MS 5193 – PROGRAMMING PROJECT PROPOSAL DOCUMENT

FOR

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PROPOSAL TOPIC

An In-depth Examination of Parameters Contributing to the Success of Electric Vehicle Business Models

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1.0 Introduction

In response to the pressing global imperative of reducing CO_2 emissions, the automotive industry is undergoing a profound transformation, marked by the introduction and commercialization of electric vehicles (EVs) (Secinaro et al., 2020). Both established automotive giants and entrepreneurial newcomers have recognized this shift and are actively developing hybrid and electric vehicles in response (Umar et al., 2021). Governmental and non-governmental incentives further bolster the prominence of EVs in the market (Yang & Tan, 2019). Heightened environmental concerns are spurring consumer interest in electric vehicles, and the convergence of technological progress, public subsidies, and rising consumer enthusiasm is poised to revolutionize the transportation landscape, transitioning it toward electricity-based systems from conventional internal combustion engines (ICEs). However, despite these encouraging attributes and favorable conditions, the electric vehicle market has not been scaling up to the extent envisioned by government and manufacturer strategies (Ziegler & Abdelkafi, 2022).

1.1 Objective/hypothesis

The primary objective of this pilot project is to investigate existing datasets pertaining to the market share (supply and demand) of electric vehicles (EVs) and to gain insights into the various factors influencing the increase in the customer adoption of EVs in the market. This analysis aims to identify key variables that can form the foundation for more extensive research on the development of a viable EV business model. In the initial phase of EV business model development, examining these factors in the context of EV adoption will aid in the establishment of a structured framework for the business model. Consequently, this project has the potential to yield valuable insights that can benefit businesses, policymakers, and researchers, facilitating well-informed decision-making for the future growth of the electric vehicle industry. The ultimate objective of this project is to provide empirically supported insights about the critical factors that contribute to the success of an EV business model, which can be particularly valuable for guiding newcomers entering this specialized market.

1.2 Methodology

The review of the literature pertaining to the electric vehicle (EV) business model has identified various parameters that can influence the diffusion of EVs. Given the scope of this pilot project, specific parameters were selected, including the distribution of charging infrastructure, the likelihood of households owning electric vehicles, household income, household size, travel behavior, and the total cost of ownership, both with and without the initial purchase cost. Data for these parameters were gathered based on state-wise market distribution. Regression analysis will be used in the analysis.

1.3 Significance

The primary significance of this pilot project lies in its endeavor to discern and elucidate the critical determinants that impact the electric vehicle (EV) business model. This holds pivotal relevance for emerging players seeking to establish their supply and demand chain operations in a manner that effectively captures their intended market. The insights derived from this project are poised to serve as foundational guidelines, offering preliminary recommendations to prospective EV business entities seeking market entry.

Furthermore, the pivotal factors underscored within this project have the potential to inform policymakers in their efforts to prioritize key attributes of the EV business model, especially concerning the development of short-term and long-term infrastructure. This data-driven endeavor also contributes to the ongoing academic discourse surrounding the evolution of the EV business model.

2.0 Related literature

1) Breetz, H. L., & Salon, D. (2018). Do electric vehicles need subsidies? Ownership costs for conventional, hybrid, and electric vehicles in 14 US cities. Energy Policy, 120, 238–249

Brief description:

In Breetz and Salon's 2018 literature, they wade through the numbers to answer a crucial question about electric vehicles (EVs) and subsidies. The dataset they use is a compilation of ownership costs for three types of vehicles: conventional, hybrid, and electric. Imagine it as a garage full of financial details, mileage numbers, and maintenance costs.

Now, the method these researchers used is like a roadmap to navigate this vast data landscape. They've outlined how they gathered and crunched the numbers, providing a transparent guide for others to follow their research footsteps. Think of it as the behind-the-scenes magic that turns a mountain of data into meaningful insights about the costs of owning different types of vehicles in various US cities. Efficient, isn't it?

2) Ziegler, D., & Abdelkafi, N. (2022). Business models for electric vehicles: Literature review and key insights. Journal of Cleaner Production, 330, 129803.

Brief description:

They navigate the landscape of business models for electric vehicles (EVs) with a keen eye. The dataset at their disposal is likely a compilation of various business models related to electric vehicles. Think of it as a collection of blueprints, financial structures, and strategic frameworks that companies use to navigate the world of electric mobility.

Now, the method they employ is like a compass guiding them through the vast sea of literature. It's a well-thought-out strategy to sift through existing studies, extracting key insights and patterns from the multitude of business models presented. They probably detail their criteria for selecting and analyzing literature, providing readers with a roadmap to understand the current state and trends in the world of electric vehicle business models. It's like peering into the intricate machinery that propels the business side of electric mobility. Quite the journey.

3) Danielis, R., Rotaris, L., Giansoldati, M., & Scorrano, M. (2020). Drivers' preferences for electric cars in Italy. Evidence from a country with limited but growing electric car uptake. Transportation Research Part A: Policy and Practice, 137, 79–94.

Brief description:

The focus is on unraveling the preferences of drivers towards electric cars in Italy. The dataset they employ is likely a comprehensive collection of information, capturing the intricacies of driver preferences. Imagine it as a mosaic of factors such as driving habits, economic considerations, and environmental attitudes, forming a detailed picture of the Italian landscape in terms of electric vehicle adoption.

Now, their method is the roadmap guiding this exploration. They've crafted a systematic approach to gather and analyze data, revealing insights into the factors influencing the adoption of electric cars in a country where the uptake is still in its nascent stages. This could involve surveys, interviews, or other research methods to delve into the minds of drivers. The goal is to understand the nuances that shape preferences in a context where electric vehicles are gradually gaining traction. It's like navigating through the evolving terrain of Italy's electric mobility landscape, providing valuable insights for both researchers and policymakers. Quite a journey into the realm of transportation preferences

4) Dijk, M., Wells, P., & Kemp, R. (2016). Will the momentum of the electric car last? Testing an hypothesis on disruptive innovation. Technological Forecasting and Social Change, 105, 77–88.

Brief description:

The intrigue lies in the examination of the momentum behind electric cars and the sustainability of their impact. The dataset they employ is likely a treasure trove of information, a collection of data capturing the evolution and dynamics of the electric car market. Think of it as a detailed timeline documenting the rise and potential challenges faced by electric vehicles.

Their method is a systematic investigation, akin to a scientific detective story. They likely propose and test a hypothesis related to disruptive innovation in the electric car sector. This involves scrutiny of trends, analysis of market forces, and perhaps statistical modeling to test the robustness of their hypothesis. Their approach could involve a mix of quantitative and qualitative methods, providing a comprehensive understanding of the factors influencing the momentum of electric cars.

In essence, they're like investigators, seeking to unveil the forces that may shape the future of electric mobility. It's a methodical exploration into the complex world of technological forecasting and social change, offering valuable insights into the staying power of electric cars. Quite a journey into the realm of disruptive innovation

5) Dorcec, L., Pevec, D., Vdovic, H., Babic, J., & Podobnik, V. (2019). How do people value electric vehicle charging service? A gamified survey approach. Journal of Cleaner Production, 210, 887–897.

Brief description:

The spotlight is on understanding how people perceive the value of electric vehicle charging services. Their dataset is likely a collection of responses gathered through a gamified survey approach. Picture it as a mosaic of opinions, preferences, and perceptions, capturing the nuanced perspectives of individuals regarding electric vehicle charging services.

The method they employ is particularly intriguing—it involves a gamified survey approach. This means they've designed the survey in a game-like manner to engage respondents, making the process more interactive and, perhaps, enjoyable. This creative method is not only innovative but also has the potential to yield richer and more authentic responses from participants.

So, in essence, they've crafted a research journey that combines traditional survey methods with elements of gamification, providing a unique lens into the way people value electric vehicle charging services. It's like turning data collection into a game, making the study not only informative but also a bit more fun for those involved. Quite a refreshing takes on understanding consumer perspectives.

6) Umar, M., Ji, X., Kirikkaleli, D., & Alola, A. A. (2021). The imperativeness of environmental quality in the United States transportation sector amidst biomass-fossil energy consumption and growth. Journal of Cleaner Production, 285, 124863.

Brief description:

The focus is on the imperative role of environmental quality in the United States transportation sector, particularly in the context of biomass-fossil energy consumption and growth. The dataset they use is likely a comprehensive compilation of environmental and energy consumption data within the U.S. transportation sector. This dataset serves as a repository of information, containing details about energy sources, consumption patterns, and environmental quality metrics.

Their method involves a sophisticated analytical approach, potentially incorporating statistical analyses and modeling. They may have employed econometric methods or other quantitative techniques to unravel the relationships between biomass-fossil energy consumption, sectoral growth, and environmental quality. By doing so, they aim to provide a nuanced understanding of how these factors interplay in the complex landscape of the U.S. transportation sector.

In essence, they embark on a data-driven exploration, using advanced analytical tools to shed light on the environmental implications of energy choices and growth patterns within the transportation sector. It's a methodical journey into the intricacies of sustainability and energy policy, offering valuable insights for both researchers and policymakers. Quite a substantial dive into the environmental challenges of the transportation sector

7) Yang, Y., & Tan, Z. (2019). Investigating the influence of consumer behavior and governmental policy on the diffusion of electric vehicles in Beijing, China. Sustainability, 11(24), 6967

Brief description:

The focus is on understanding the factors influencing the diffusion of electric vehicles (EVs) in Beijing, China. The dataset they use is likely a compilation of diverse information related to consumer behavior, governmental policies, and the adoption rates of electric vehicles in Beijing. This dataset serves as a comprehensive source, capturing the intricate dynamics of EV adoption in a specific urban context.

Their method involves a thorough investigation, likely using a mix of qualitative and quantitative approaches. They might have employed surveys, interviews, or case studies to delve into consumer preferences and behaviors regarding electric vehicles. Additionally, they could have analyzed policy documents and governmental initiatives to gauge their impact on EV adoption. The

combination of these methods allows them to provide a holistic view of the factors at play in the diffusion of electric vehicles in Beijing.

In essence, they embark on a multi-dimensional exploration, employing both consumer-focused and policy-oriented lenses to understand the nuances of electric vehicle adoption. It's a methodical journey into the complexities of sustainable transportation, providing valuable insights for urban planners, policymakers, and researchers interested in promoting environmentally friendly mobility solutions in China's capital. Quite a comprehensive dive into the factors shaping the electric vehicle landscape in Beijing.

3.0 Dataset(s)

Table 1 Parameters and associated datasets

Parameters	Data source	Variables addressed	Comments
Charging station distribution	Data source reference: https://developer.nrel.gov/docs/transportation/alt-fuel-stations-v1/all/#request-url Data access site: https://www.kaggle.com/datasets/prasertk/electric-vehicle-charging-stations-in-usa	Total count of charging stations per state, EV level 1 charging stations, EV level 2 charging stations, EV DC charging stations.	The number of individual state codes will be counted to yield the total number of charging stations per state.
Electronic vehicle registration	Data source reference: https://afdc.energy.gov/data/10962 Data access site: https://afdc.energy.gov/data/10962 Alternative Data source reference: https://afdc.energy.gov/data/10962 Data access reference: https://electrek.co/2022/08/24/current-ev-registrations-in-the-us-how-does-your-state-stack-up/	Vehicle registration count	Registration count will be divided by household number to identify the probability of adopting EV per household

Household	Data source reference: https://worldpopulationreview.com/state-rankings/households-by-state Data access site: https://worldpopulationreview.com/state-rankings/households-by-state	Number of households per state	The number of total households will be used to identify the probability of an EV registration per state
Household income	Data source reference: census.gov Data access site: https://www.statista.com/statistics/233170/median-household-income-in-the-united-states-by-state/	Median household income	The effect of median household income will be evaluated in the probability of EV usage
Total costs of Ownership	Data Source reference: (as mentioned in the access website) United States Department of Transportation - Federal Highway Administration, The Alternative Fuels Data Center (AFDC), The National Conference of State Legislatures, FuelEconomy.gov, Department of Motor Vehicles, Finder.com, Statista, Edmunds, Tesla, Quote Inspector, and other state-specific governing bodies and consumer reports. Data access site: https://www.self.inc/info/electric-cars-vs-gas-cars-cost/#maintenance-cost (Licensed under Creative Commons Attribution-ShareAlike 4.0 International License.)	Total maintenance cost, Purchase price, Taxes, Fuel cost, Insurance cost	Data has been collected for both EV and non-EV to achieve a comparative perspective. The database has to be modified based on the state-wise arrangement of the addressed variables. The difference between EV and Non-EV can also be addressed as additional variables
Household travel tendency	Data source reference: https://www.bts.gov/statistical-products/surveys/vehicle-miles-traveled-and-vehicle-trips-state Data access site: https://www.bts.gov/statistical-products/surveys/vehicle-miles-traveled-and-vehicle-trips-state	Vehicle miles traveled, Vehicle trips traveled	The effect on travel tendency will be investigated to adopt EVs