

1. Chapter 4: Statistical Analysis & Findings discussion

1.1. Introduction

This chapter presents the statistical analysis conducted on the survey data collected as part of the study. The analysis focuses on the assessment of various factors impacting the integration of electric vehicles (EVs) for grid support in urban environments, particularly in Amman. The statistical methods employed include descriptive statistics, correlation analysis, and reliability analysis using Cronbach's Alpha.

1.2. Sample profile (descriptive statistics for research sample)

4.2.1 Descriptive statistics for the Likert scale questions

The overall mean score for all Likert scale questions was found to be 3.7143, with a standard deviation of 0.39983. This suggests that, on average, respondents had moderately positive views towards the factors investigated in the study, with some variability in responses.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Overall Mean	13	3.00	4.29	3.7143	.39983

The overall mean score across all items was 3.71, indicating that respondents generally agreed with the statements provided in the survey. The standard deviation of 0.40 suggests moderate variability in responses.

4.2.1.1 Descriptive Statistics for Individual Items:

Descriptive Statistics				
	Mean	Std. Deviation	Analysis N	Missing N
Grid Stability Impact	3.92	.641	13	0
Voltage Concern	3.62	.870	13	0
Business Model Feasibility	3.92	.760	13	0
Policy Effectiveness	2.62	.650	13	0
Stakeholder Coordination	4.77	.439	13	0

Public Awareness	2.85	.801	13	0
Future Optimism	4.31	.751	13	0

The variables with the highest means were "Stakeholder Coordination" (mean = 4.77) and "Future Optimism" (mean = 4.31), indicating strong positive agreement among respondents. Conversely, the lowest mean was for "Policy Effectiveness" (mean = 2.62), reflecting weaker perceptions of policy impacts.

4.2.2 Descriptive Statistics for Demographic Questions

Descriptive statistics for the demographic questions were analyzed as follows:

Statistics			
	Q1	Q2	Q3
Mean	2.92	2.92	3.00
Std. Error of Mean	.459	.288	.226
Std. Deviation	1.656	1.038	.816
Minimum	1	1	2
Maximum	6	4	4

Variable	Variable Classes	Frequency	Percent
current role in the electric vehicle (EV) industry	EV Owner	3	23.1
	Utility Company Employee	3	23.1
	Policymaker	3	23.1
	EV Manufacturer	1	7.7
	Academic/Researcher	2	15.4

	others	1	7.7
	Total	13	100
years involved in the EV industry	Less than 1 year	1	7.7
	1-3 years	4	30.8
	3-5 years	3	23.1
	More than 5 years	5	38.5
	Total	13	100
level of education	Bachelor's Degree	4	30.8
	Master's Degree	5	38.5
	PhD	4	30.8
	Total	13	100

Below are Pie chart of the data discussed

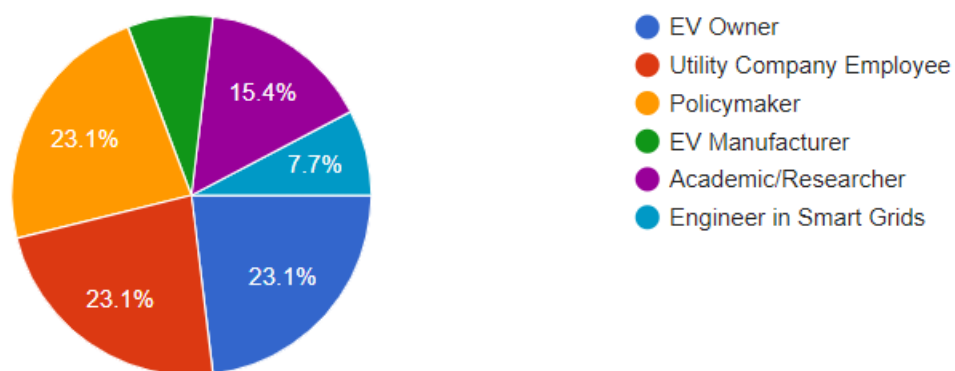


Fig: Current Role in the Electric Vehicle (EV) Industry

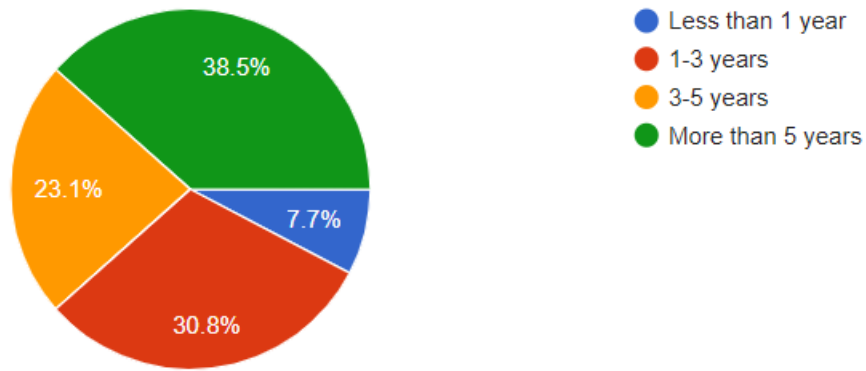


Fig: Years of Involvement in the Electric Vehicle (EV) Industry

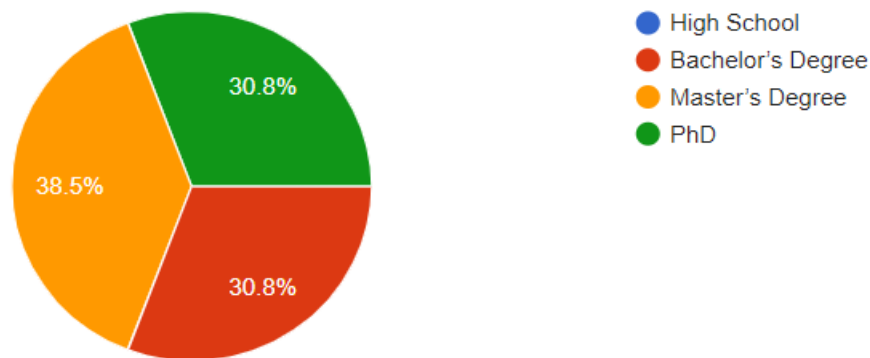


Fig: Highest Level of Education of Survey Respondents

4.2.3 Descriptive Statistics for Multiselect Questions

This section presents the results for multi-select questions, where respondents could choose more than one option. For each question, we provide a detailed frequency analysis, percentage breakdown, and visual representation.

4.2.3.1 Multi-Select Question: Technical Challenges

Question: What are the main technical challenges associated with electric vehicles (EVs)? (Select all that apply)

Table: Frequencies and Percentages for Technical Challenges

Technical Challenges Frequencies		Responses	
		N	Percent
Technical Challenge	Charging infrastructure	7	31.8%
	Grid capacity	7	31.8%
	Communication protocols	4	18.2%
	Energy management	4	18.2%
Total		22	100.0%

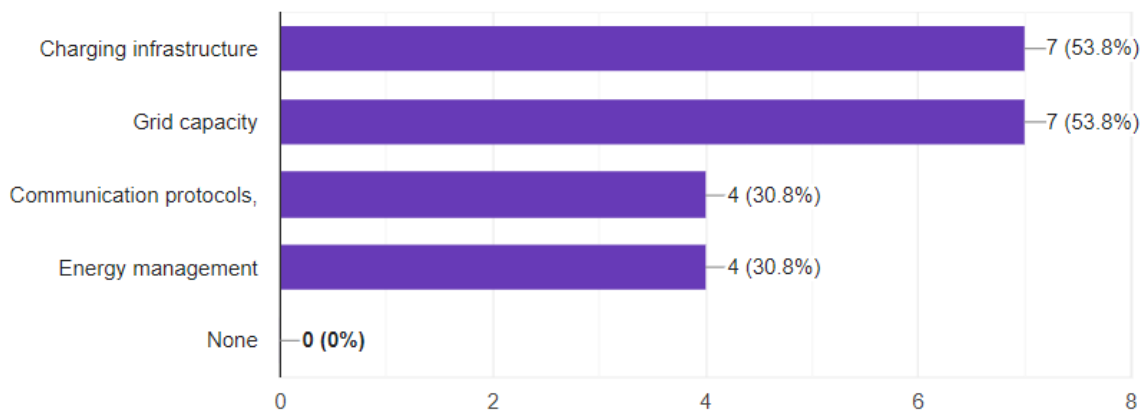


Fig: Technical Challenges Associated with Electric Vehicles (EVs)

The most frequently identified technical challenges in the electric vehicle (EV) industry were Charging Infrastructure and Grid Capacity, each cited by 31.8% of respondents. This indicates a significant concern about the adequacy and expansion of charging infrastructure and the ability of the grid to handle increased demand from EVs. Communication Protocols and Energy Management were less frequently mentioned, each at 18.2%, but still relevant.

Implication: To address these challenges, initiatives could focus on enhancing charging infrastructure and upgrading grid capacity. Developing robust communication protocols and energy management systems should also be considered.

4.2.3.2 Multi-Select Question: Economic Barriers

Question: What are the main economic barriers to electric vehicles (EVs)? (Select all that apply)

Table: Frequencies and Percentages for Economic Barriers

Economic Barrier Frequencies		Responses	
		N	Percent
\$Economic Barrier	High initial costs	7	31.8%
	Lack of government incentives	6	27.3%
	Limited charging infrastructure	8	36.4%
	Maintenance costs	1	4.5%
Total		22	100.0%

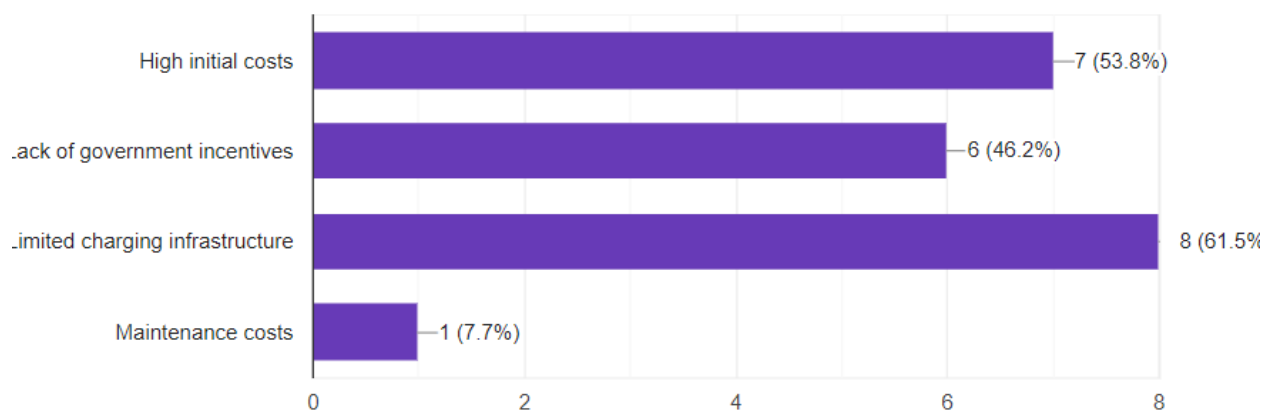


Fig: Economic Barriers to Electric Vehicles (EVs)

Respondents highlighted Limited Charging Infrastructure as the most significant economic barrier (36.4%), followed by High Initial Costs (31.8%). Lack of Government Incentives was also a notable barrier (27.3%), while Maintenance Costs were less frequently cited (4.5%).

Implication: Economic strategies to promote EV adoption should address the expansion of charging infrastructure and consider ways to reduce initial costs and provide government incentives. Maintenance costs are less of a concern but could still impact long-term adoption.

4.2.3.3 Multi-Select Question: Policy Incentives for V2G

Question: What policy incentives could support vehicle-to-grid (V2G) technology? (Select all that apply)

Table: Frequencies and Percentages for Policy Incentive V2G

Policy Incentive V2G Frequencies		Responses	
		N	Percent
Policy Incentive V2G	Tax incentives	5	27.8%
	Subsidies for EV purchase	4	22.2%
	Investment in charging infrastructure	5	27.8%
	Simplification of regulatory processes	4	22.2%
Total		18	100.0%

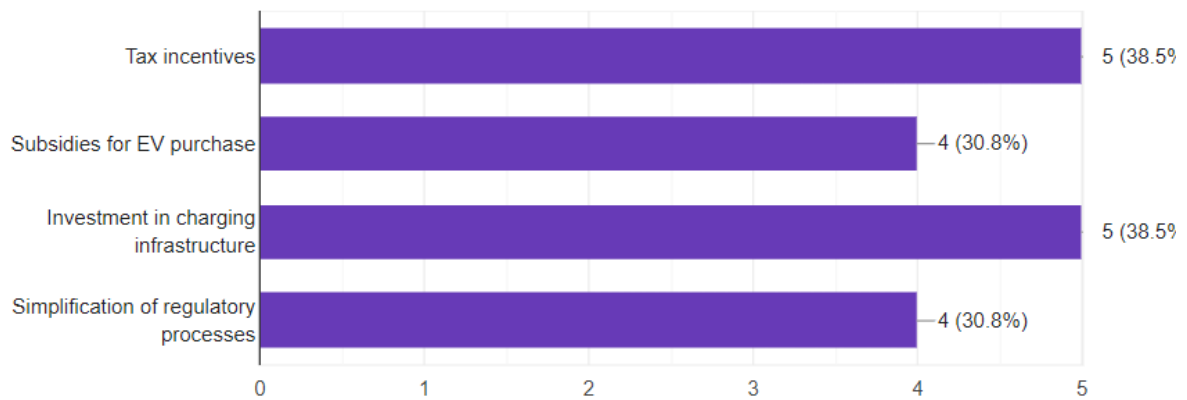


Fig: Policy Incentives for Vehicle-to-Grid (V2G) Technology

Limited Tax Incentives and **Investment in Charging Infrastructure** were the most popular policy incentives (27.8% each), indicating that financial and infrastructural support is crucial for the success of vehicle-to-grid (V2G) technology. **Subsidies for EV Purchase** and **Simplification of Regulatory Processes** were also mentioned (22.2% each), emphasizing the need for financial support and streamlined regulations.

Implication: Policymakers should focus on tax incentives and investments in infrastructure to support V2G technology. Additionally, simplifying regulatory processes and providing subsidies for EV purchases could further encourage adoption.

4.2.3.4 Multi-Select Question: Urban Challenges

Question: What are the main urban challenges for electric vehicles (EVs)? (Select all that apply)

Table: Frequencies and Percentages for Urban Challenge

Urban Challenge Frequencies		Responses	
		N	Percent
Urban Challenge	High population density	5	29.4%

	Limited space for charging stations	3	17.6%
	Diverse stakeholder interests	3	17.6%
	Inadequate infrastructure	6	35.3%
Total		17	100.0%

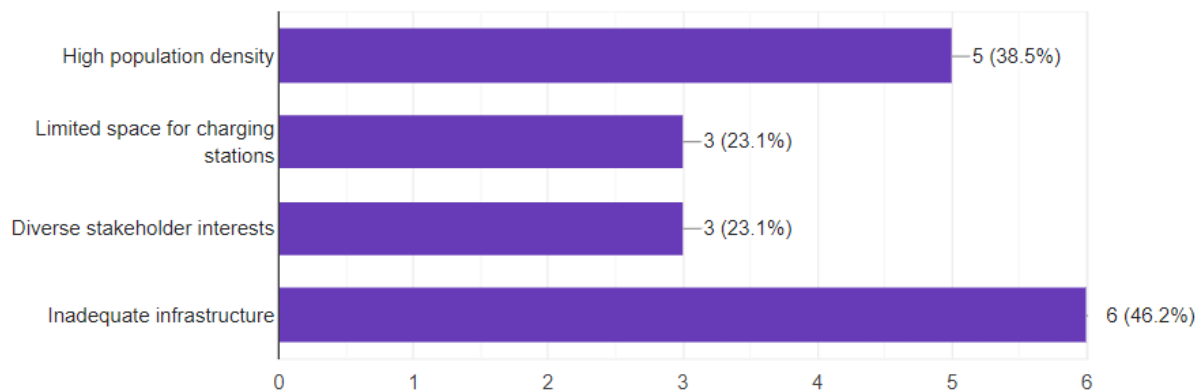


Fig: Urban Challenges for Electric Vehicles (EVs)

Inadequate Infrastructure was the most frequently cited urban challenge (35.3%), followed by High Population Density (29.4%). Limited Space for Charging Stations and Diverse Stakeholder Interests were less frequently mentioned but still significant (17.6% each).

Implication: Urban planning and development should prioritize improving infrastructure and managing population density to support EV adoption. Solutions for space constraints and stakeholder coordination are also necessary.

4.2.3.5 Multi-Select Question: Public Adoption Barriers

Question: What are the main barriers to public adoption of electric vehicles (EVs)? (Select all that apply)

Table: Frequencies and Percentages for Public Adoption Barriers

Public Adoption Barrier Frequencies	Responses
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		N	Percent
Public Adoption Barrier	High costs	8	40.0%
	Lack of charging stations	9	45.0%
	Lack of awareness	3	15.0%
Total		20	100.0%

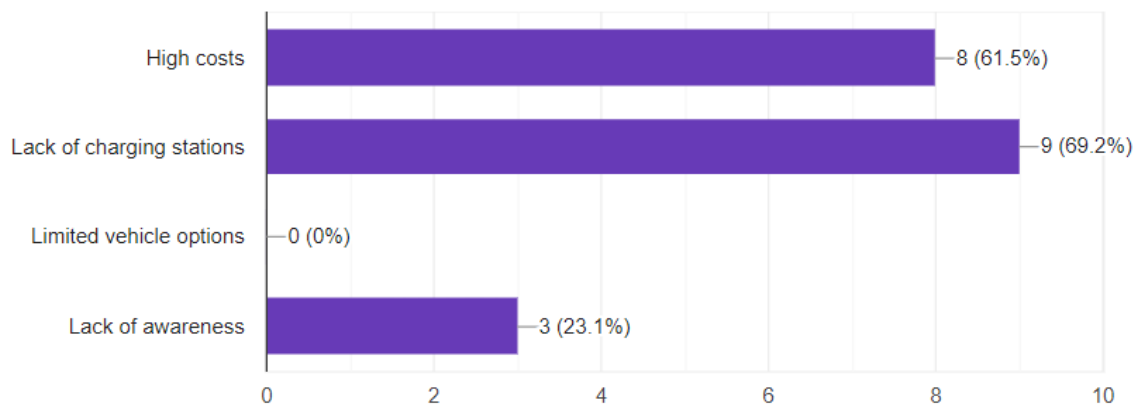


Fig: Public Adoption Barriers for Electric Vehicles (EVs)

Lack of Charging Stations (45.0%) and High Costs (40.0%) were the primary barriers to public adoption of EVs, indicating that expanding charging infrastructure and reducing costs are critical for increasing EV adoption. Lack of Awareness was less frequently cited (15.0%).

Implication: Addressing the lack of charging stations and high costs should be a priority for increasing public adoption. Awareness campaigns could help, but they are less critical compared to infrastructure and cost-related issues.

4.2.4 Descriptive Statistics for Opinion Questions

Question: What are your views on the economic benefits of vehicle-to-grid (V2G) technology?

Table: Frequencies and Percentages for Economic Benefits of V2G Technology

V2G Economic Benefits		Frequency	Percent
Variables	yes	6	46.2
	no	1	7.7
	Maybe	6	46.2
	Total	13	100.0

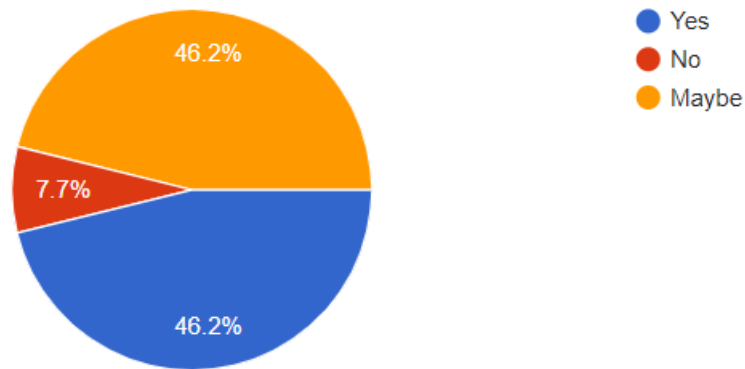


Fig: Opinion on Economic Benefits of V2G Technology

Respondents were nearly evenly split between those who see economic benefits (Yes, 46.2%) and those who are unsure (Maybe, 46.2%), with a small proportion believing there are no benefits (No, 7.7%).

Implication: There is strong support for the potential economic benefits of V2G technology, though opinions are divided. More education and evidence on the economic advantages of V2G could help address uncertainty and build confidence in its benefits.

1.3. Validity & reliability tests for the questionnaires

1.4. Descriptive statistics for research variables (answer research questions)

1.5. Testing Hypotheses & Findings Discussion

1.6. Conclusion