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Factors Influencing Adoption of Two-Wheeler Electric Vehicles in Nepal

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ABSTRACT

This study aimed to explore the factors influencing the adoption of two-wheeler electric vehicles (2WEVs) in Nepal during the 2022/23 period. As the adoption of electric vehicles (EVs) gains momentum worldwide, understanding the factors driving or hindering their adoption is critical for policymakers, manufacturers, and distributors in Nepal. The study collected data from 387 respondents through an online questionnaire. The questionnaire included several independent variables, such as financial incentives, social reinforcement, environmental concerns, charging infrastructure, and price. These variables were analyzed to determine their impact on the adoption of 2WEVs. Exploratory Factor Analysis was conducted to simplify the factor structure of the data and identify the suitability of the responses. By using correlation and multiple regression analyses, the findings of the study showed that price, financial incentives, and charging infrastructure had a significant impact on EV adoption. Environmental concern and social reinforcement did not show a significant relationship with the dependent variable. To improve the adoption of 2WEVs in Nepal, manufacturers and distributors need to improve their pricing compared to fuel-driven vehicles. It is also necessary to provide financial incentives, such as tax breaks and subsidies, to promote electric vehicle adoption. Additionally, the government needs to upgrade the charging infrastructure to provide convenience for electric vehicle users. Furthermore, as environmental concerns are not a top priority for Nepalese consumers, it is crucial to raise citizens' environmental awareness through educational campaigns and other initiatives.

Keywords: financial incentives, social reinforcement, environmental concern, price, charging infrastructure, EV adoptions

Introduction

Electric Vehicles (EVs) are automobiles that run entirely or mostly on electricity. An EV operates on an electric motor, instead of an internal combustion engine that generates power by burning a mix of fuel and gases (Business Standard, n.d.).

EV demand has grown dramatically in recent years, yet they still make up a relatively small portion of all new vehicles sold globally. Although it is still in its infancy stage, global sales of electric cars reached 16.5 million in 2021 from 10 million in 2020, which is just 1% of all sales (Rives, 2022).

The ability to avoid traffic and commute short distances at quicker speeds has led to the enormous global popularity of tiny variants of 2WEVs (TechSci Research, 2019).

There is not much long history of two-wheelers in the Nepalese context, but the popularity of two-wheelers is increasing day by day in the context of Nepal as bikes and scooters can easily surpass the traffic jams which enables people to reach their destination at a stipulated time (Neupane & Sawagvudcharee, 2019).

The transport sector in Nepal is dominated by road transport, which accounts for about 90% of all trips (Shrestha and Nepal, 2016).

The growth in the number of vehicles is particularly high for two-wheelers, which grew at an annual rate of 17% from 1990 to 2018 (MoFE, 2021).

Electric-two wheelers and electric cars have also been introduced in Nepal as private vehicles in the past few years. The Electric Vehicle Association of Nepal (EVAN) estimates that at present there are approximately 6,000 electric two-wheelers and 1,000 electric cars in Nepal (Shrestha, 2020).

This indicates that altogether there are currently about thirty-four thousand EVs in the country, which would be about 1% of the total vehicle fleet in the country. Among these, more than 80% are three-wheelers that operate as public vehicles (Wagle et.al, 2021). The 21st century has seen a resurgence of fully electric automobiles due to modern environmental concerns. Many automakers are releasing fully electric, mass-produced automobiles into the market (Lai, Liu, Sun, Zhang, & Xu, 2015).

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Electric vehicles' main issues are their expensive batteries, poor driving range due to insufficient charging capacity, and lengthy recharge time (Cecelia & Garmendo, 2022).

Therefore, it was crucial to investigate and understand the various perspectives held by Nepali consumers regarding the uptake of EVs in Nepal (Neupane & Sawagvudcharee, 2019).

Review of Literature

EV Adoption

EV adoption is described as a choice among a group of vehicle alternatives described by their characteristics or attributes (Liao, 2017). EV adoption refers to electric cars becoming more and more prevalent in the automotive industry (Connect, 2022).

'The transport sector is the primary cause of greenhouse gas emissions and local pollution, with vehicle emissions being the main source of pollutants such as particulate matters (PM) in the Kathmandu Valley, and contributing to approximately 63% of all PM10 emissions (Schwela, 2009). The most sought-after mode of private road transport in Nepal is two-wheelers (including motorcycles, combustion engine-based scooters, and electric scooters), which account for about 78% of the circulating vehicles in 2021 (MCD, 2022). In addition to strengthening public transport systems, a potential solution to the problem of pollution from vehicular emissions is individuals switching to driving more fuel-efficient or electric vehicles (Filipini, Kumar & Srinivasan, 2021). However, consumers have shown less interest in buying fuel-efficient and environmentally clean two-wheelers in Nepal despite their availability and market potential, even though they do not have significantly higher purchase costs, and generally have lower lifetime costs (Filipini et.al, 2021). Nepalese consumers find 2WEVs insufficient as the existing ICE motorcycles and scooters give higher ranges and speeds. Now, however, several models of large and small electric scooters from China and India have entered the Nepalese market and there is a

possibility that at least some of them will meet these market desired characteristics in the future (Wagle et.al, 2021).

Electric four-wheelers are not a feasible option in developing countries due to their high purchase price. On the contrary, electric two-wheelers may be beneficial as they come with a lower purchase price (Albrecht & Rajper, 2020). There are several driving forces associated with EVs' adoption, such as the reduction in greenhouse gas emissions (GHG), efficient energy use, gasoline savings, and low operational cost. The resisting forces influencing the acceptance of EVs include high purchase prices, inadequate range, slow charging, and new production adoption anxiety (Albrecht & Rajper, 2020). Key determinants behind the adoption of electric vehicles are government financial incentives, industry development, and pattern of demand in the market (Hertzke, Muller, Schenk & Wu, 2018). Motivating people to adopt and purchase electric vehicles by providing financial and non-financial incentives is highly effective and successful. The government needs to formulate market and customer-friendly policies such as a flexible regulatory framework, tax advantages, and other financial incentives to encourage rapid adoption among potential customers (Jin, Searle, & Lutsey, 2014). All manufacturers are launching electric vehicles. This will provide more choices to the customers, and they will be more motivated to adopt electric vehicles in the future. Electric vehicle manufacturers can achieve economies of scale which will boost companies' profit and reduce prices for the customers (Ali & Naushad, 2022).

Financial Incentives

Financial Incentives consist of 'direct subsidies for EV purchases and road tax exemption. Government policy has a significant impact on the adoption of electric vehicles. By formulating customer-friendly policies and providing financial incentives on production and consumption, the government stimulates the usage of products (Ali & Naushad, 2022). Nepal's government has accelerated the National Action Plan for Electric Mobility in the country. The Budget for FY 2022/23 has increased the excise and customs duty on private EVs ranging from 45-60%, depending on the power of the motor, and increased the road tax to 10% (Wagle et. al, 2022). Although the new customs duty for EVs is still lower than that for ICE vehicles, the drastic increase in customs duty and excise duty will almost double the price of EVs and make them less competitive in the market (Wagle et. al, 2021).

Many countries have introduced targets that increase the number or overall share of EVs or ban sales of ICE within a target date. The country that has the most ambitious target is Norway, where it will be illegal to sell petrol or diesel cars from 2020. The government of Norway has introduced attractive incentives that encourage people to shift to EVs to meet this target (Fridstrom, 2021).

Some of the financial incentives offered to promote EVs in Norway include VAT and other tax exemptions during purchase, free parking, 50 % lower car and road tax, and free battery charging (Fridstrom, 2021).

China is by far the largest producer and consumer of EVs. Its dominance in the EV market is mainly because of the strong support provided by the Chinese government to this industry over the past decade. Some financial incentives provided by the Chinese government include subsidies and tax exemption on manufacturing, consumption, and sales tax exemption, 50 % waiver on vehicle registration fees (Sandalow, 2019).

India's government has accelerated the Fast Adoption and Manufacturing of hybrid and electric vehicles (FAME) in the country. The Indian Government has provided demand incentives for the procurement of EVs, which reduces the purchase price and introduces zero road tax (Wagle et. al, 2021).

Financial incentives are a critical factor in determining the adoption of electric vehicles. Customers are motivated to purchase an electric

vehicle due to the availability of financial incentives. Financial incentives come in a wide variety of forms purchase incentives, coupons, interest subventions, road tax exemption, registration tax fee exemption, income tax benefits, scrapping incentives, interest interest-free loans (NITI Aayog, n.d.). Numerous research studies have confirmed that electric vehicle adoption occurred because of government financial incentives.

Government financial incentives have been extremely beneficial and successful in countries such as Sweden, France, Germany, and the United States of America (Wang, Tang, & Pan, 2019). Additionally, electric vehicles are environmentally friendly and contribute to environmental protection. As a result, the government provides financial incentives to encourage the rapid adoption of electric vehicles to conserve resources and protect the environment (Ali & Naushad, 2022). Therefore, it is assumed that financial incentives being an indirect force play a vital role in EV adoption. The following hypothesis can be stated.

Hypothesis 1 (H1). There is a significant association between financial incentives and electric vehicle adoption.

Social Reinforcement

The term "social reinforcement" refers to the influences of friends, family, and neighbors on the purchasing decisions of customers. Before purchasing a product, every customer wishes to obtain consent from their friends and family members. Customers make purchases based on the opinions, preferences, and dislikes of family and friends (Ali & Naushad, 2021) Customers prefer to purchase products that are socially acceptable and are praised by their friends and relatives. As a result, customers decide whether to purchase a product (Ali & Naushad, 2022). Other people's behavior affects the purchasing decisions of customers. This social reinforcement is a significant factor in determining whether to purchase an electric vehicle. It can be divided into two exogenous variables: Interpersonal influence and external influence (Yang & Tu, 2019).

a) **Interpersonal influences:** Interpreted as the impact of the groups with which consumers have frequent interactions, including parents, family, friends, and supervisors, on their purchase of electric vehicles in this study.

b) **External influences:** Interpreted as the impact of mass media, expert opinions, and other non-interpersonal information on consumers' purchase of electric vehicles in this study.

An individual's decisions are expected to be influenced by the behavior of people in their social network and social norms, which can be regarded as the behavior of the collective society (Lane & Potter, 2007). Several qualitative studies found that social influence plays an important positive role in EV promotion (Liao, 2017). Social reinforcement affects the purchasing behavior and intentions of customers (Ali & Naushad, 2022). As a result, social reinforcement is critical for consumer adoption of electric vehicles. The following hypothesis is admissible.

Hypothesis 4 (H4). There is a significant association between social reinforcement and electric vehicle adoption.

Charging Infrastructure

EV charging stations are a set of power electronics, usually wall or pedestal-mounted, that safely supply regulated power from the grid to the vehicle batteries. Different types of chargers supply different current and voltage levels as required meeting vehicle-specific battery requirements. EV chargers range from as low as 500 watts (W) to as high as 500 kW. It is expected that improvements in battery chemistry will enable even higher charging rates in the future (Fitzgerald, 2020).

Charging infrastructure is critical for owners of electric vehicles. Customers gain confidence in purchasing an electric vehicle due to the availability of charging infrastructure. Each customer cannot install a charging infrastructure

at their home. Therefore, it is critical to improve the public charging infrastructure for electric vehicles (Ali & Naushad, 2022).

A sufficient number of charging stations is a prerequisite for EV diffusion. The lower number of charging networks has been recognized as a limiting factor for consumers to buy EVs. The public and private sectors are reluctant to invest in charging stations as the number of EV users is still insufficient and, conversely, potential EV users hesitate from purchasing EVs due to the insufficient number of charging stations (Adhikari, Ghimire, Aryal & Khadka, 2020).

Currently, the number of EVs is on the rise. However, the majority of the vehicles are inefficient, carry heavy batteries, and have a minimal capacity range of 99 – 498 km per charge (Mali, Shrestha, Chapagain, Bishwokarma, & Kumar, 2022). Significant research is carried out throughout the world to develop new batteries that have an overall higher capacity. This will ultimately allow for the development of long-range capable vehicle services. Moreover, with the mileage of EVs getting better every year, the need for better facilities to recharge them is also increasing (Kumar, 2017). The charging stations must be capable of delivering charging power to the batteries quickly, safely, and economically 30. Such charging stations must be capable of being controlled in such a way that different batteries have different capacities and terminal voltages must be accommodated at charging stations (Kumar, 2017). The EV charging station can be categorized into three subheadings (Mali et. al, 2022): Home Charging Station, Public Charging station, and battery swap station.

Because of the expensive technology and installation cost, there are only a few charging stations situated in major cities under the ownership of private parties. However, the NEA is in the process of installing fifty charging stations in main cities all over the nation. In the current situation, the vehicle owners are forced to charge their vehicle with the traditional approach at their home or office with low ratings (i.e., single-phase power supply with 16 A or 32 A current limit). With a limited number of charging stations along the highway, the possibility of long-distance EV travel is very limited. Charging infrastructure has embarked on a positive relationship with electric vehicle adoption (Mali et. al, 2022). Therefore, a good charging infrastructure has a great role in electric vehicle adoption by consumers. The following hypothesis can be stated.

Hypothesis 2 (H2). There is a significant association between charging infrastructure and electric vehicle adoption.

Environmental Concern

Environmental concern is a term that refers to a person's awareness of environmental issues and concerns. Concern for the environment reflects an individual's desire to help solve environmental problems. Environmental issues are a top priority for governments, customers, and international organizations today. Numerous studies established that environmental concerns impudence a customer's decision to purchase an electric vehicle. Customers are willing to adopt electric vehicles as environmental concerns continue to grow at an alarming rate (Ali & Naushad, 2022). Many researchers have studied the relationship between concern for the environment and consumer buying behavior and found that with higher environmental concern consumers are more likely to buy environmentally friendly products like electric two-wheelers (Jayasingh et. al, 2020).

A research survey conducted in Germany shows that the environmental benefits of EVs are one of the main motivators for the intention to buy EVs. A study in China showed that environmental concern indirectly affects the intention to adopt hybrid EVs and that attitude has a mediating effect. A study conducted in Macau also supports the finding that environmental concern influences the adoption of full-electric vehicles. Based on previous research work, it is clear that consumers with great concern for the environment may consider buying environment-friendly products or green products like EVs (Jayasingh et. al, 2020).

Customers who are environmentally conscious and want to save money on fuel are more likely to purchase an electric vehicle. Customers who care about the environment express a relative preference for electric vehicles. The adoption of electric vehicles will address a variety of environmental issues and result in significant energy savings (Ali & Naushad, 2022). Electric vehicles are environmentally friendly and help to mitigate environmental risks (Mashoor & Difrazno, 2021).

Manufacturers of electric vehicles should prioritize not only energy conservation but also environmental concerns. Consumers who are environmentally sensitive and perceive themselves as environmentally responsive would be more likely to adopt EVs (Liu & San, 2015). Thus, previous studies recommended that, similar to carrying out self-sacrificing activities (such as giving to a charity), EV users could sense a "warm glow" and "intrinsic emotional reward in pro-environmental behavior" (Datta & Hwang, 2021), as they perceived that they played their role in curtailing carbon emissions and preserving the environment. This pleasing sense of honor encourages consumers to adopt EVs. The environmental concern has been growing dramatically in recent years due to severe environmental issues and the government's appeal to protect the environment. According to the Global Burden of Diseases project report, air pollution was responsible for 4.2 million deaths worldwide in 2015 (Datta & Hwang, 2021).

It seems that governments of different countries are trying to solve pollution in different ways. In this sense, EV offers an opportunity for Taiwan to improve air quality by reducing emissions (Datta & Hwang, 2021). Hence, individual environmental protection concerns can improve Taiwanese individuals' motivation to adopt EVs. The following hypothesis can be stated.

Hypothesis 3 (H3). There is a significant association between environmental concerns and electric vehicle adoption.

Price

Price is a critical factor in a customer's purchasing decision. Customers are constrained by a limited budget with which to purchase a product (Winbrake & Green, 2014). Customers want to compare the price they paid for a product with the benefits they received. When the benefits received outweigh the costs incurred, customers are more likely to purchase a product. This is especially true when electric vehicles are more expensive than conventional vehicles (Ali & Naushad, 2022). Customers may not prefer to purchase an electric vehicle if their budget is limited and they cannot afford the high cost of such vehicles. Electric vehicles are expensive due to the batteries and a lack of economies of scale (Turrentine & Kurani, 2007). Manufacturers can easily achieve economies of scale if their manufacturing operations are extremely large. The demand for traditional products is enormous and sustainable. This resulted in manufacturers lowering their prices, but demand for electric vehicles remains low and unsustainable. When it comes to purchasing an electric vehicle, price is a critical factor (Theo, Henkel, & Waller, 2011). The price of electric cars and hybrids is very expensive for middle-income people in developing countries. For lower-income people, the option of medium-sized electric scooters or E2Ws can be attractive as sticker prices are more affordable than gasoline-based cars (Albrecht & Rajpat, 2020). The purchase price preferences are different among variations of populations as the price of the EV is higher than CV it is found that heterogeneity is particularly high. Moreover, the person's with high incomes are less price-sensitive than others (Rajouli & Timmermans, 2013).

Low cost of vehicle purchase decisions of vehicles always come under the rational model of purchase, which means that the vehicle that provides value for money is always sought after. But regarding electric vehicles, a very interesting phenomenon is studied that the initial heavy cost of Electric Vehicle is responsible for the negative

perception of Electric Vehicles, and on the contrary long run fuel saving and effectiveness lead to a little positive thrust to perception and adoption (Bhalla, Nazneen, & Ali, 2018). The upfront purchase price is a significant consideration when purchasing an electric vehicle (Lane & Potter, 2007). When customers decide to purchase an electric vehicle, financial considerations are always paramount (Ali & Naushad, 2022).

Hypothesis 5 (H5). There is a significant association between price and electric vehicle adoption.

Conceptual Framework and Hypothesis

According to the background, the influencing factors that have been identified for the study are financial incentives, charging infrastructure, price, social reinforcement, and environmental concerns. The following hypotheses were formulated to explore the relationship between factors influencing the adoption of 2WEVs in Nepal.

H1: There is a significant association between financial incentives and electric vehicle adoption.

H2: There is a significant association between charging infrastructure and electric vehicle adoption.

H3: There is a significant association between price and electric vehicle adoption.

H4: There is a significant association between social reinforcement and electric vehicle adoption.

H5: There is a significant association between environmental concern and electric vehicle adoption.

Research Design

Research design refers to the systematic approach taken to design the study in a way that would guide the researcher toward a result or conclusion (Ismail & Al-Saeeady, 2020). A quantitative, descriptive survey research technique was employed to get results that were representative of the entire population. A self-conducted online-based questionnaire approach was selected. Numerous questions from a self-reported, online-based survey helped to clarify the study question evaluate the hypotheses, and explain relationships between variables. To guarantee that the hypotheses were tested properly, numerous questions were asked for each hypothesis. A six-point Likert scale was employed in the investigation ranging from 'Strongly Disagree' to 'Strongly Agree' to assess respondents' intent to adopt EVs because a point measurement scale allows for increased measurement precision and encourages participants to think about the issue more thoroughly and make a decision that has a positive or negative slant.

Method

A quantitative, descriptive survey research technique was employed to get results that were representative of the entire population. A self-conducted online-based questionnaire approach was selected. A six-point Likert scale was employed in the investigation ranging from 'Strongly Disagree' to 'Strongly Agree' to assess respondents' intent to adopt EVs.

Analysis and Findings

This chapter is intended to analyze and interpret the results of the collected data from the respondents. The data are properly processed and analyzed following the objectives of the study to pave the way for further research. The hypotheses were tested to determine whether the relationships stated in them are significant or not. IBM SPSS was used to analyze the data.

This section is subdivided into four parts. The first part deals with the respondents' demographic profile. The second part analyzes and interprets the collected data through descriptive analysis. Similarly, the third part focuses on inferential statistics, which includes correlation and regression analysis of the dependent and independent variables, and thus hypothesis testing. The final part discusses the results obtained from the analysis.

Table 1

Respondent's Demographic Profile

Gender	Frequency	Percent
Male	188	48.6
Female	199	51.4
Age		
18-25	32	8
26-35	197	47.8
36-45	73	18.2
46-55	67	16.7
55-above	23	5.7
Education		
High School	4	1
Intermediate	14	3.5
Graduate	148	36.8
Masters	212	52.7
PhDs	9	2.2
Profession		
Banking	42	10.4
Corporate Finance	18	4.5
Insurance	5	1.2
Marketing	12	3
Medicine	24	13.7
IT & Engineering	110	18.7
Catering	4	1
Farming	-	-
Unemployed	17	4.2
Student	36	9
Educational Services	54	13.4
Others	70	17.4
Income Level per annum		
less than Rs.400000	150	37.3
Rs.400001-Rs.500000	99	24.6
Rs.500001-Rs700000	63	15.7
Rs.700001 & above	75	18.7
Do you have Electric Vehicle?		
Yes	41	10.2
No	346	86.1

The data collected in this research were obtained through online surveys to find the factors influencing the purchase of 2WEVs in Nepal. The questionnaire method was employed with a total of 387 respondents and was distributed from September to December 2022. Table 4 illustrates the Profile of the respondents in this study. The number of responses from female participants was slightly higher than from male participants, and 47.8 percent of the sample represented the 26–35 years age group with 52 percent master's graduates.

Exploratory Factor Analysis

Kaiser – Meyer Olkin (KMO) Measure of Sampling Adequacy and Bartlett's test of sphericity

As presented in Table 5, the Kaiser-Meyer-Olkin (KMO) measure returns a value of 0.738, which is considered good and acceptable. Furthermore, Bartlett's test of sphericity yields a significant value of 0.000, suggesting that the data are suitable for further analysis.

Table 2

KMO and Bartlett's Test

Data Sphercity Test	Parameters	Values
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.738
Bartlett's Test of Sphericity	Approx. Chi-Square	6882.79
	df	378
	Sig.	0.000

Principal Component Analysis

As previously mentioned, the KMO value of 0.738 and a significant Bartlett's test (p = .0000) indicate that a Principal Component Analysis (PCA) test is appropriate for the dataset. Communalities, which measure the amount of variance in each dimension, were also examined to ensure an acceptable level of explanation. The results showed that all communalities were above 0.5. However, in the initial Exploratory Factor Analysis (EFA), two items (P2: "The prices of electric vehicles are higher than conventional vehicles" and EV3: "Compared with conventional vehicles, electric vehicles are more attractive") loaded onto a factor other than their underlying factor. Therefore, these two items were excluded from further analysis.

Table 3

Rotated Component Matrix[a]

Constructs	1	2	3	4	5	6
FI1			.758			
FI2			.775			
FI3			.689			
FI4			.726			
FI5			.674			
SR1	.745					
SR2	.895					
SR3	.763					
SR4	.708					
SR5	.752					

Constructs	1	2	3	4	5	6
EC1		.873				
EC2		.813				
EC3		.645				
EC4		.706				
EC5		.794				
CI1				.617		
CI2				.682		
CI3				.723		
CI4				.699		
CI5				.864		
P1					.782	
P3					.922	
P4					.947	
EV1						.829
EV2						.865
EV4						.700

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

The component matrix was rotated using Varimax rotation. This method was chosen to produce uncorrelated factors.

Component 1: Financial Incentive

Component 2: Social Reinforcement

Component 3: Environmental Concern

Component 4: Charging Infrastructure

Component 5: Price

Component 6: EV Adoption

Construct Reliability and Validity

Table 4

Construct Reliability and Validity for Each Construct

Constructs	Item Code					No. of Items	Cronbach's Alpha	Average Variance Extracted (AVE)
Financial Incentives (FI)	FI1	FI2	FI3	FI4	FI5	5	0.785	0.530
Social Reinforcement (SR)	SR1	SR2	SR3	SR4	SR5	5	0.829	0.598
Environmental Concern (EC)	EC1	EC2	EC3	EC4	EC5	5	0.829	0.599
Charging Infrastructure CI	CI1	CI2	CI3	CI4	CI5	5	0.786	0.520
Price (P)	P1	P3	P4			3	0.906	0.791
EV Adoption (EV)	EV1	EV2	EV3			3	0l847	0.613

The study used 6 constructs, each identified by a code: Financial Incentives (FI), Social Reinforcement (SR), Environmental Concern (EC), Charging Infrastructure (CI), Price (P), and EV adoption (EV).

Table 4 reports the results of validity and reliability tests. The constructs all have an AVE (average variance extracted) value greater than 0.5, indicating satisfactory validity of the scale. In addition, all constructs have an alpha value greater than 0.7, indicating a high level of reliability of the scale.

Table 5

Construct Reliability and Validity for Overall Construct

Cronbach's Alpha	AVE	N of Items
.787	.61	28

The validity and reliability of the study are demonstrated by the values presented in Table 8, where the overall AVE is .61 and the alpha value is .787..

Descriptive Statistics

Financial Incentives construct

Table 6

Descriptive Statistics for Financial Incentive Construct

	FI1	FI2	FI3	FI4	FI4	Overall Score
Mean	4.08	4.11	3.67	3.89	3.92	3.93
Std. Deviation	1.174	1.033	1.112	1.399	1.341	.89
Std. Error	.6	.53	.57	.71	.68	.45
Variance	1.377	1.068	1.237	1.957	1.797	.79

The data in Table7 presents descriptive statistics for financial incentives, indicating that the respondents generally hold a positive perception of financial incentives, with an overall mean score of 3.93 (SD=0.89). Among the three factors measured, FI2 had the highest mean value, suggesting that people consider the Nepali Government's financial incentives as a positive encouragement for developing 2WEVs. On the other hand, FI3 had the lowest mean value, indicating that respondents did not find it easy to understand the government's financial incentives.

Environmental Concern Construct

Table 7

Descriptive Statistics for Environmental Concern construct

	EC1	EC2	EC3	EC4	EC5	Overall Score
Mean	5.35	5.25	4.82	5.14	5.12	5.13
Std. Deviation	.982	.971	1.194	1.130	1.096	.83
Std. Error	.05	0.049	0.061	0.052	0.056	.042
Variance	.964	.943	1.425	1.278	1.2	.69

The data in Table 7 presents descriptive statistics for environmental concerns, indicating an overall mean score of 5.13 (SD=0.83). This suggests that people are highly aware and concerned about protecting the environment. Among the five factors measured, EC1 had the highest mean value, indicating that people believe that using a 2WEV instead of a conventional fuel-driven two-wheeler can help protect the environment. However, EC3 had the lowest mean value, suggesting that people were not willing to buy environmentally friendly products.

Charging Infrastructure Construct

Table 8

Descriptive statistics for charging infrastructure construct

	CI1	CI2	CI3	CI4	CI5	Overall Score
Mean	4.75	4.62	5.14	5.08	4.82	4.88
Std. Deviation	1.229	1.049	1.101	1.126	1.106	.83
Std. Error of mean	.062	0.053	0.056	0.057	0.056	.042
Variance	1.510	1.101	1.212	1.269	1.223	.681

Table 8 presents descriptive statistics for charging infrastructure, indicating an overall mean score of 4.88 (SD=0.83). This suggests that people have a high demand for improved and increased charging stations to promote the purchase of 2WEVs. Among the three factors measured, CI3 had the highest mean value, indicating that people think that charging stations should be installed in different locations as a home charging station will not be sufficient. On the other hand, CI2 had the lowest mean value, suggesting that people did not believe that improving charging infrastructure alone could help increase the adoption of 2WEVs in Nepal.

Price Construct

Table 9

Descriptive Statistics for Price Construct

	P1	P2	P3	Overall Score
Mean	4.19	3.87	3.91	3.99
Std. Deviation	1.149	1.134	1.113	1.04
Std. Error of mean	.058	0.058	0.057	.53
Variance	1.319	1.287	1.239	1.079

The data in Table 9 presents descriptive statistics for price, indicating an overall mean score of 3.99 (SD=1.04). This suggests that people's purchasing decision for 2WEVs is highly influenced by the pricing or cost of EVs. Among the two factors measured, P1 had the highest mean value, indicating that most of the respondents could afford a 2WEV. On the other hand, P2 had the lowest mean value, suggesting that people did not accept the price of 2WEVs to be higher than fuel-driven vehicles.

Inferential Statistics

Regression Analysis

The theoretical model or the relationship is formulated as the equation below:

$$Y = a+b1FI+b2SR+b3CI+b4EC+b5P+ei$$

Where,

Y = EV adoption

a = constant

FI = financial incentives

SR = Social reinforcement

CI = charging infrastructure

EC = environmental concern

P = price

b = coefficient

Environmental Concern Construct

Table 10

Regression Analysis and Hypothesis Testing

Hypothesis	Regression Weights	Beta Coefficient	t-value	p-value	Hypothesis Status
H1	EV ➔FI	.068	1.555	.012	Accepted
H2	EV➔ SR	.208	3.623	.000	Accepted
H3	EV➔ EC	.117	2.525	.012	Accepted
H4	EV➔ CI	.164	3.485	.001	Accepted
H5	EV➔ P	.327	8.953	.000	Accepted

Hypothesis 1 (H1). There is a significant association between financial incentives and electric vehicle adoption.

According to the results presented in Table 13, the hypothesis testing the impact of financial incentives (FI) on EV adoption was carried out. In this analysis, the dependent variable EV was regressed on the predicting variable FI. EV significantly predicted FI, with p value 0.012 which is less than 0.05 which suggests that financial incentives can play a significant role in encouraging the adoption of EVs. These findings highlight a clear positive effect of financial incentives on the adoption of EVs.

Hypothesis 2 (H2). There is a significant association between social reinforcement and electric vehicle adoption.

According to the results presented in Table 13, the hypothesis testing the impact of social reinforcement (SR) on EV adoption was carried out. In this analysis, the dependent variable EV was regressed on the predicting variable SR. EV significantly predicted SR, with p value 0.000 which is less than 0.05 which suggests that financial incentives can play a significant role in encouraging the adoption of EVs. These findings highlight a clear positive effect of social reinforcement on the adoption of EVs.

Hypothesis 3 (H3). There is a significant association between environmental concerns and electric vehicle adoption.

According to the results presented in Table 13, the hypothesis testing the impact of environmental concern (EC) on EV adoption was carried out. In this analysis, the dependent variable EV was regressed on the predicting variable EC. EV significantly predicted EC, with p value 0.012 which is less than 0.05 which suggests that environmental concern can play a significant role in encouraging the adoption of EVs. These findings highlight a clear positive effect of environmental concern on the adoption of EVs.

Hypothesis 4 (H4). There is a significant association between charging infrastructure and electric vehicle adoption.

As presented in Table 13, the purpose of the hypothesis was to determine whether the availability of charging infrastructure has a significant impact on the adoption of electric vehicles (EVs). The dependent variable EV was regressed on the predicting variable, CI. The results indicate that EV significantly predicted CI; with p value 0.01which is less than 0.05. This suggests that the availability of charging infrastructure can play a significant role in the adoption of EVs, and the findings point to a positive effect of CI on EV adoption.

Hypothesis 5 (H5). There is a significant association between price and electric vehicle adoption.

As presented in Table 10, the hypothesis aimed to determine whether price has a significant impact on the adoption of electric vehicles (EVs). The dependent variable, EV, was regressed on the predicting variable, P. The results indicate that EV significantly predicted P, with a p-value 0.000 which is less than 0.05. This implies that price can play a significant role in the adoption of EVs, and the findings suggest a positive effect of P on EV adoption.

Table 11

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.501a	.251	.241	.73476	2.018

a. Predictors : (Constant) FI, SR, CI, EC and P

b. Dependent Variable : EV Adoption

The above Table 11 summarizes the model used in the study. It shows that the adjusted R squared value is 0.241, which indicates that 24.1% of the variance in the dependent variable, EV adoption, can be explained by the independent variables, namely financial incentives, social reinforcement, charging infrastructure, environmental concern and price.

Analysis of Variance (ANOVA)

Table 12

ANOVA[a]

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	69.022	5	13.804	25.570	.000b
Residual	205.690	382	.540		
Total	274.712	387			

a. Dependent Variable: EV

b. Predictors: (Constant), P, CI, SR, EN, FI

Table 12 presents the ANOVA results which show that the model used in the study is valid, with a significant p-value of 0.000. The dependent variable in this model is EV adoption, and the predictors are financial incentives, social reinforcement, charging infrastructure, environmental concern and price.

Regression Coefficient

Table 13

Pearson Correlation Analysis

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Erro	Beta			Tolerance	VIF
(Constant)	.796	.451		1.766	.000		
FI	.068	.044	.072	1.555	.000	.922	1.085
SR	.208	.057	.163	3.623	.045	.975	1.025
EC	.117	.046	.116	2.525	.178	.939	1.065
CI	.164	.047	.161	3.481	.001	.921	1.086
P	.327	.037	.403	8.953	.000	.971	1.029

Table 13 presents the standard error, beta coefficients, t-values, and significance levels for each of the independent variables, namely financial incentives, social reinforcement, charging infrastructure, environmental concern, and price, concerning the dependent variable, which is EV adoption. The results show that financial incentives, charging infrastructure, and price have a significant relationship with EV adoption, while social reinforcement and environmental concern do not have a statistically significant relationship with EV adoption. This suggests that there is no strong evidence to support the idea that an increase in social reinforcement and environmental concern would lead to an increase in EV adoption.

Reporting Pearson's Correlation

Table 14

Pearson Correlation Analysis

	FI	SR	EC	CI	P	E
FI	1					
SR	.120*	1				
EC	.112*	.049	1			
CI	.230*	-.050	.172**	1		
P	-0.38	-.051	.155**	.554	1	
EV	.326*	.137**	.192**	.302**	.411**	1

Correlation is significant at the 0.05 level (2-tailed). , Correlation is significant at the 0.01 level (2-tailed). ** N= 387*

Table 14 displays the Pearson's correlation coefficients between the dependent variable and each of the independent variables in the model to assess which independent variables are most strongly related to the dependent variable and how they contribute to predicting EV adoption.

Relationship Between Financial Incentives and EV Adoption

Table 14 presents the results of the correlation analysis between financial incentives and EV adoption. The Pearson correlation coefficient between these two variables is r = .326, indicating a positive correlation between them. However, the correlation is weak. The statistical significance of the correlation is confirmed by a p-value less than 0.05 at the 5% level of significance.

Relationship Between Social Reinforcement and EV Adoption

Table 14 presents the results of the correlation analysis between social reinforcement and EV adoption. The Pearson correlation coefficient between these two variables is r = .137, suggesting that there is little to no correlation between them. The statistical significance of the correlation is

Multicollinearity Diagnostics

Table 16 shows the Variance Inflation Factor (VIF) values for the independent variables used in the study, namely financial incentives (FI), social reinforcement (SR), charging infrastructure (CI), environmental concern (EC), and price (P). All VIF values are less than 10, which indicates that there is no significant issue of Multicollinearity among the independent variables. This implies that each independent variable provides unique and non-redundant information for predicting EV adoption. Thus, the study's results can be considered reliable and valid.

Autocorrelation Test

According to Table 14, the Durbin-Watson statistic for the model is 2.018, which is equal to 2, indicating that there is no autocorrelation problem in the model.

confirmed by a p-value less than 0.01 at the 1% level of significance.

Relationship Between charging infrastructure and EV Adoption

Table 14 displays the results of the correlation analysis between charging infrastructure and EV adoption. Pearson's correlation coefficient between these two variables is r = .302, indicating a positive correlation between them. However, the degree of correlation is low. The statistical significance of the correlation is confirmed by a p-value less than 0.01 at the 1% level of significance.

Relationship Between Environmental Concern and EV Adoption

Table 14 presents the results of the correlation analysis between environmental concern and EV adoption. Pearson's correlation coefficient between these two variables is r = .192, indicating a positive correlation between them. However, it should be noted that the correlation is weak, suggesting that there is not a strong relationship between the two variables. The statistical significance of the correlation is confirmed by a p-value less than 0.01 at the 1% level of significance.

Relationship Between Price and EV Adoption

Table 17 displays the results of the correlation analysis between price and EV adoption. The Pearson's correlation coefficient between these two variables is r = .411, indicating a positive correlation between them. The degree of correlation is moderate, suggesting a meaningful relationship between the two variables. The statistical significance of the correlation is confirmed by a p-value less than 0.01 at the 1% level of significance.

Additionally, Table 14 presents the correlation coefficients between all pairs of independent variables in the model. Some of these coefficients are negative, indicating an inverse relationship between the variables. The negative correlation coefficient between financial incentives and price (-0.38) suggests that as the price of electric vehicles increases, the effectiveness of financial incentives in promoting EV adoption decreases. This can be attributed to the fact that consumers may perceive the financial incentives to be less valuable as the overall cost of purchasing an EV increases.

The negative correlation coefficient between social reinforcement and charging infrastructure (-0.05) suggests that as the availability of charging infrastructure increases, the impact of social reinforcement on EV adoption decreases. This may be because consumers are more likely to adopt EVs based on the practical considerations of charging infrastructure, rather than social influences.

Finally, the negative correlation coefficient between social reinforcement and price (-0.051) suggests that as the price of electric vehicles increases, the impact of social reinforcement on EV adoption decreases. This may be because consumers are more likely to be influenced by social factors when the financial burden of purchasing an EV is relatively low.

It is important to note that the degree of correlation between these variables is relatively low. This suggests that while there is some relationship between these factors, they are largely independent of each other and should be considered as separate drivers of EV adoption.

Discussion and Implications

The study emphasizes the importance of education and awareness-raising campaigns to increase consumer knowledge and confidence in electric vehicles. There is a need to educate consumers about the environmental benefits, cost savings, and overall advantages of electric vehicles over traditional gasoline vehicles. This will help to create a more informed and receptive market for electric vehicles, ultimately increasing their adoption.

The study also highlights the importance of investing in charging infrastructure to support

the adoption of electric vehicles. The lack of charging infrastructure is often cited as a barrier to adoption, and the results of the study support this claim. Therefore, the government and private sector should work together to expand the network of charging stations to improve access and convenience for electric vehicle owners.

Contribution

The primary contribution of this study was to identify the key factors that significantly impact consumer decisions to purchase electric two-wheelers (2WEVs) in Nepal through experimentation. The results of the SPSS analysis conducted in this study revealed that all five variables examined - financial incentives (FI), social reinforcement (SR), environmental concern (EC), charging infrastructure (CI), and price (P) - have a significant influence on consumers' purchasing decisions of 2WEVs. Specifically, pricing was found to be the most significant factor influencing consumers' intentions to purchase 2WEVs. In addition to price, financial incentives and charging infrastructure were also found to be significant factors influencing Nepalese consumers' purchases of 2WEVs. However, when it comes to purchasing 2WEVs in Nepal, environmental concerns and social reinforcement were found to have the least impact on consumer decision-making. Overall, these findings provide valuable insights into the factors that are most important to consider when promoting the adoption of 2WEVs in Nepal.

The research findings from this study can serve as a valuable guide for manufacturers of 2WEVs when developing their marketing strategies. With the potential to significantly improve air quality, the benefits and significance of 2WEVs must be emphasized to prospective buyers. The study indicates that FI and price are the two main factors influencing consumers' decisions to purchase 2WEVs in Nepal. Thus, companies marketing 2WEVs can focus on highlighting the economic benefits of these vehicles to attract more customers.

Furthermore, the government can also refer to this study's findings when making laws regarding financial incentives for consumers who prefer electric vehicles. Financial incentives were found to be the second most significant factor influencing consumer intention for purchasing 2WEV in Nepal. These incentives could include post-purchase rebates, which are given to consumers after they have purchased the vehicle, and a reduction in purchase tax based on the CO2 emissions of the vehicles. By implementing these government schemes and incentives, the upfront purchase price for 2WEVs can be reduced, making them more accessible to a wider range of consumers.

Conclusion

The adoption of electric vehicles is influenced by various factors, including financial incentives, charging station availability, societal acceptance, environmental concerns, and cost. While all of these factors play a role in the decision-making process, research indicates that cost is the most significant factor in determining the uptake of electric vehicles.

Despite the dominance of cost as a determining factor, the study also found that other independent factors, such as financial and non-financial incentives, charging infrastructure, social reinforcement, and environmental concerns, have a limited impact on adoption. This suggests that while these factors may play a role in shaping consumer attitudes towards electric vehicles, they may not be strong enough to influence purchasing decisions on their own.

Interestingly, the data also revealed that men are more likely than women to favor electric automobiles, with males being more likely than females to adopt electric cars. Additionally, younger consumers are more likely to adopt electric vehicles than older consumers, which may suggest that younger individuals are more open to new technologies and more likely to be influenced by environmental concerns.

Higher levels of education were also found to be associated with greater knowledge about the advantages of electric cars, suggesting that educational initiatives aimed at increasing awareness of the benefits of electric vehicles could be an effective way to encourage adoption.

Overall, these findings have important implications for manufacturers, policymakers, and other stakeholders seeking to promote the uptake of electric vehicles. By highlighting the economic benefits of electric vehicles, developing robust charging infrastructure, and offering financial incentives to encourage adoption, these actors may be able to overcome some of the barriers to adoption identified in this study. Additionally, efforts to increase education and awareness about the benefits of electric vehicles may be particularly effective in encouraging adoption among younger, more educated consumers.

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