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Electric vehicle adoption in Generation Z: Drivers of Hungarian higher education students' attitude

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ABSTRACT

The transition to electric vehicles has become an urgent priority due to their lower environmental impact. The automotive industry has already developed solutions for zero-emission vehicles to significantly reduce greenhouse gas emissions. However, this transition heavily depends on the evolution of consumer demand. This paper focuses on Generation Z, as they will soon become a determining consumer segment in the automotive market. Our research aims to analyze Generation Z's attitude toward electric vehicles. Their attitude provides valuable insights for industry leaders regarding future consumer behavior. We analyzed the relationship between selected adoption factors (environmental concern, perceived risk, ease of use, and enjoyment) and Generation Z's attitude toward electric vehicles (measured by perceived relative advantage). Our research is based on data from Hungarian Generation Z respondents, and our findings conclude that environmental concern is less relevant than enjoyment and ease of use, which are the most impactful factors.

KEYWORDS

strategic technology management, electric vehicle transition, diffusion of innovation, environment concern, Generation Z's attitude

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1. INTRODUCTION

The automotive industry is facing one of the most profound transformations in its history, following more than 100 years of steady growth within a relatively stable business and technological environment. The transition to electric vehicles requires car manufacturers (OEMs) and their suppliers to develop new technologies, acquire new skills, and adapt their business models to the rapidly evolving reality. However, the electric vehicle transition not only poses a significant challenge to industry players (Pikhart et al. 2021), but also represents a disruptive transformation for society and infrastructure (Desai et al. 2023). In this context, the right actions within this complex ecosystem are becoming essential for the successful transition to electric vehicle technologies.

The transformation of this overall ecosystem has become an urgent necessity for humanity due to environmental impacts, air pollution, and their consequences on quality of life and longevity (Braun 2020). Transportation, comprising aviation and maritime flows, accounts for 23.2% of greenhouse gas emissions (Eurostat 2022). Road transport, including passenger cars and commercial vehicles, represents 74.5% of transportation-generated GHG emissions (IEA 2023). International organizations (WHO 2018) and state governments consider that CO_2 emission could be significantly reduced with the implementation of the electric technology for passenger and commercial vehicles (Theilen – Tomori 2023). Therefore, the implementation of electric technology in transportation is primarily driven by ecological considerations and concerns, but the true impact on greenhouse gas emissions also depends on the technological advancement of energy sourcing and production infrastructure in a specific country or region. The decarbonization process imposes the coordination of complex systems including institutions, private firms and the changes on user attitudes (Németh et al. 2021).

State governments have implemented progressive supporting actions and imposed strict policies to accelerate the electric vehicle transition, not only due to environmental concerns but also to address energy sourcing (limiting dependence on foreign states and its impact on national security and trade balance), economic factors (employment, trade balance, and healthcare costs), and to establish national competitive advantage in strategic economic sectors. Additionally, there is a political impact, as the societal well-being influenced by these factors can affect political preferences and votes (Kovacs 2023). Governments have allocated central funds (for example, Japan and the US since the 1970s), set specific targets, and led long-term R&D projects, coordinating actions among state institutions, universities, car manufacturers, and suppliers to develop low-emission vehicles (LEVs). These initiatives have been essential to developing the necessary technology, including electric vehicles, batteries, and other complementary technologies, within the required timeframe. Government policies have played a crucial role in fostering and accelerating the mass-market availability of battery electric vehicles (BEVs) by setting key milestones for the electric vehicle transition, implementing incentives to customers, imposing mandates on car manufacturers, and accelerating the deployment of charging networks.

The speed of the electric vehicle transition is very different by country and depends on the willingness of society to switch from traditional internal combustion engine (ICE) cars to electric vehicles (EVs). Consumer attitudes toward adopting this new technology are key to a successful and rapid transition.

The preferences of younger generations may also be of great importance, as they will become the future customers of the automotive market. Our research focuses on the attitudes

of Generation Z, a subject that has not yet received sufficient academic attention. This paper aims to address this research gap. In exploring these relationships, we primarily focus on the potential effects of environmental concern, perceived risk, enjoyment, and ease of use.

The remainder of the paper is structured as follows. Section 2 covers the literature review and details the hypothesis development, while Section 3 introduces data and methodology. Section 4 describes the regression analysis, Section 5 summarizes the results, and Section 6 concludes with limitation and future research directions.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1. Fourth industrial revolution

Industrial revolutions based on major technological innovations have always triggered profound social and important economic changes (Kiss – Páger 2024). The Third Industrial Revolution was based on the use of personal computers and access to the Internet, while the Fourth Industrial Revolution (4IR) goes further with digital transformation, based on connected devices (routers, IoT) and the combination of cyber-physical systems with innovative digital technologies (cloud computing, big data, and AI). This revolution allows to redefine the production process and optimize the different areas of the firm with the autonomous data communication between the different systems, products and tools to optimize the organization to achieve their objectives (Katona – Birkner – Péter 2023b). This revolution accelerates the optimization of the production, the business processes (Katona – Birkner – Németh 2023). It generates also huge opportunities and threats for the different actors of the economy and society as they disrupt traditional behaviors, processes and interactions inside industries, and redefine relationship with suppliers and between industries. The strategies of successful firms should include the review of the traditional business model and the impact on customer attitudes and engagement as well (Katona – Birkner – Péter 2023a).

The automotive industry is one of the leaders of the current industrial revolution, and the emergence of electric vehicles is not only disrupting production processes but also transforming the product and customer interactions, based on the key pillars of 4IR.

2.2. EV transition

Following enormous investments in the automotive sector to develop electric vehicle technology, new production processes and charging infrastructure, the global electric vehicle market has seen exponential growth with sales exceeding 10 million units in 2022 (IEA 2023). This volume represented 13% of all new cars sold in 2022, an increase from 8.3% in 2021 and from below 4.2% in 2020 (Irle 2023). However, market penetration is geographically uneven. The speed of geographical transition depends on three factors, the development and availability of the electric vehicle technology, the different states' government policies, and consumer acceptance.

Despite the obvious benefits for the customers, such as ecology and safety, the pace of electric vehicle adoption varies by region. Norway had the highest market share of electric vehicles at 79%, followed by Iceland at 45% and Sweden at 32%. In China the EV sales mix achieved 27%, 20.8% in Europe and 7.2% in the USA (Irle 2023). The fast growth in China was initially driven by the aggressive support schemes of the central government, which were later replaced by mandates for car OEMs. Thanks to this policy, the market share of electric vehicles reached over 40%.

At the same time, electric vehicle transition in some countries is significantly slower than expected. In Europe for example, while many Western European countries are leaders in electric vehicle transition, Eastern Europe is lagging behind (Zaher – Usmani 2022). In this regard, the transition to electric vehicles depends on, among other aspects, the willingness of the society to switch from traditional ICE cars to EVs. This is why consumer attitudes to adopt this new technology are key for the successful and rapid transition. The preferences of the young generation may be of high importance as well, as they will be the future customers of the automotive market. Our research focuses on the attitudes of Generation Z.

2.3. Generation Z

This young generation differs in several areas from other age groups, as they are the first true digital native generation (Francis – Hoefel 2018). They have been exposed since birth to the internet, to social media and networks, and mobile systems, leading to a hypercognitive generation (Csiszárik-Kocsir et al. 2022). They are also highly skilled to collect and cross-reference information from different sources and integrate it with both virtual and offline experiences. Generation Z behaviour is based on the search for truth, and they mobilize themselves for a variety of causes (Francis – Hoefel 2018). They value individual expression, believe profoundly in the efficacy of dialogue to handle conflicts. Finally, their approach to problems and decisions is pragmatic and analytical. Such behaviors define the relation of Generation Z to brands and consumption as well. Consumption means access instead of ownership, a way to express their personality, open to innovation and reflects ethical values as well (Vajkai – Zsóka 2020). These features may be of high importance when the purchased product is an electric vehicle. The automotive industry also faces the challenge related to redefining how they deliver value to consumers, and rebalancing mass production against personalization, by considering marketing issues and work ethics as well.

2.4. Diffusion of technological innovation

The adoption of electric vehicles may be considered as a diffusion related process. Diffusion is the way how people adopt and begin to use innovations (Rice 2017). The model developed by Rogers in the 1950s and 1960s became the most dominant model of diffusion (Dodgson et al. 2008) and has become a key analytical tool subsequently used by many other researchers. Social factors, for example the attitude of individuals or the point of view of the community can influence the opinion about an innovation and the speed of adoption or rejection (Moore 2006).

The adoption of technological innovations is influenced by the relevant relative advantage versus existing technologies, bigger advantage increases acceptation and speed of adoption; the complexity of innovation reduces the adoption rate as implementation and usage requires more efforts; the trialability of innovation can significantly increase or reduce the adoption rate and speed; the ease of use, skills and knowledge required for usage are main defining factors of adoption; the observability and obviousness of test usage results impact the adoption rate and speed of diffusion; the uncertainty about the outcome of the innovation reduces the rate and speed of diffusion; the right fit for users, as users often have different needs; and the support required from the innovator, producer before consumers can use their products successfully, all influence the rate and speed of adoption (Rogers 2010).

Innovation goes through different stages from rejection through adoption, saturation, and reinvention. The diffusion of innovations is highly impacted by the communication through the

different channels providing increased importance to the mix of interpersonal, mass, digital communication and social networks (Rice 2009). New media reduced the boundaries between interpersonal, mass media communication. All these channels of information, providing different type of messages increases awareness, reduces uncertainty about the features and potential purpose of any kind innovation (product, technology, or services), thus influencing adoption (Rice 2017).

The adoption rate can be impacted by other context-related conditions, because in specific cases the freedom of the user can be limited, or some innovations may even be mandatory to all, even unwilling or resistant users.

Based on their attitude toward innovation adoption, users can be grouped into innovators (who drive and filter new ideas to the community), early adopters (influencing the community and testing the innovation), early majority adopters (interacting with opinion leaders), late majority adopters (who are often sceptics), and laggards (Rogers 2010). In their attitudes to innovation adoption, young generations may differ from other age groups, especially when the innovative new product is related to technology. Probably several members of Generation Z may belong to the early adopters in the near future, and this emphasizes the importance of examining the attitudes of this generation in electric vehicle adoption.

2.5. Hypothesis development

The previous literature about innovation adoption is wide, and several theoretical frameworks have been applied. We decided to analyze customer acceptance based on the factors defined by Roemer and Henseler (2022). They analyzed the influencing factors for EV adoption and acceptance, through meetings with experts and comparing their outcome with the corresponding articles and theories, integrating it with Rogers' theory of the adoption of innovations (Rogers 2010) and the different theories related to the acceptance of technology, for example the Theory of Planned Behavior (TPB; Ajzen 1985), the Theory of Reasoned Action (Ajzen – Fishbein 1980) the Technology Acceptance Model (TAM), and the Unified Theories of Acceptance and Use of Technology (UTAUT 1 by Venkatesh et al. 2003 and UTAUT 2 by Venkatesh et al. 2012).

It is important to note that the TAM is an evolution of the Theory of Reasoned Action (TRA) developed by Ajzen and Fishbein. This model (Davis 1989) is the most influential application when modeling users' acceptance and usage of technology (Venkatesh et al. 2003). The TAM includes behavioral factors and presumes user freedom to decide and act, which in the reality can be limited by different kinds of constraints (Davis et al. 1992).

Our research focuses on the EV transition. The transition and customer acceptance of this new technology has been analyzed in case of many countries, and among various categories of users. Empirical results are available for Sweden (Jansson et al. 2017), Denmark (Jensen et al. 2013), US urban areas (Carley et al. 2013), German cities (Degirmenci – Breitner 2017), Germany (Barth et al. 2016), the UK (Schuitema et al. 2013; Skippon – Chappell 2019), Spain (Junquera et al. 2016), Malaysia (Khazaei - Tareq 2021), and China (Pang et al. 2023).

Attitudes toward EV adoption may be associated with the perceived relative advantages or disadvantages. Perceived disadvantages, including the higher price, limited autonomy, and charging time of BEVs reduce the intention to buy plug-in vehicles, as concluded by a 2011 study in US urban areas (Carley et al. 2013). The highest interest for electric vehicles has been identified among highly educated individuals, who may be considered part of the "early adopters".

The importance of perceived risks related to the use of electric vehicles concluded the same result in Spain (Junquera et al. 2016) and Denmark (Jensen et al. 2013). Respondents indicated, based on their driving experience with electric vehicles that limited autonomy (range) and an insufficient charging network represent a major negative impact toward purchase intention and EV adoption.

Environmental effects may be theoretically among the most important influencing factors when examining electric vehicle adoption. For instance, a study among German users investigated the role of environmental impact on consumer purchase intention and concluded that the environmental impact of EVs allows to better forecast consumer purchase intention than price and autonomy (Degirmenci – Breitner 2017). The study highlighted that respondents realized the impact and threat of the GHG emissions on the environment and considered that the adoption of EVs provided an important opportunity to reduce emissions and improve the quality of the air, especially if production of electricity could be switched to renewable sources.

The importance of a community's objective has a clear impact on the intention to use an EV. Environmental concerns can form part of community members' decisions and increase the adoption of pro-environmental innovation in personal transportation. The study by Homburg and Stolberg (2006) confirms that individuals' decisions can be driven by perceived collective interest to improve air quality, instead of purely personal interest and considerations. Hence, EV adoption can be considered as a personal contribution to achieve a more important goal for the community, reducing the usage of fossil fuels to improve air quality.

Research in Germany on predictors of EV adoption considers that social identity variables, (for example social norms and collective efficacy), are more important factors for individuals than personal costs and benefits. However, their result confirms that cost-related variables (high purchasing prices), and the limited autonomy, limited charging network and the extensive charging time has negative impact and reduces the acceptance of EVs (Barth et al. 2016).

The importance of sociodemographic variables in considering environmental factors during EV purchases was highlighted in research conducted on a large sample in the UK. The research assessed utilitarian, image, and environmental considerations when buying a new car, analyzing the attitudinal, behavioral, and sociodemographic predictors' relationship with the consideration of environmental factors related to EV purchases (Chng et al. 2019). In some cases, environmental considerations were less important than utility or image related factors due to the specificity of this process, considered as an infrequent purchase behavior with high financial costs (Thornton et al. 2010). This attitude is very different compared to a more regular, smaller value purchasing decisions which are often driven by habit, due to the lack of possibility to fully assess the total environmental impact of EVs (Rocco et al. 2018). The results, based on self-reported considerations, concluded that during real car purchasing processes, personal interest has been a stronger factor than environmental features or concerns. Among key sociodemographic variables (gender, age, income, highest qualification, cars in household, etc.), urban and female persons were more likely to buy EVs due to environmental concerns.

As a result of the Generation Z's general attitudes, their consumer decisions may be significantly influenced by other factors as well. The analysis of instrumental, hedonic, and symbolic attitudes on the adoption of BEV and plug-in hybrid electric vehicles (PHEV) concluded that persons identifying themselves sensible for environmental concerns are indicating better opinion of EVs (Schuitema et al. 2013).

Social influence, facilitating conditions, environmental concern, and perceived enjoyment all increase adoption rate of electric vehicles. However, the result highlighted once again anxiety due to the autonomy and the importance of driving experience (Khazaei – Tareq 2021).

Roemer and Henseler (2022) examined the EV transition in a complex model, where they assumed a positive impact of environmental concern, attitude, ease of use and enjoyment on EV acceptance and behavioral intention. They also considered negative impact of the perceived risk on behavioral intention to use EVs. In their model, enjoyment factor mediated the relations between the behavioral intention and ease of use.

While the previous literature covered many different aspects, we address a research gap concerning the attitude of Generation Z, which has received less attention. Therefore, our research focuses on Generation Z, which will become shortly a defining part of society and one of the most important consumer segments in the market. Therefore, their attitudes and opinions provide valuable insights about future consumer behavioral patterns.

Based on the literature review above, we defined the following research hypotheses.

In order to confirm the impact of Generation Z's environmental consideration as potential key decision-making factor, our first hypothesis focuses on how this is influencing relative advantage of EVs.

H1: Higher environmental concern increases the perceived relative advantage of electric vehicles.

As indicated above, EV range and charging conditions might also be important decisive factors for various generations, thus our second hypothesis explores these in relation to relative advantage of EVs.

H2: Perceived risk, due to limited range, insufficient charging network coverage and long charging times negatively influences the perceived relative advantage of electric vehicles.

Our third hypothesis plans to analyze the evolution of Generation Z's perception of consumption in the context of enjoyment:

H3: Enjoyment has a positive effect on the perceived relative advantage of electric vehicles.

Each new generation brings with them new information, beliefs and practices; therefore we would like to confirm with our fourth hypothesis how Generation Z is considering the ease of use as a perceived relative advantage of EVs.

H4: Ease of use has a positive effect on the perceived relative advantage of electric vehicles.

3. DATA AND METHODOLOGY

We developed an online questionnaire in Qualtrics©, which included questions about the automotive industry and its future trends. In order to measure the attitude of young adults toward EVs we included in the survey questionnaire elements similar to those in Roemer and Henseler (2022). Before the final questionnaire was distributed, we implemented numerous internal checks and tests to evaluate respondents' reactions, to ensure the correct wording of the questions in Hungarian language in order to minimize response time. The questions are presented in Table 1.

Table 1. Questionnaire structure and theoretical background

Group	Question	Theoretical background
EC Environmental Concern		inspired by Lee (2008)
	1. I take part in environmental protection activities.	
	2. I often think about how the situation of the environment can be improved.	
	3. In my daily life, I use environmentally friendly products.	
PR Perceived Risks		based on expert interviews from Roemer and Henseler (2022)
	1. I fear/find that the range of the EV will be/is insufficient.	
	2. I fear/find that it will be/is difficult to find a charging station when I need it.	
	3. I fear/find that charging the battery takes too much time.	
ENJ Enjoyment		adapted from Davis, Bagozzi and Warshaw (1992)
	1. I (will) have fun driving an electric vehicle	
	2. I (will) find driving an electric vehicle pleasant.	
	3. Driving an electric vehicle (will) thrill(s) me.	
	4. I (will) enjoy driving an electric vehicle.	
EOU Perceived Ease of Use		adapted from Davis (1989)
	1. I (will) find that driving an electric vehicle is easy.	
	2. Learning to drive an electric vehicle will be/is easy.	
	3. I find that handling an electric vehicle will be/is easy.	
	4. Learning to handle an electric vehicle will be/is easy.	

Source: authors.

We invited by email 612 students at Hungarian universities to connect and answer our questions. We received 115 answers out of which 108 have been considered valid and complete, resulting in a response rate of 18.3%.

In the questionnaire we requested the answers on a scale of 1–7 which is a balanced scaling in terms of decreasing response time and increasing response rate. Responses related to relative advantage have been requested on a scale from 1 to 5.

We included some socio-demographic control variables (about gender, car ownership and intention to purchase a car in the next 12 month) considered by Rogers (2010) as the context-specific antecedents and integrated in research (Chng et al. 2019) previously mentioned. These three control variables could have an impact on the attitude of the respondents towards an electric vehicle. Car ownership generates experience on usage, financial costs and the specification required to fulfill the respondents' needs related to mobility. Short-term purchase intention provides an additional factor to further consider the validity of respondents' answers. Therefore, binary variables indicating car ownership and car purchase intention are included in the regression calculations. In addition, our research planned to analyze if men and women had different considerations and priorities related to the four variables (environment concern, perceived risks, enjoyment, perceived ease of use). To examine this effect, a control variable indicating female respondents was also included in the research.

We performed all our analysis in SPSS v27. The descriptive statistics are presented in Table 2.

The respondents' gender mix is 53.7% men and 46.3% women. According to the Hungarian Central Statistics Office (KSH 2023), in Hungary in the 18–34 age category, women represent 48.4% of the population, so our sample is representative from this point of view. Regarding other control variables, 23.1% of respondents indicated car ownership and 16.7% considered to purchase a car in the next 12 month. Based on the KSH (2023) data, the motorization in Hungary is 40.3% (no data is available by age category) and the survey performed by Forsense (2017) indicated that 31.1% of the total population considered changing their car in the next 3 years. Only 5.6% considered buying a new car, 21.5% intended to buy a used car and 4% was undecided between new or used car. In the 18–34 age category, these values are 5.1%, 32.7% and 2.8% respectively. Thus, car ownership among our respondents is slightly lower than the overall Hungarian population, which is in line with the expectation due to their age category, but they have higher purchase intentions.

Table 2. Descriptive statistics

Gender	Men	53.7%
	Women	46.3%
Car ownership	Yes	23.1%
	No	76.9%
Purchase intention in the next 12 month	Yes	16.7%
	No	83.3%

Note: The sample size is 108 respondents.
Source: authors.

4. REGRESSION ANALYSIS

Our aim was to assess which of the four variables (environmental concern, perceived risks, enjoyment, perceived ease of use) has the strongest impact on the relative advantage of electric vehicles in order to understand the acceptance patterns and consequently, the potential adoption rate of future customers.

We performed several analyses to measure validity and reliability, and to test the defined hypotheses. Table 3 summarizes the main principal component analysis results related to the applied measures.

For each of the four variables. the Cronbach α value is above 0.7, confirming that our result is consistent and reliable. Bartlett's test of sphericity and KMO values (above 0.6) indicate that our data is adequate for factor analysis.

The variable relative advantage allows us to assess attitudes towards electric vehicle adoption. In our research we used the relative advantage to measure the electric vehicle adoption attitude and to define a binary variable, while Roemer and Henseler (2022) considered the relative advantage as part of the determinants of acceptance. When measuring relative advantage, the respondents were asked to evaluate the following statement: "The advantages of using an electric vehicle (will) outweigh the disadvantages", on a scale from 1 to 5. The values of 4 and 5 indicate a strong positive preference, so we created the corresponding binary variable which becomes the dependent variable of our logistic regression model.

As previous literature suggests, these four variables (environmental concern, perceived risks, enjoyment, perceived ease of use) are theoretically relevant in explaining electric vehicle adoption. Therefore, we conducted separate binary logistic regression analysis to determine the strength of the relationships between these drivers of electric vehicle adoption and the binary variable indicating the strong preference for electric vehicles.

We developed three models for each explanatory variable in order to evaluate the impact of the control variables as well. Model 1 only includes the main explanatory variable. In addition to this, Model 2 includes the dummy variable indicating female respondents, and Model 3 includes all three control variables (related to gender, car ownership, and car purchase intention).

Table 4 indicates that environmental concern does not have a statistically significant influence on the relative advantage of EVs in any of the models. It can also be observed that the control variables do not have a statistically significant effect at the 5% significance level.

Table 5 presents the results related to the relationship with perceived risk. The empirical findings suggest that similar to the environmental concern, the perceived risk of EVs does not significantly influence the relative advantage of electric vehicles. Additionally, none of the other variables in the models have a significant effect.

The relationship between enjoyment and the perceived relative advantage of EVs is also examined, and the related regression results are presented in Table 6. As opposed to the previous empirical findings, Table 6 indicates that enjoyment is statistically significantly and positively related to the perceived relative advantage of EVs, and this result is not influenced by the inclusion of the control variables.

The possible effects of the perceived ease of use were also examined through a series of logistic regression models, and the empirical results are summarized in Table 7. Based on the previous literature on EV adoption, this explanatory variable may be especially important when exploring the drivers of EV adoption. Table 7 indicates that the perceived ease of use

Table 3. Measures

Group	Question	Cronbach α	KMO	Bartlett's test of sphericity (*P* value)	Loading
EC Environmental Concern		0.798	0.649	<0.001	
	1. I take part in environmental protection activities.				0.839
	2. I often think about how the situation of the environment can be improved.				0.905
	3. In my daily life, I use environmentally friendly products.				0.784
PR Perceived Risks		0.925	0.717	<0.001	
	1. I fear/find that the range of the EV will be/is insufficient.				0.941
	2. I fear/find that it will be/is difficult to find a charging station when I need it.				0.960
	3. I fear/find that charging the battery takes too much time.				0.897
ENJ Enjoyment		0.960	0.793	<0.001	
	1. I (will) have fun driving an electric vehicle				0.957
	2. I (will) find driving an electric vehicle pleasant.				0.940
	3. Driving an electric vehicle (will) thrill(s) me.				0.936
	4. I (will) enjoy driving an electric vehicle.				0.948
EOU Perceived Ease of Use		0.961	0.865	<0.001	
	1. I (will) find that driving an electric vehicle is easy.				0.912
	2. Learning to drive an electric vehicle will be/is easy.				0.960
	3. I find that handling an electric vehicle will be/is easy.				0.961
	4. Learning to handle an electric vehicle will be/is easy.				0.951

Source: authors.

Table 4. Regression results on environmental concern

	Model 1	Model 2	Model 3
Constant	−0.782	−0.510	−0.856
	(<0.001) **	(0.065)	(0.009) **
Environmental Concern	−0.151	−0.075	0.000
	(0.488)	(0.744)	(0.999)
Gender		−0.626	−0.515
		(0.155)	(0.258)
Car ownership			0.538
			(0.325)
Car purchase intention			0.868
			(0.150)
Nagelkerke R square	*0.006*	*0.033*	*0.099*

Source: authors.
Notes: The values in the parentheses are *P* values. The asterisks * and ** denote statistical significance at the 5% and 1% significance level, respectively.

Table 5. Regression results on perceived risk

	Model 1	Model 2	Model 3
Constant	−0.796	−0.527	−0.853
	(<0.001) **	(0.055)	(0.009) *
Perceived risk	−0.256	−0.231	−0.115
	(0.241)	(0.302)	(0.623)
Gender		−0.620	−0.501
		(0.150)	(0.258)
Car ownership			0.505
			(0.354)
Car purchase intention			0.827
			(0.175)
Nagelkerke R square	*0.018*	*0.045*	*0.101*

Source: authors.
Notes: The values in the parentheses are *P* values. The asterisks * and ** denote statistical significance at the 5% and 1% significance level, respectively.

Table 6. Regression results on EV enjoyment

	Model 1	Model 2	Model 3
Constant	−0.968	−0.696	−0.888
	(<0.001) **	(0.025) *	(0.013) *
Enjoyment	1.139	1.157	1.086
	(<0.001) **	(<0.001) **	(<0.001) **
Gender		−0.666	−0.581
		(0.166)	(0.236)
Car ownership			0.269
			(0.640)
Car purchase intention			0.533
			(0.422)
Nagelkerke R square	*0.267*	*0.287*	*0.302*

Data source: authors.
Notes: The values in the parentheses are *P* values. The asterisks * and * * denote statistical significance at the 5% and 1% significance level, respectively.

Table 7. Regression results about perceived ease of use

	Model 1	Model 2	Model 3
Constant	−0.865	−0.6570	−0.853
	(<0.001) **	(0.049) *	(0.013) **
Perceived ease of use	0.830	0.853	0.814
	(0.001) **	(<0.001) **	(0.001) **
Gender		−0.716	−0.578
		(0.121)	(0.221)
Car ownership			0.204
			(0.725)
Car purchase intention			0.927
			(0.149)
Nagelkerke R square	*0.168*	*0.196*	*0.233*

Source: authors.
Notes: The values in the parentheses are *P* values. The asterisks * and ** denote statistical significance at the 5% and 1% significance level, respectively.

is statistically significantly and positively related to the perceived relative advantage of EVs, and this result is not influenced by the inclusion of the control variables.

The results of our research indicated that the respondents' environmental concern did not generate a positive impact on the relative advantage of EVs and cannot be considered as a key motivational factor for adoption. Considering that the main objective of EV implementation has always been environmental protection and the promotion of environmentally conscious lifestyles, these results do not confirm the positive impact of EV strategy in this regard.

Interestingly, between the four factors analyzed (environmental concern, perceived risks, enjoyment, perceived ease of use) enjoyment emerged as the strongest factor in influencing the perceived relative advantage of EVs. This indicates that Generation Z members, as future customers, primarily focus on enjoyment when theoretically assessing the advantages of EVs.

Figure 1 illustrates the relationship between the perceived relative advantage of EVs (which can be considered as being related to the attitude to electric vehicles) and the examined possible drivers of EV adoption (environmental concerns, perceived risk, ease of use and enjoyment). As the regression results highlight, the drivers with the most significant (positive) effect are enjoyment and perceived ease of use. The statistically not significant effect of environmental concern can also be observed on Fig. 1.

Based on the regression analysis, conclusions regarding the four hypotheses can be formulated. The regression results suggest that H1 (environmental concern increases perceived relative

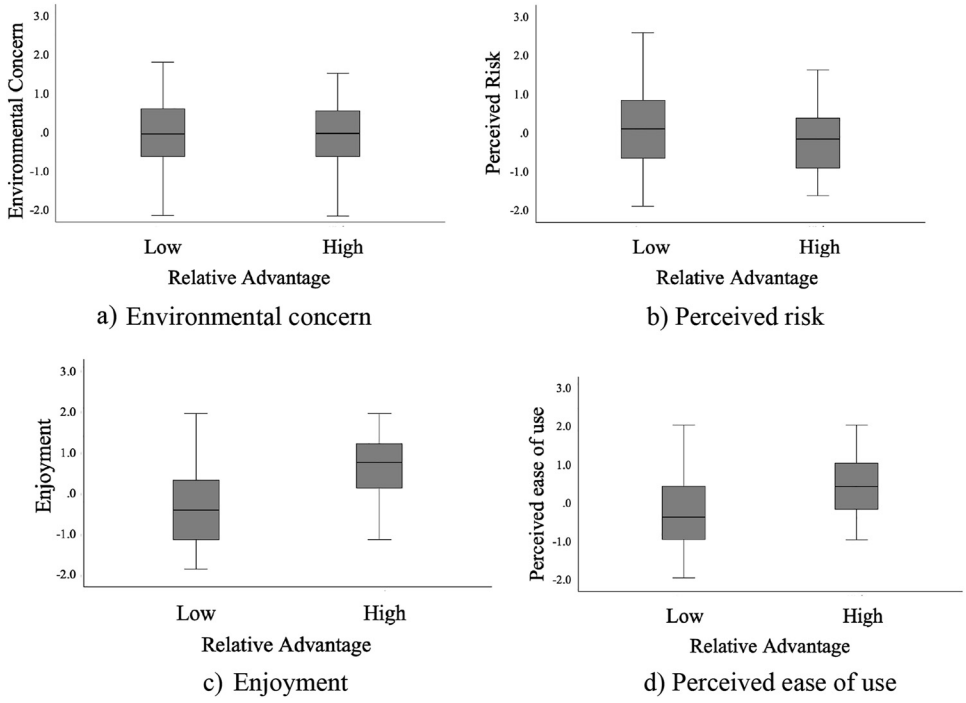

Fig. 1. Comparison of EV adoption drivers
Source: authors.

advantage) and H2 (perceived risk decreases perceived relative advantage) are not accepted. However, H3 (enjoyment has a positive effect on the perceived relative advantage) and H4 (ease of use has a positive effect on the perceived relative advantage) are accepted. It is also worth noting that the inclusion of control variables does not influence these conclusions.

5. CONCLUSIONS AND MANAGERIAL IMPLICATIONS

Generation Z has a very important characteristic in today's world of consumption. They are a native digital generation with the skills to fully benefit of the wide range of technological advancements, and the members of Generation Z will become the defining prospects and customers in the future. Analyzing Generation Z to better understand their drivers of consumption and social values provides valuable insight and knowledge that can help managers and industry practitioners better to fulfill Generation Z's expectations by adding more emphasis to their priorities in the business propositions (Ince et al. 2023).

We analyzed the attitudes of Generation Z using a sample of university students living in urban areas. Based on a study conducted in the most advanced European countries regarding electric vehicle transition, more than 81.7% of the EV users reside in urban areas (Morrison – Wappelhorst 2022), confirming the relevance of our exploratory research.

The previous literature has examined electric vehicle adoption in detail, however the exploration of young generations' attitudes received limited academic attention. Our paper aimed to contribute to previous literature by examining the relationship between possible drivers of adoption (environmental concerns, perceived risk, ease of use and enjoyment) and Generation Z's attitude to electric vehicles (which is measured by the perceived relative advantage of electric vehicles in our paper).

The conclusions of the empirical analysis partly differ from those of the previous literature. In many papers, environmental impact was found to be an important factor in influencing consumer purchase intention (Degirmenci – Breitner 2017). However, our findings suggest that environmental concerns may not be the main factor driving the electric vehicle transition in case of Generation Z, even though it is one of the key motivations for the implementation of electric technology in transportation by international organizations and state governments. Additionally, our analysis confirms that the highest priorities for Generation Z are enjoyment and ease of use. This is not necessarily surprising, given Generation Z's role and preferences in contemporary consumption culture (Ince et al. 2023). Therefore, industry leaders may need to rethink future motivational patterns, distribution strategies and communication strategies of electric vehicle market launches.

Exploring the purchasing behavior of young generations may provide valuable insights to the future trends. In addition to this, when assessing current electric vehicle marketing and distribution strategies, a comparison with the behaviors of current consumers can also be interesting.

6. LIMITATION AND FUTURE RESEARCH DIRECTIONS

The main limitation of our research is related to the sample size, which, together with the extent of representativeness is one of the fundamental parameters (Lakens 2022). Although representativeness of the sample (related to all demographic features of Generation Z) could

not be guaranteed in the present analysis, the results may provide insights into the potential future consumer behavioral patterns of Generation Z regarding electric vehicle technologies and their adoptions.

Generation Z members are the first true digital natives, connected "since birth" to the internet and social networks, meaning that they are exposed to global sources of information, which leads their very analytical and pragmatic purchase decisions. Hence expanding our research to other countries, nationalities could further enhance our understanding of Generation Z and confirm whether this generation, exposed so heavily to the global environment, could present less diversity and "locally different" attitude.

It is also worth noting that we explored current relationships between attitudes and drivers of electric vehicle adoption, and the question might be raised naturally whether and how these relationships will be transformed by the time Generation Z becomes a major part of consumer groups. Although we believe that distinctive consumption attributes of Generation Z will not alter significantly, this should be considered as a limitation of this study as well.

Finally, our results raise several further research questions related to Generation Z's decision-making process, particularly their attitudes toward environmental protection and concerns. Such research could provide a deeper understanding of Generation Z's motivational patterns and decision-making behavior. This information would be an invaluable input for brands to determine how to modify their current brand, product, sales, and communication strategies to better align with the future requirements defined by Generation Z's values and priorities.

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