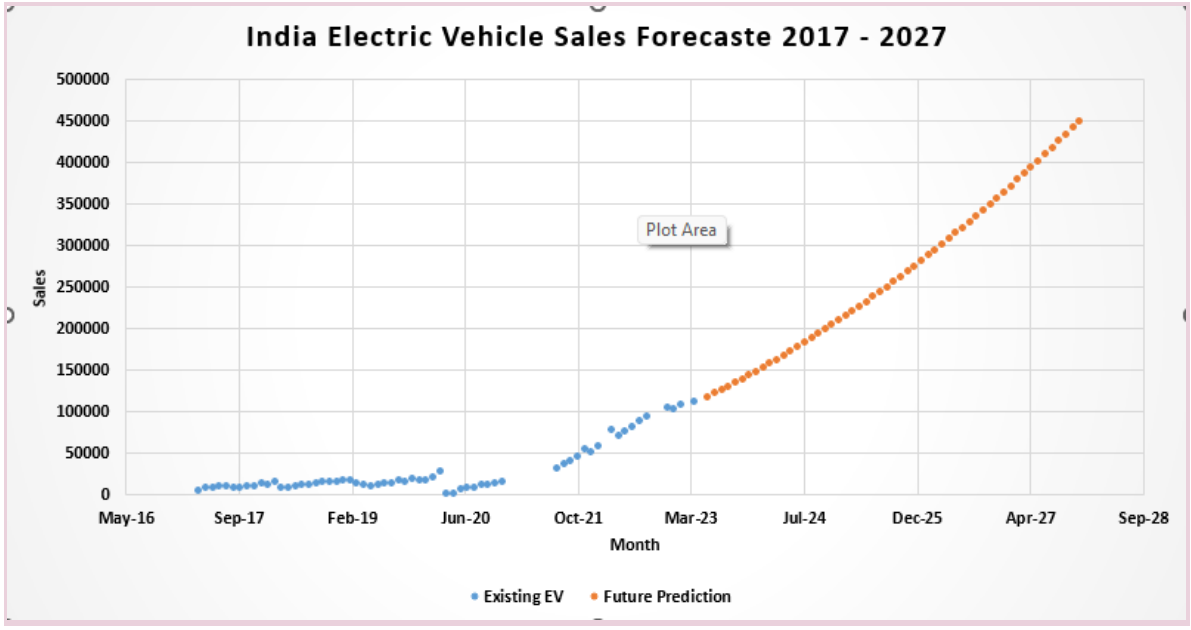
The t-statistic for the intercept is 6.50657, which is calculated by dividing the coefficient estimate by its standard error. This t-statistic suggests that the intercept is significantly different from zero.

The t-statistic for the "Years" coefficient is -7.3238, indicating that the estimated effect of "Years" is significantly different from zero.

The t-statistic for the "Year^2" coefficient is 13.4760, suggesting a significant effect of the squared "Year" variable on the dependent variable.

We can be reasonably confident that the true population values fall within a range defined by the lower and upper bounds of the 95% confidence intervals:

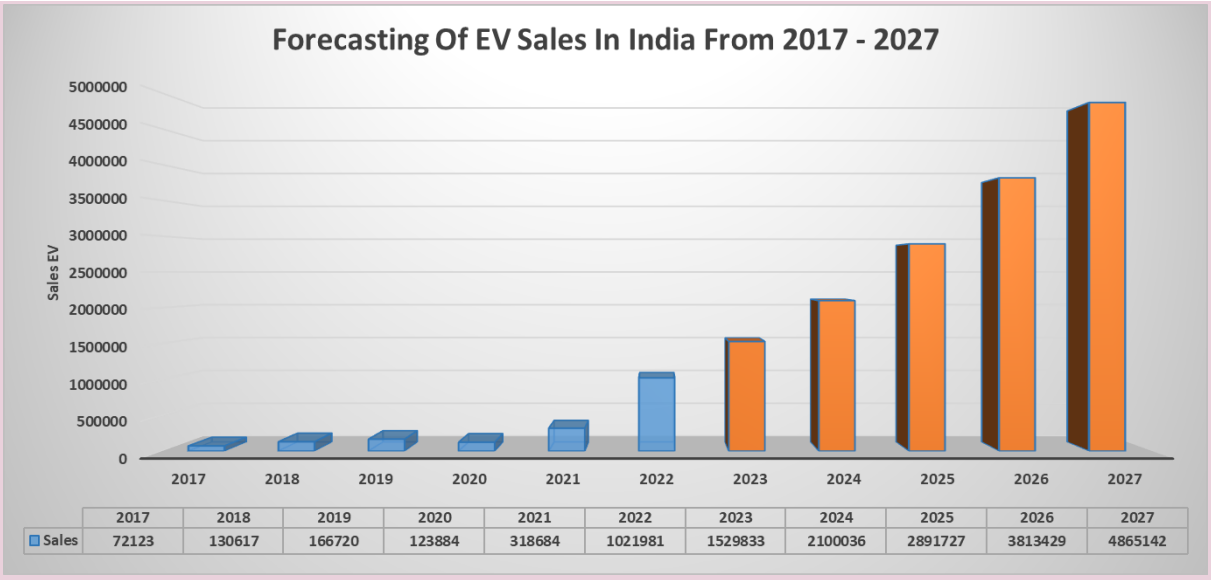
- The intercept has lower and upper bounds of 14550.95 and 27475.55574, respectively.
- The "Years" coefficient has lower and upper bounds of -1956.83 and -1117.00633, respectively.
- The "Year2" coefficient has lower and upper bounds of 32.03 and 43.2049672, respectively.



This chart shows the existing EV sales in India from 2017 till march 2023 and further there's future prediction from 2023-2027. From 2026 the sales will always be above 350000.

Future EV Sales From 2023- 2027

Jun-23	117352
Jul-23	121496
Aug-23	125715
Sep-23	130009
Oct-23	134378
Nov-23	138823
Dec-23	143342
Jan-24	147937
Feb-24	152608
Mar-24	157353
Apr-24	162174
May-24	167070
. . . .	. . . .
Jun-27	401112
Jul-27	408867
Aug-27	416697
Sep-27	424603
Oct-27	432584
Nov-27	440639
Dec-27	448771



This figure indicates the total number of EV sales in each year from 2017-2027 including the future prediction.

Conclusion:

The null hypothesis was rejected because there was a significant correlation between the Year and Sales data, indicating that these variables are correlated strongly. It is reasonable to anticipate that the trend of rising electric vehicle (EV) sales in India will continue in the future based on this finding.

With an estimated on-road electric vehicle count of 1 crore 70 lakhs in both the current and future years, the data shows an approximate increase in sales of 1 crore 45 lakhs. This growth is quite encouraging.

This growth will be fueled by the EV market's expansion in the two-wheeler and automobile segments. Sales will also be significantly boosted by the growing use of EVs and the government's continued support of the EV industry through advantageous policies and incentives.
Given these statistical results, it is obvious that the Indian EV market has a bright future. India stands a good chance of becoming a global leader in the electric vehicle sector with the right strategies in place. The country's EV market is set for a bright and sustainable future thanks to the rising popularity of EVs and encouraging government initiatives.

Reference

introduction
https://e-vehicleinfo.com/top-10-electric-vehicle-manufacturers-in-india/
https://www.smev.in/

Both the economy and the environment could benefit from India's EV sector:

https://e-vehicleinfo.com/government-policies-and-incentives-for-electric-vehicles-in-india/

https://www.investindia.gov.in/team-india-blogs/electric-vehicle-ev-sector-india-boost-both-economy-and-environment#:~:text=Secondly%2C%20the%20Indian%20government%20has%20also%20been%20implementing,Start-ups%20%28CGSS%29%2C%20tax%20breaks%2C%20and%20subsidies%20for%20consumers

Data Collection
India's Electric Vehicle Sales Trend | November 2022 • EVreporter

Electric two-wheeler sales charge past 275,000 units in H1 FY2023, Ola Electric bounces back | Autocar Professional

Three Wheeler, Rickshaw Sales Apr 2022 - Bajaj, YC Electric, Mahindra, TVS (rushlane.com)

10 Electric Two Wheeler Sales

Top 10 Electric Two Wheeler Sales H1 2022 - Okinawa No 1, Ola 3, TVS 7, Bajaj 9 (rushlane.com)

Three Wheeler Sales Increase By 28.37% In January 2022 (tractorjunction.com)

Electric Rickshaw, Three Wheeler Sales Feb 2022 - Mahindra, Piaggio, YC, Terra (rushlane.com)

India's Electric Vehicle Sales Trend | September 2022 • EVreporter

Electricity consumption in future:

https://www.brookings.edu/articles/the-future-of-indian-electricity-demand-how-much-by-whom-and-under-what-conditions/

'Made in India' luxury electric car

https://www.hindustantimes.com/car-bike/mercedes-launches-eqs-580-first-made-in-india-luxury-electric-car-101664606662992.html

https://www.financialexpress.com/auto/car-news/hyundai-india-may-2022-sales-breakup-creta-remains-best-seller/2554635/

Electric Buses Sales Trend

https://e-vehicleinfo.com/ev-sales-data-april-2022/#:~:text=Volvo%2C%20and%20Porsche.-,Electric%20Buses%20Sales%20Trend,and%20Olectra%20Greentech%20(18%25)

https://e-vehicleinfo.com/ev-sales-data-april-2022/#:~:text=Volvo%2C%20and%20Porsche.-,Electric%20Buses%20Sales%20Trend,and%20Olectra%20Greentech%20(18%25)

https://e-vehicleinfo.com/ev-sales-data-april-2022/

https://evreporter.com/indias-electric-vehicle-sales-trend-september-2022/

Electric Two Wheeler Sales 2021 Jan To Nov - Hero, Ather, Revolt, Okinawa, Ampere (rushlane.com)

https://www.autocarpro.in/analysis-sales/electric-two-wheeler-sales-in-india-soar-305-in-cy2022-to-race-past-600000-units--113705

Electricity consumption in future:

https://auto.economictimes.indiatimes.com/news/industry/india-stares-at-power-outages-will-evs-add-to-the-burden-of-its-stretched-power-sector-in-future/87010652#:~:text=In%20a%20more%20realistic%20scenario%20where%20EVs%20would,scenario%20and%202785%20TWh%20in%20an%20ambitious%20scenario

Challenges for electric vehicles in India
https://ecogears.in/top-10-challenges-for-electric-vehicles-in-india/

https://inc42.com/features/how-electric-vehicles-will-impact-electricity-demand-indias-grid-capacity/

Review article (Charging infrastructure planning for electric vehicle in India)

https://www.sciencedirect.com/science/article/pii/S2666660X22000706#bib16