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Electric Vehicle Adoption in Poland: Insights from Academia and Technically Educated Youth

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Abstract: As global concerns about climate change and air quality intensify, nations are increasingly adopting sustainable transportation solutions, with electromobility emerging as a key alternative. This study investigates the factors influencing powertrain technology choice and the barriers to electric vehicle (EV) adoption in Poland, focusing on insights from technically educated youth, early-career researchers, and academic professionals. Drawing on a mixed-methods approach, the study investigates public perceptions, motivations, and challenges associated with EV uptake in a country historically reliant on fossil fuels. Key drivers such as environmental considerations, government policies, and infrastructure development are evaluated alongside persistent obstacles, including high initial purchase costs, inadequate charging networks, range anxiety, and scepticism about battery performance. While the sample is not representative of the broader Polish population, it provides insights from a technically literate cohort likely to shape future technological and policy advancements. Our findings reveal that the adoption of EVs among this group is influenced by factors such as technological innovation and government policies, while barriers include high initial costs, limited charging infrastructure, and scepticism about perceived sustainability, battery life, and performance. The research also highlights the critical role of education and awareness in shaping attitudes toward EVs. This study, though limited by sample size and demographic focus, offers valuable contributions to understanding the early-stage adoption of EVs in Poland and serves as a foundation for future research targeting a more diverse population. The applied research model is scalable, providing a framework for broader studies that could include different age groups, geographical regions, and professional sectors.

Keywords: electromobility challenges; survey opinions; policy creation; perceived environmental benefits; sustainability; European Green Deal; fossil fuel dependence

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1. Introduction

Mankind's need for fast and efficient transport has led to the intensified development of transport infrastructure, the improvement of transport policies, and the modernisation of means of transport. Practically in parallel, the trend in the development of automotive propulsion systems has been aimed at greater economy, greater power, smaller mass, and longer service life. Furthermore, low emissions of local pollutants and greenhouse gases (GHGs) have proven to be equally important. On 14 July 2021, the European Commission

adopted a package of legislative proposals to adapt EU climate, energy, transport, and taxation policies to achieve the objective of reducing net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. The implementation regulations package, called Fit for 55, reinforces the need for changes in the automotive market, and the electrification of vehicles has been recognised as a key part in addressing global climate change challenges [1].

In 2023, electric vehicles represented nearly 18% of global car sales and reached almost 14 million, representing a 35% increase from 2022. This growth meant that the global electric fleet increased to 40 million in 2023, signalling a transformative shift toward sustainable transportation [2]. Given the increasingly restrictive measures to limit the amount of direct harmful emissions from road transport and the larger efficiency of electric motors over their internal combustion counterparts, the expansion of EV sales seems justified, although it secures a different market proportion for different geographical areas.

Poland, whose automotive history includes a heavy dependence on coal and traditional fuels, is now slowly transitioning toward electromobility, embracing it as a cornerstone of its environmental strategy. Although progress is evident, the journey toward widespread adoption of electric vehicles presents both challenges and opportunities. As of 20 June 2024, 69,020 battery electric vehicles (BEVs)—both passenger and commercial—had been registered in Poland, marking a 7% increase compared to the same period in 2023. At the end of June 2024, the total fleet of electric passenger cars in Poland had reached 119,297 vehicles, of which 62,125 were fully electric (BEVs) and 57,172 were plug-in hybrid electric vehicles (PHEVs). Additionally, there were 6926 electric vehicles and trucks on the road, and the electric two-wheeler fleet had grown to 21,382 units. The fleet of zero-emission buses had also expanded to 1357, with 1293 fully electric and 64 hydrogen-powered buses [3]. Although this growth is encouraging, the progress of Poland toward its government targets remains slow. The original goal of having 1 million electric vehicles on the road by 2025 is unlikely to be achieved without significant acceleration [4].

Globally, the adoption of EVs has focused on exploring the technological challenges related to the introduction of this powertrain technology, such as the high infrastructure costs, the scarcity of charging stations, the limited range or range anxiety, the charging time, and the performance of batteries [5,6].

The aim of this article is to explore the current landscape of electromobility in Poland by examining the perceptions of representatives of academia, including students, researchers, and teaching professionals from technical universities. The central hypothesis of this study is that among technically educated individuals, who may be more informed about sustainable technologies, fossil fuel vehicles remain the preferred option due to perceived cost advantages, infrastructure limitations, and scepticism about the practical and environmental benefits of EVs. Through an analysis of survey results, the study offers a nuanced understanding of the key barriers to a successful transition to electric vehicles, ranging from infrastructural and technological limitations to societal attitudes and readiness for change. By focusing on this technically literate cohort, the research provides insight into how Poland's future-orientated academic community envisions the role of electromobility in advancing environmental sustainability and shaping the country's economic future.

2. Related Work

The topic of electromobility has attracted considerable attention from researchers in various disciplines in the past couple of years, reflecting its growing importance in the management of environmental challenges and the promotion of sustainable transportation. Subsequently, a substantial body of literature has emerged that explores different aspects of

electromobility, including consumer preferences, technological advancements, and policy measures [7–9].

Liu et al. (2021) demonstrated that government support in the form of tax incentives and subsidies significantly boosts consumer interest in EVs. Their findings show that regions with well-developed policy frameworks tend to experience higher EV sales and have a more favourable public perception of electromobility [10]. Cross-national surveys confirm that both environmental concerns and economic considerations shape consumer attitudes. For instance, PwC (2024) found that environmental consciousness and potential cost savings are the main motivators for EV adoption, whereas uncertainty regarding total cost of ownership and charging convenience remains a deterrent for many consumers [11].

Barriers and motivators from the consumer perspective have also been extensively examined. Jaiswal et al. (2021) emphasised the importance of factors such as range anxiety, battery performance, and charging infrastructure in shaping adoption decisions [8]. Similarly, Tarei et al. (2021) observed that despite growing interest in EVs, practical concerns (particularly regarding insufficient charging networks) continue to hinder widespread uptake [12]. Lanzini (2024), focusing on the Italian context, identified similar obstacles, suggesting that consumer readiness for EVs remains closely related to perceptions of infrastructure adequacy and long-term cost-effectiveness [13].

According to Zhao et al. (2024), psychological and value-based dimensions also play a role in influencing adoption, showing that personal values, especially those aligned with environmental protection, strongly affect purchase intentions [14]. Their study underscores the importance of sustainability-focused messaging in promotional efforts. Demographic influences further contribute to the adoption landscape. Tao et al. (2024) found that younger, more educated, and higher-income individuals are more likely to adopt EVs, suggesting that targeted outreach to these demographics could enhance uptake [15]. Limpasirisuwan et al. (2024) added nuance by demonstrating how generational differences influence adoption drivers, highlighting the importance of age-sensitive communication strategies [16].

Several comprehensive reviews consolidate these findings, offering broader conceptual frameworks. Pamidimukkala et al. (2024) provided a global overview of EV adoption barriers and motivators, while Farajnezhad et al. (2024) and Purwanto and Irawan (2024) emphasised the importance of socioeconomic and environmental factors in the formulation of consumer decisions [17–19]. Zaino et al. (2024) provided a systematic review that integrates the technological, organisational, and policy-related dimensions of EV diffusion, demonstrating the need for coordinated action in multiple sectors [20].

In addition to consumer-oriented studies, recent research has also examined the role of urban vehicle access regulations as a means to promote electromobility. Ogunkunbi and Meszaros (2023), for example, analysed how urban policy tools in Budapest contribute to changing mobility behaviours and increasing the uptake of EVs [21]. He and Hu (2024) applied a goal-directed behaviour model to capture the complexities of decision making in the adoption of EVs, highlighting the interplay between attitudes, perceived control, and contextual enablers [22].

Although these studies contribute significantly to understanding global and regional trends in EV adoption, they often overlook national specificities, especially within individual member states of the EU. This study addresses this gap by focusing on Poland's challenges and opportunities in the transition to electromobility, situated within the broader goals of the European Green Deal and the Fit for 55 package. To explore these dynamics, the research targeted academic representatives—a group selected due to their high levels of technical education, social engagement, and potential to shape public discourse and influence broader societal attitudes toward sustainable technologies.

3. Research Methodology

A mixed-method approach was used to explore the factors that influence powertrain technology preferences and barriers to the adoption of electric vehicles (EVs) among technically educated individuals in Poland. The research was conducted through an online survey distributed among students, researchers, and teaching professionals at Kielce University of Technology, a demographic characterised by above-average knowledge of engineering, sustainability, and emerging technologies.

The questionnaire (Figure 1) was designed to collect demographic and attitudinal data. Respondents were asked about their current or intended vehicle type, the criteria they consider when selecting a vehicle, and their attitudes toward electromobility and environmental sustainability. To provide quantitative insight, Likert-scale [23] and multiple-choice questions were used to gauge the importance of factors such as cost, range, charging infrastructure, and perceived environmental impact. The instrument was developed based on insights drawn from previous research on the adoption of EVs, consumer behaviour, and sustainability motivations [7–22].

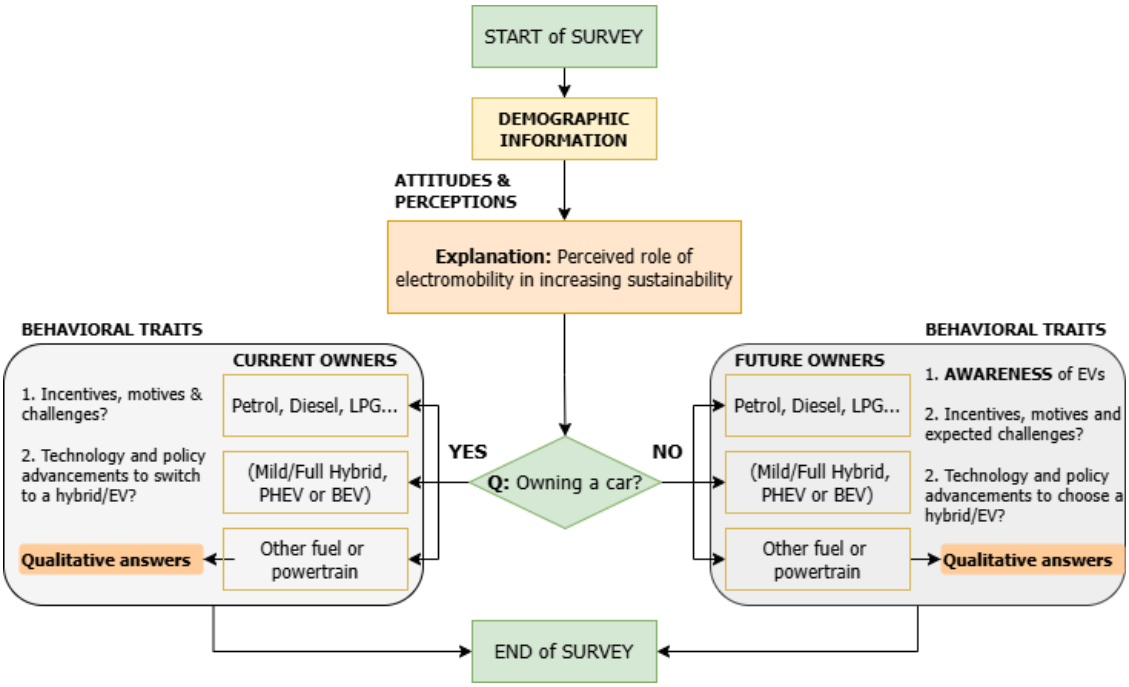

Figure 1. Diagram of the questionnaire of the survey. Source: Author's own elaboration.

Given the focus on a technically informed population, the study also sought to examine a critical assumption frequently made in the existing literature: that higher levels of technical education correlate with increased openness to emerging sustainable technologies such as EVs [14–16]. However, previous findings suggest that this group may not exhibit uniformly positive attitudes toward EV adoption. In fact, people with technical knowledge may be more aware of the current limitations of EVs, including concerns about lifecycle emissions, battery production impacts, and infrastructural insufficiencies.

Consequently, the following hypothesis was formulated to guide the research:

H1: *Due to their technical knowledge and environmental awareness, technically educated individuals are likely to express scepticism toward the adoption of electric vehicles, citing concerns about infrastructure limitations, high purchase costs, performance issues, and doubts regarding the true sustainability and lifecycle emissions of EVs.*

This hypothesis informed both the survey design and subsequent analysis, allowing for a more nuanced understanding of the attitudes held by a group expected to play a key role in Poland's green transition. The findings are intended to provide both academic and policy-orientated insights into how electromobility is perceived by those likely to shape its future implementation and acceptance.

It should be noted that before the survey was launched, a pilot survey was conducted with a small group of 10 people to draw conclusions about the effectiveness of the survey design, the relevance of the questions, and the general attitudes and awareness of the target population regarding electromobility. Using these insights, small, well-informed adjustments were made before launching the full survey.

The survey was conducted using Google Forms to facilitate access and participation. Participants were recruited in person, through social media, and via email invitations. The survey was conducted in accordance with ethical guidelines, and informed consent was obtained from all participants, while confidentiality was ensured by anonymising the responses. Participants were informed of the purpose of the survey and their right to withdraw at any time.

The survey remained open for a period of one full month (from 16 October to 15 November 2024), during which a total of 141 responses were collected. The size (total number of students and staff) of Kielce University of Technology is 4868 [24]. This is a relatively small sample; therefore, it was important to determine the margin of error and the level of confidence of the sample. This was performed using the following equation:

$$MOE = z \cdot \frac{\sigma}{\sqrt{n}} \quad (1)$$

where:

n—sample size;

σ—standard deviation;

z—score consistent with the desired confidence interval (for the 95% confidence level, equals 1.96).

The resulting error margin, calculated for a confidence level of 95%, is 8%, which is a sufficiently low margin, considering the small sample size.

4. Survey Results

To analyse the collected survey data, no specific restrictions were applied, which means that individual responses were not excluded from the analysis. However, some of the non-mandatory questions were not answered by some of the participants. Once collected, the quantitative data were analysed to perform descriptive statistics, while the qualitative responses were thematically analysed to identify common themes and insights. This approach involved identifying and organising patterns, themes, topic, or ideas within written responses to gain deeper insights into the perspectives and experiences of the participants.

The small sample included people of different ages, education levels, and income levels (Figures 2 and 3). Approximately 76% of the responses that were collected from the survey were students, while 22% represented academic staff (including PhD candidates/researchers, professors, and assistants), and the remaining participants fell into the category of administration or other staff. The largest age group among participants was 22–25 years old, comprising approximately 50% of the total number of respondents. This was followed by participants aged 26 to 35, who made up approximately 18%, while the third-largest group consisted of individuals aged 18–21.

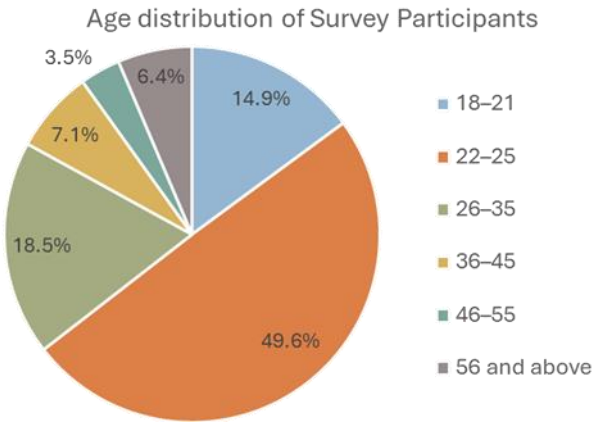

Figure 2. Age distribution of survey participants. Source: Author's own elaboration.

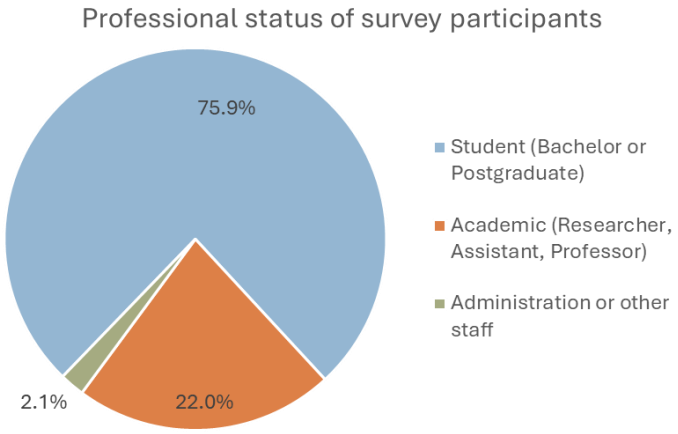

Figure 3. Professional status of survey participants. Source: Author's own elaboration.

The responses collected from the questionnaire were summarised into the following categories:

4.1. Fuel and Powertrain Preferences

The survey results revealed that of the 141 participants who took the survey, 78.7% were car owners, while 21.3% did not own a car but were considered prospective or future car owners. Approximately 45% of current car owners surveyed used diesel, fossil-fuel-powered vehicles. The key factor for choosing this technology was economic efficiency, especially for those who regularly travel long distances. Diesel fuel was criticised in the context of local pollutant emissions, but it remains the dominant choice among users from rural and suburban areas. It should be noted that when analysing the results for future car owners, diesel as a fuel in light passenger cars drops well below 20% (Figure 4).

About 37% of the respondents drive petrol cars, characterised by their greater availability and versatility, especially among urban users. The survey highlighted that the lower purchase costs of these cars are a significant factor contributing to their growing popularity among respondents, especially prospective car owners. LPG fuel cars are chosen by 10.9% of survey participants. This fuel is mainly popular among users who prefer lower fuel and operating costs. Although this fuel is more economically available, the limited availability of refuelling stations and the potential for higher service costs somewhat reduce its attractiveness. Both petrol and LPG cars not only maintain but also increase their attractiveness for future owners, with their numbers likely to increase in the future, primarily to account for the drop in diesel car sales (Figures 4 and 5).

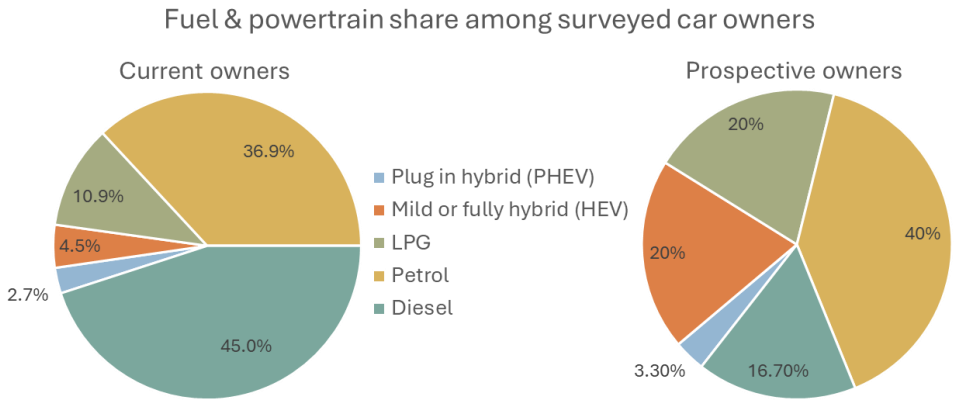

Figure 4. Fuel and powertrain share among current and prospective owners. Source: Author's own elaboration.

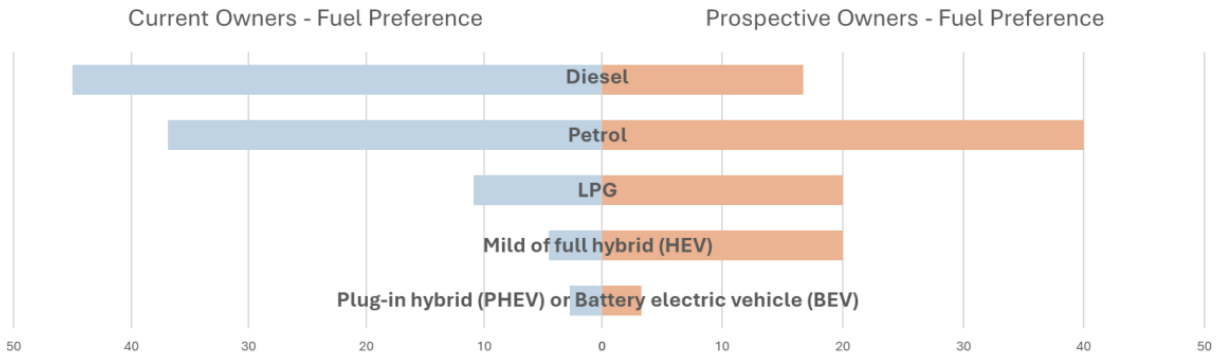

Figure 5. Car preference by fuel/powertrain technology among current and prospective owners. Source: Author's own elaboration.

Currently, just 7.2% of respondents use mild and full hybrid electric vehicles (HEVs), PHEVs, and BEVs. The survey results indicated that hybrid powertrains may be attractive for people who travel primarily in urban environments. Short distances and frequent stops potentially allow for a fuller use of the electric powertrain. The respondents also highlighted the benefits associated with quiet engine operation and lower operating costs. The powertrain choice of future owners is likely to include a larger number of cars powered by these alternative powertrains, as their response percentage indicated a share of 23.3%, but with the majority of those being mild or full hybrids (20%) (Figure 5).

4.2. Factors Influencing the Choice of Powertrain Technology

When selecting their car, owners consider a range of factors that influence their decision-making process. Among these, operating costs, infrastructure availability, technological innovation, ecological concerns, and attachment to traditional technologies play a key role. These various outside influences reflect a complex balance between cost efficiency, environmental impact, and personal preferences, with different types of powertrain technologies offering distinct advantages and limitations.

The results of the survey revealed that personal preference was the most influential factor for current and future car owners in Poland in all categories. Among fossil fuel car owners, 75.2% cited personal preference as a key reason for their choice, with 54.3% considering it their main motivation (Figure 6). A similar pattern was observed among future fossil fuel buyers, where 76% also identified personal preference as a key driver. For HEV/EV owners, 56% of current owners and 50% of future owners reported personal preference as the dominant factor (Figure 7).

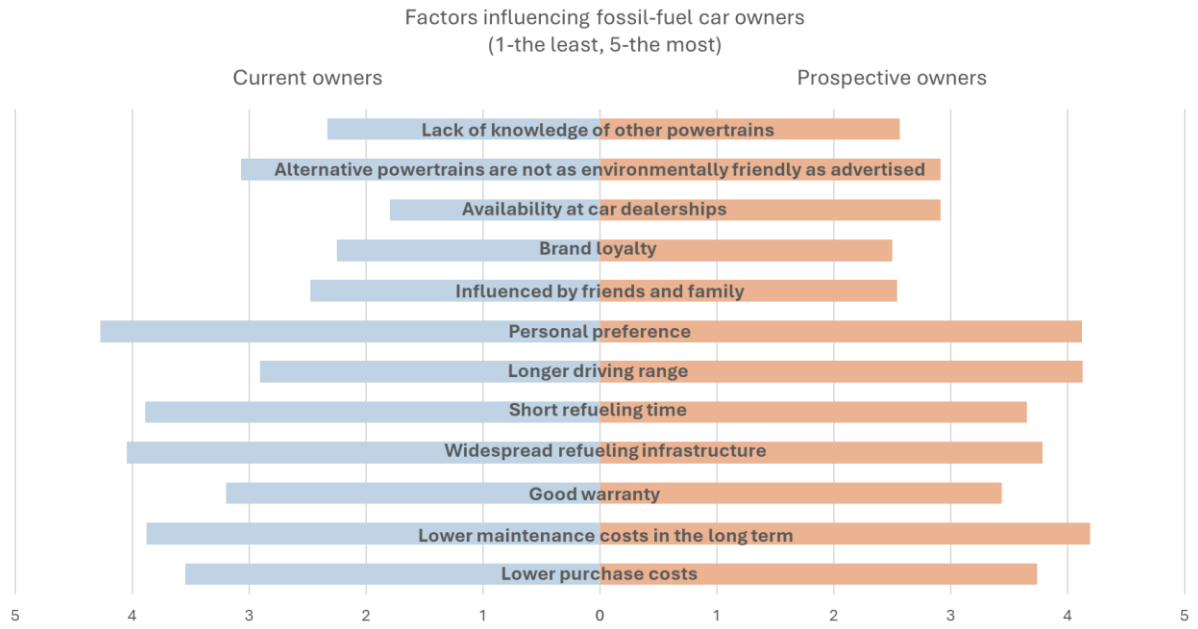

Figure 6. Factors that influence the choice of fuel and powertrain among current and prospective fossil-fuel-powered car owners. Source: Author's own elaboration.

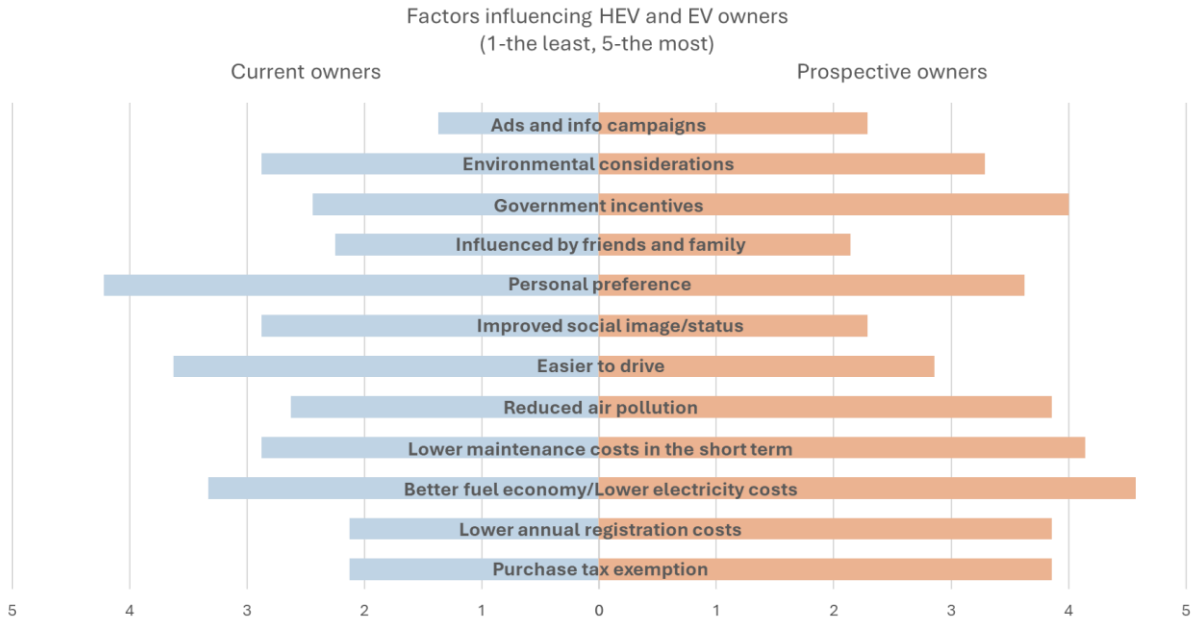

Figure 7. Factors that influence the choice of fuel and powertrain among current and prospective HEV and EV owners. Source: Author's own elaboration.

Both current and prospective fossil fuel car owners prioritised range, refuelling infrastructure, and cost-related factors when considering alternative car choices. Many respondents, specifically 67% of current owners and 65% of future buyers, expressed concerns about long-term maintenance costs, often citing the high expense of battery replacements as a key factor shaping their perception of electric vehicles. Cost efficiency also played a crucial role, with 61% of current and prospective owners highlighting the lower initial purchase price of fossil fuel vehicles as a significant advantage over HEVs and EVs. Driving range remained an important factor for 58% of current fossil fuel car owners and 78% of prospective buyers, who viewed it as a critical determinant in their decision-making process. Similarly, fuel consumption time has emerged as a notable consideration, with

55% of current owners and 52% of prospective buyers perceiving it as a distinct advantage of fossil fuel vehicles over electric alternatives.

In addition to these concerns, 40% of current fossil fuel car owners acknowledged that a lack of knowledge about alternative powertrains could have influenced their resistance to the adoption of EVs. However, this knowledge gap appeared to be narrowing among future buyers, suggesting that increasing awareness and education efforts may play a crucial role in shaping consumer preferences over time. In general, long-established market solutions are perceived to be more reliable and easier to maintain, especially considering the potential difficulty of handling new driving systems.

A large proportion of future HEV/EV owners prioritised better fuel efficiency and lower electricity costs. Furthermore, 89% of future buyers placed value on lower short-term maintenance costs or general operational costs, in contrast to current owners, who showed a lesser emphasis on this factor. Government incentives (monetary and non-monetary) also played an important role for future EV buyers, with 71% citing them as an important motivator, compared to 45% of current HEV/EV owners. This change suggests that future buyers are more attuned to the financial benefits and policies that support the adoption of electric vehicles. Approximately 63% of all groups cited an improved social image or status as the least motivating factor in their decision to purchase an HEV/EV car.

4.3. Barriers and Challenges Faced by Car Owners

The results of the survey reveal a strong alignment between current and future car owners with respect to the challenges associated with both fossil fuel cars and cars using electrified powertrains. Although some concerns are unique to specific groups, a few broader themes emerge, particularly related to infrastructure, costs, and evolving regulatory pressures.

For current fossil fuel car owners, the most pressing challenges revolve around regulatory restrictions and rising costs (Figure 8). Stricter emission regulations are already influencing vehicle usage, with 68% of respondents citing penalties based on Euro emission standards as a significant concern when driving into urban areas. Furthermore, 66% pointed to rising short-term maintenance costs, indicating that as fossil fuel cars age and environmental policies tighten, maintenance expenses are becoming increasingly burdensome. Interestingly, peer pressure is perceived as the least challenging factor, with 64% of current fossil fuel owners indicating that social influence has little to no effect on their vehicle choice. This suggests that while the transition toward cleaner mobility is underway, societal expectations alone are not yet strong enough to drive behavioural change.

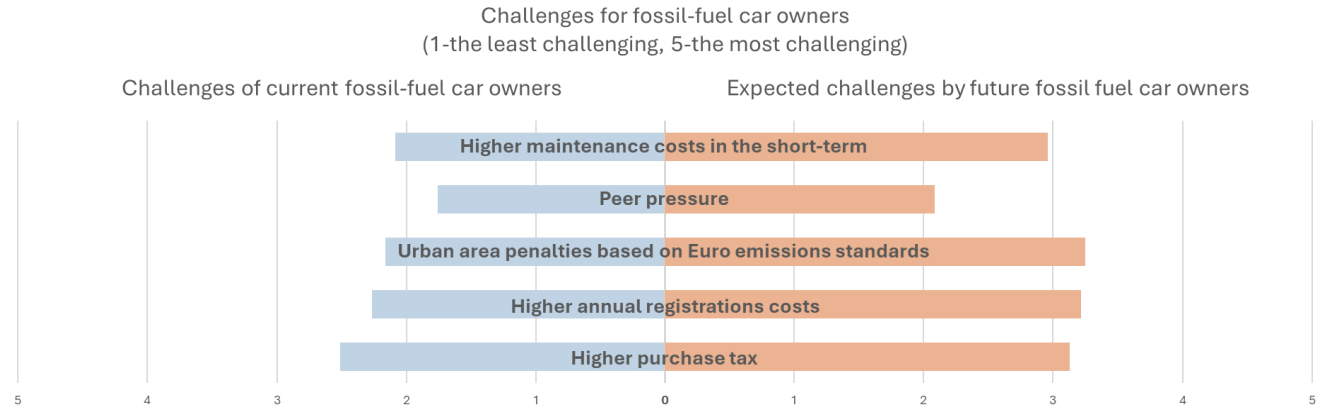

Figure 8. Challenges of current and prospective fossil fuel car owners as part of the green transition. Source: Author's own elaboration.

Future fossil fuel vehicle owners anticipate higher annual registration costs (48%) and continued penalties for emissions (43%) as their biggest challenges. These findings highlight a growing awareness that regulatory pressures will continue to shape the market, potentially making fossil fuel cars less financially viable over time. However, as with current owners, peer pressure remains one of the least influential factors, reinforcing the idea that financial and infrastructure considerations outweigh social influence in consumer decision making.

For current HEV and EV owners, the most significant barriers relate to the charging infrastructure and operational limitations (Figure 9). The overwhelming majority (75%) cited insufficient charging infrastructure as a key challenge, followed closely by concerns over long charging times and limited driving range (63%). These findings suggest that, while EV adoption is increasing, Poland's charging network remains inadequate, making daily use of electric vehicles more difficult, particularly for those without home and/or workplace charging solutions. Financial concerns were also prominent, with 50% of current HEV/EV owners identifying high initial purchase costs as a challenge. This highlights the ongoing issue of affordability, as electric vehicles remain significantly more expensive in the beginning compared to their fossil fuel counterparts. Interestingly, the availability of maintenance services was the least concerning issue, suggesting that despite fears about the cost of repairs, existing HEV/EV owners in Poland do not struggle significantly with finding service providers.

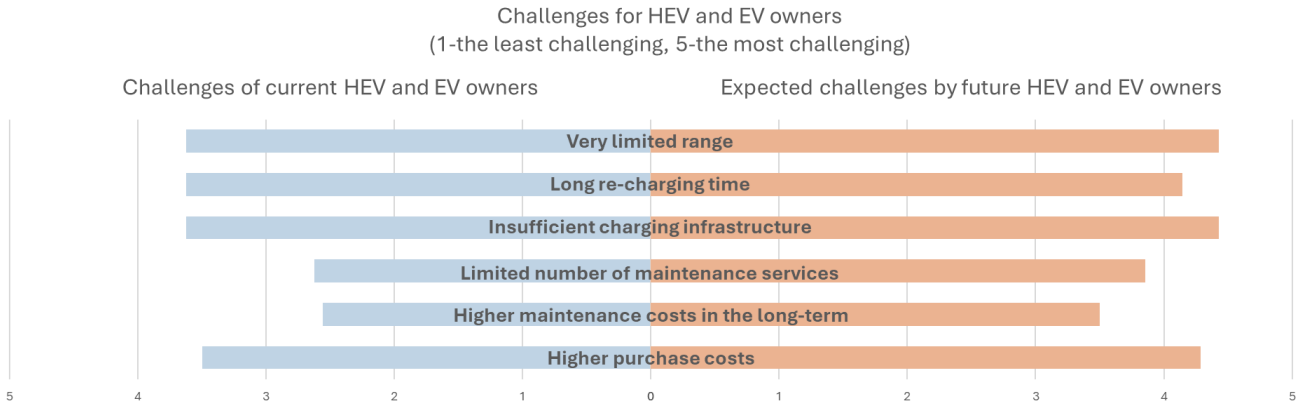

Figure 9. Challenges of current and prospective HEV and EV car owners. Source: Author's own elaboration.

An overwhelming 86% of future owners anticipate insufficient charging infrastructure and range limitations as their primary obstacles, further underscoring the urgent need for investment in public and private charging networks. Furthermore, 71% expect high purchase costs to be a significant barrier, reinforcing the importance of continued financial incentives and cost reduction strategies to encourage adoption.

4.4. Next Car Purchase Preference

When asked about their car purchase preferences, an overwhelming 64.6% of current fossil fuel car owners declared that they would choose a conventional, fossil-fuel-powered car again (Figure 10). This result clearly indicates the dominant trust in traditional technologies among respondents, valued for their availability, affordability, and well-developed supporting infrastructure. In contrast, 21.5% of current fossil fuel car owners indicated they would switch to a mild/full hybrid (coinciding with the likelihood that prospective car owners would buy this type of car). This suggests moderate openness to technologies that combine known elements with modern solutions, maintaining an average level of confidence. Respondents showed the least interest in PHEVs and BEVs (13.9%). The

result highlighted the barriers identified by the respondents, such as high purchase costs, technological limitations, or insufficient charging infrastructure.

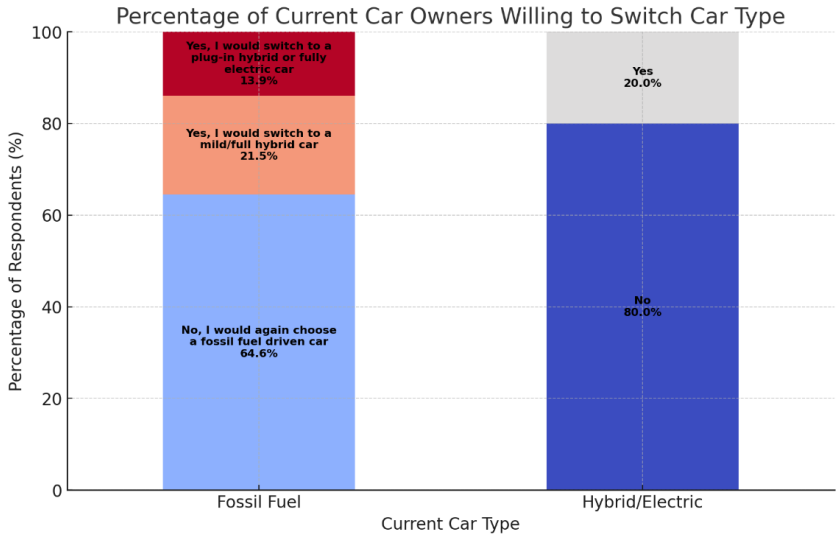

Figure 10. Percentage of car owners willing to switch car powertrain type. Source: Author's own elaboration.

Among current car owners, fossil fuel cars had the highest level of recommendation (a grade of 5), with up to 46.6% of the respondents stating that they would highly recommend fossil-fuel-driven cars to their friends or family, and an additional 14.6% rated them at 4. This allows for a clear statement that more than 60% consider fossil fuel cars to be worthy of recommendation and a technology that is reliable in use. Only 8.7% of the respondents would advise against their purchase, indicating a low level of criticism of this conventional technology, despite the associated environmental concerns.

The results obtained for hybrid vehicles confirm their moderate acceptance among the respondents, receiving the highest percentage (35.9%) for value 3 on the recommendation scale (1 meaning least likely and 5 meaning most likely to recommend). The second-highest rating is 1, indicating scepticism toward this technology. The high recommendation (values 4 and 5) totals only 22.3%, which shows concerns among the survey participants related to the cost-effectiveness and reliability of the use of hybrid vehicles. PHEVs and EVs received the lowest level of recommendations in the survey, with most ratings being 1 and 2, fully reflecting the low level of trust in this technology among participants. Barriers such as high purchase costs, the lack of a well-developed charging infrastructure, and technological limitations were named the main factors that hinder their acceptance. Only a small percentage of the respondents (9.7%) chose values 4 or 5, indicating a low level of interest and recognition for these advanced vehicle technologies.

Valuable insights came up by analysing the 'next car' purchase preferences, based on the level of knowledge (1 meaning the least and 5 meaning the most knowledge) of the different available powertrain options (Figure 11). At lower knowledge levels (1–2), petrol cars remain a dominant choice, with 50% of respondents at knowledge level 1 choosing petrol and a mix of diesel and LPG. As knowledge increases (levels 3–4), the preference for mild/full hybrid cars grows, while interest in diesel decreases. At the highest level of knowledge (5), 100% of the respondents chose petrol, which could indicate scepticism about alternative powertrains or a preference for familiarity despite being informed.

This suggests that awareness and education play a crucial role in shaping consumer preferences. Although hybrid interest increases with knowledge, the dominance of petrol cars even among well-informed consumers suggests that other factors, such as cost, infras-

tructure, or trust in new technologies, may outweigh knowledge-driven decisions. Taken together, these insights suggest a gap between awareness and action, while knowledge influences openness to hybrids, entrenched habits and infrastructure limitations still play an important role in determining purchase decisions.

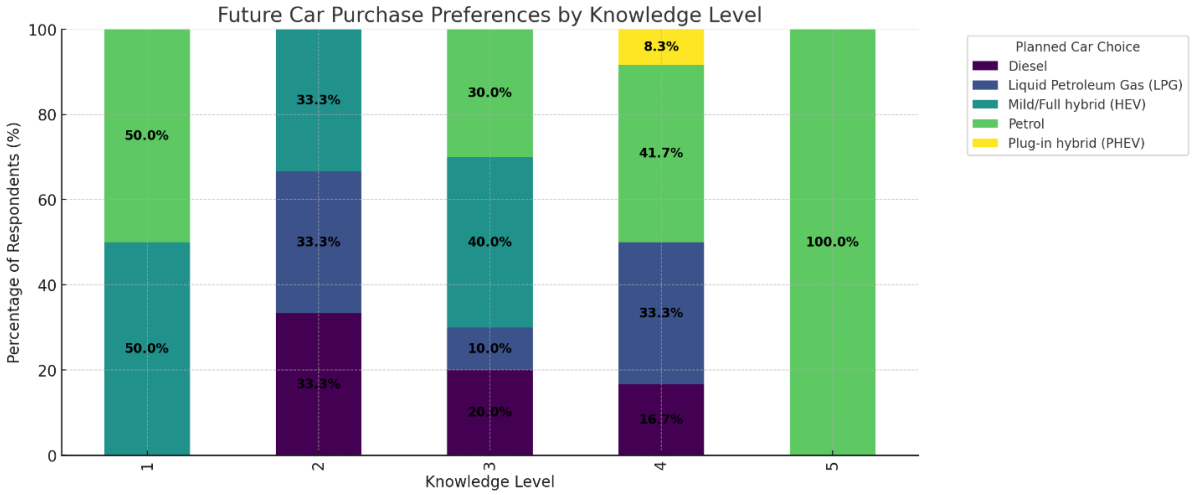

Figure 11. Future car purchase preferences based on knowledge level. Source: Author's own elaboration.

4.5. Environmental Sustainability as a Decision-Making Factor in the Purchase of HEVs and EVs

An important observation was made when analysing environmental sustainability and how it influences the purchase of new cars. More than 80% of the participants (Figure 12) believe that hybrid and fully electric vehicles have little to no importance in addressing urban air pollution or combating climate change. As a result, when considering the purchase of a new car, participants generally think of environmental sustainability as a low-priority factor in their decision making. Similarly, they do not consider these vehicles a significant contributor to the green transition in the EU, and only 12% of the participants agree/strongly agree that the energy transition would fail without the transition to electromobility. Based on these insights, it can be concluded that the Polish people do not see electromobility as part of the solution when it comes to the EU's green energy transition.

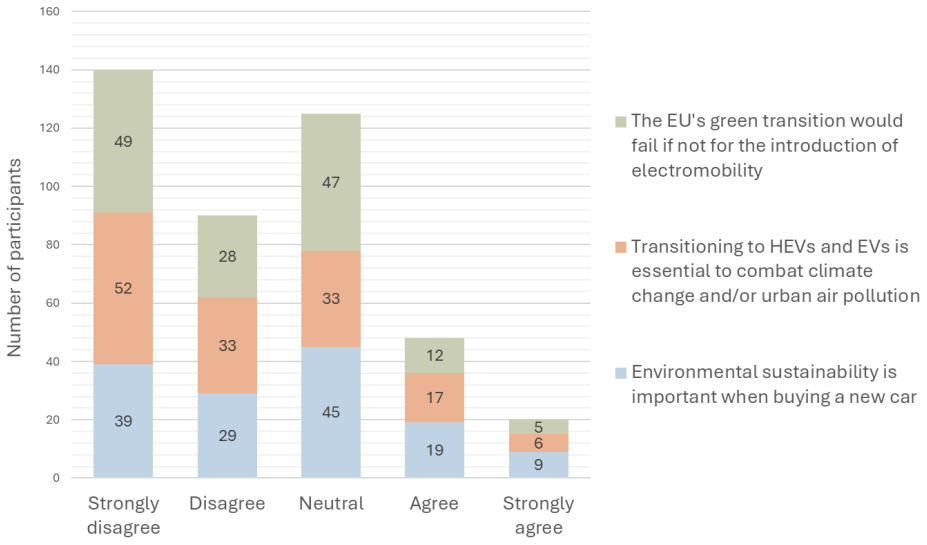

Figure 12. Participant's opinion of the importance of environmental considerations when buying a new car. Source: Author's own elaboration.

5. Discussion

This study aimed to explore the factors influencing powertrain technology choice and the barriers to electric vehicle (EV) adoption in Poland, with a specific focus on the perspectives of technically educated youth. Unlike studies that attempt to generalise across the entire population, this research targeted students and young researchers from a technical university—individuals who possess foundational knowledge in engineering, sustainability, and emerging technologies. While this sample is not demographically representative of Poland's general population, it reflects a forward-looking cohort likely to shape technological and societal trends in the coming decades.

The decision to study this particular demographic was intentional. Technically educated youth are often at the forefront of innovation and play a crucial role in shaping future consumer behaviour, policy design, and technology adoption. Their insights are valuable in understanding not just current market behaviours but also the direction of future developments in sustainable transport. However, reliance on a single academic institution (Kielce University of Technology) introduces potential selection bias and limits the external validity of the findings. As such, the results should be interpreted as context-specific and not broadly generalisable to the Polish population.

Additionally, survey data were collected over a full month, which may not account for temporal variations in attitudes or behaviour. For instance, seasonal factors or shifts in energy pricing, public transport availability, or policy announcements could influence responses. Future studies could address these limitations by applying longitudinal or repeated cross-sectional designs, surveying participants over extended periods or at different times of the year.

Despite these limitations, the research model applied in this study is scalable. The survey instrument and analytical approach can be extended to include other demographic groups, such as working professionals, older vehicle owners, or residents of rural and urban areas, to capture a more comprehensive picture of Poland's readiness for electromobility. By starting with a group that is knowledgeable about the technological aspects of EVs, this study establishes a conceptual foundation that can support broader investigations and inform the design of targeted policies. Ultimately, while the findings offer initial insights into EV-related perceptions among a technically literate population, they also lay the groundwork for future research that is more inclusive and generalisable. Expanding the scope of the study will be essential to validate and deepen our understanding of consumer preferences and systemic barriers in the Polish context.

6. Conclusions

The research presented in this article aimed to examine the factors that influence the choice of powertrain technology and barriers to the adoption of electric vehicles in Poland, focusing on the perspectives of technically educated youth. The hypothesis proposed that "*Due to their technical knowledge and environmental awareness, technically educated individuals are more likely to express scepticism toward the adoption of electric vehicles, citing concerns about infrastructure limitations, high purchase costs, performance issues, and doubts regarding the true sustainability and lifecycle emissions of EVs*."

The findings of this study partially support the hypothesis. Technically educated youth in Poland, while generally open to the idea of electric vehicles, do exhibit scepticism about the practicality of adopting EVs. The data revealed that high purchase costs, insufficient charging infrastructure, and concerns about range limitations and performance are prominent barriers to adoption, aligning with the hypothesis. These concerns were cited as significant obstacles to the adoption of EVs, even among a technically educated group that should, in theory, be more open to technological innovations.

However, the data also indicated that environmental awareness, which was expected to be a strong motivator for the adoption of EVs, was less influential in driving actual purchase decisions. In fact, participants did not necessarily view electric vehicles as the environmentally friendly solution that they are often portrayed as. Specifically, the cohort expressed scepticism regarding the life cycle emissions of EVs, which tempered their enthusiasm for these technologies as a means of addressing urban air pollution and climate change.

This disconnect between awareness and adoption behaviour highlights the gap between technical knowledge and consumer actions. While the cohort demonstrated an understanding of the potential advantages of EVs, including some ecological benefits, their doubts about the true environmental impact over their entire life cycle underscore significant barriers to EV adoption.

Theoretically, this study contributes to the literature on consumer behaviour and EV adoption by focusing on a niche but influential demographic—technically educated youth. Practically, it provides actionable input to policymakers, municipal authorities, academic institutions, and mobility stakeholders aiming to foster a smoother transition to electromobility. The key beneficiaries of the findings include national and local governments, EV infrastructure developers, transport planners, and educators designing curricula around sustainability and mobility.

Looking ahead, this research offers a scalable and replicable framework that could be applied to other demographic segments in Poland. Future studies should aim to validate these findings using larger and more diverse data sets and explore cross-country comparisons. Longitudinal research would also help track changing attitudes over time, particularly in response to policy shifts and market developments.

In conclusion, this study contributes to the broader discourse on sustainable transportation and the green transition in the EU, emphasising the current barriers and future potential of Poland. With focused policy interventions, expanded infrastructure investment, and sustained public engagement, Poland can accelerate its transition toward electromobility and better align with the goals of the European Green Deal.

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