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MODELING USER'S PREFERENCES TOWARDS ELECTRIC VEHICLES. A DISCREET CHOICE MODEL APPROACH.

Abstract: Sustainability, and the demand for sustainable products came to the four in the last years. One of the most polluting acts of humanity is transportation. Even tough changing our location is an unavoidable part of the everyday life, we can choose alternatives which are less burdensome on the environment. Electric vehicles (EVs) present an environmentally friendlier solution in the future of mobility. The existence of these cars can already be seen on the streets of our cities, as they are available to the masses. At the same time, the spread of such vehicles is not so rapid, as there are compromises need to be made while using them. Since there is little information about electric cars, the range anxiety and high price tags also prevent EVs from spreading in large numbers. At the same time, besides being less polluting, there are multiple advantages of driving e-cars. However, the benefits of EVs will only come true if people will accept and use them. At present there are several car manufacturers who produce EVs, although people seem to still prefer internal combustion engine vehicles. In our research we use Choice Based Conjoint and Maxdiff analysis to understand people's preferences towards EVs. In our results, we determine the best combination of attribute levels, that present the most preferable EV and show which are the most preferred EV brands. Our online research was published in the beginning of February for three weeks period, and we have reached 206 people.

Keywords: Electric car, Sustainability, Consumer behavior, Preferences, Choice Based Conjoint, MaxDiff

INTRODUCTION

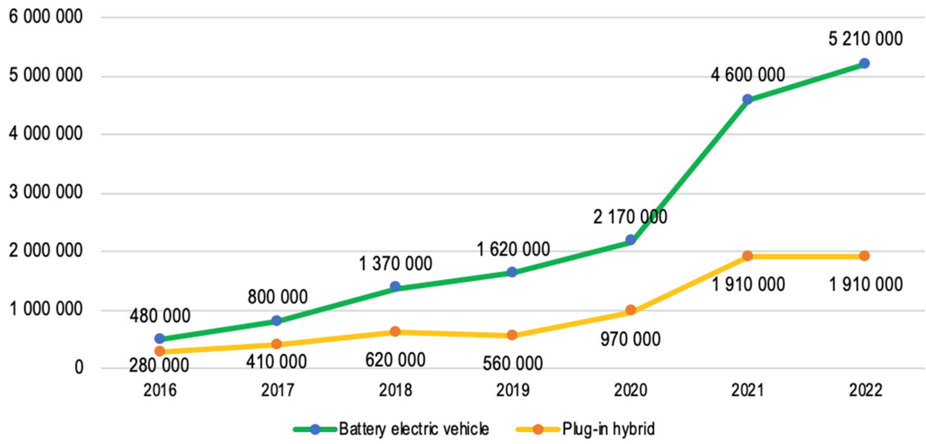
Unlimited transport and mobility, in addition to being an important factor in the global economy, result in an extremely high ecological footprint. Sustainable development, according to the Brundtland report, says that we should live our lives in such a way that the generations that come after us have the opportunity to use the same resources and opportunities that are given to us (Lele, 2013). This is relatively difficult to do in a world where we are constantly getting messages – through the media and the society – that constantly encourage us to keep buying the newer, nicer, better, and the bigger. The need for continuous growth is difficult to meet with the ideal world in which different aspects of sustainability could appear. It is not for nothing that the initiatives that try to guide not only consumers, but also companies (Brewer, 2019) in the direction of providing as many alternative solutions available to the masses as possible, with the use of which we exert a smaller burden on our environment, are popping up. According to previous researches (for example Wunderman Thompson Intelligence, 2019), people would like to do more for the environment, but it is not certain that in every case they will receive alternatives that can be adapted without compromise in everyday life (Verma, 2020). Companies are therefore forced at the governmental or even EU level to expand their product portfolio in such a way that they can meet consumers' sustainable consumption needs (Glass & Newig, 2019). The same phenomena can be seen in the automotive industry as well. With a quota system, large car manufacturing companies are

encouraged – or rather forced – to produce electric cars (EV), which is considered as an environmentally friendlier solution. As a result, it is now difficult to find a manufacturer that does not deal with electrification on some level, and even new entrants to the market, even tech companies are appearing. In addition, consumers are encouraged to purchase electric cars with local, financial allowances (K.R., 2022). At the time of the first passenger car that could also operate electrically and was available to the masses, there were no green license plates and the technology was rudimentary. The plug-in hybrid (PHEV) or mild-hybrid (MHEV) system cars of that time were equipped with an electric motor in addition to the traditional internal combustion engine, which meant that these vehicles were able to run electrically when the car started rolling or when idling in traffic. And then, when the technology deemed it necessary, the traditional – typically gasoline-powered – engine was started, which continued to move the car-body. As the years passed, new techniques appeared both in the field of battery production and their usability (Blomgren, 2016). In addition to the still available cars with PHEV and MHEV systems, you can now also buy vehicles equipped with purely electric technology, where the traditional gasoline and diesel engines do not appear at all, the cars can operate only in fully electric mode. Electric cars, which operate without CO_2 emissions, have brought a completely new era to the car-world.
The eco-conscious, quiet, dynamic driving, which can be purchased with the governmental state support from time to time, is also accompanied by the financial allowance provided by the outstanding (green) number plate found on such cars. In Hungary, since 2016, all vehicles that can travel 25 kilometers in pure electric mode receive such a registration plate. Battery electric vehicles have this distinguishing mark by default, as do most plug-in hybrids, which are able to cover this distance without starting their internal combustion engine. In Hungary, this registration number is important not only because of the distinction, but also because of the allowances. For example, you don't have to pay a registration tax, and in the case of purely electric cars, you don't have to pay a vehicle tax either. Parking is also free in most domestic cities, which is being withdrawn in more and more places due to the increase in the number of cars with green license plates, however, depending on the parking zone, parking discounts still apply locally (Bukovics, 2021). In addition to the fact that this innovation is indeed more environmentally conscious and in many other ways better than the usual, there are still many dilemmas for both those who are about to buy a car and those who are thinking about it. The technique has limitations – some of which we will explain in more detail later – which are difficult to overcome. Because of this, the phenomenon of rapid growth will certainly not be perceptible for quite some time. Leaving aside the detailed presentation of the limitations related to adaptation, the price tag of the currently available electric cars does not help the rapid spread either. A conventionally driven car in the same category can be purchased at a much lower price than its electric version. Year after year, the estimates are that the production prices of batteries will continue to decrease, but practice does not show this (Soulopoulos, 2017). The product range of available electric cars is not that wide yet, so even if the user is thinking about switching to an e-car, it is sometimes difficult to find a car with a structure that suits his preferences.
Considering the above described in our study we use a set of discreet choice experiments in pursuit to understand users' preferences towards EVs. We used choice based conjoint analysis where EV specific product features were randomly combined resulting fictive end products. 300 of these conjoint cards were created where every attribute was presented equally. Our respondents were shown 4 of these cards at a time and were asked to choose which one of them would they buy if those were their only options. After this using MaxDiff we showed our respondents 5 – out of 23 – brands at a time to see which brands are the most and least preferred when considering of buying an EV.
Our paper proceeds as follows. We define EVs and their potential of lowering the negative effects of transportation on the environment. Then we present our research method as well as the primary research. After the discussion of the results, we conclude our study.

THE RISE OF THE ELECTRIC CAR

Number of Battery Electric Vehicles (BEVs) and Plug-in Hybrid Electric Vehicles (PHEVs)

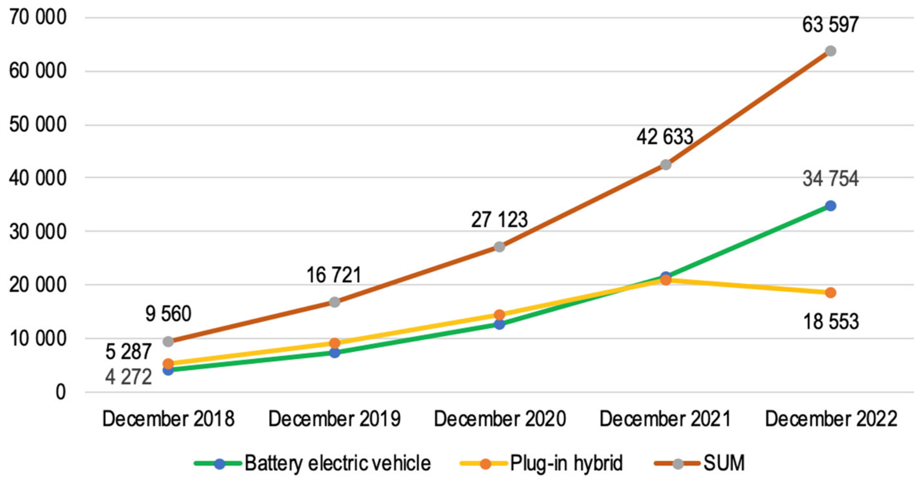
As we indicated earlier, the number of electric cars is slowly but steadily increasing both in Hungary and around the world. **Picture 1** clearly shows how the sales numbers of battery electric vehicles and plug-in hybrid electric vehicles have changed worldwide from 2016 to 2022. The increase is clearly visible, as also the fact that the growth rate of the sales of plug-in hybrids has fallen, while pure electrics has increased more and more. While in 2016 a total of 760 000 vehicles equipped with some form of electric technology found their owners, by 2022 this number will have nearly increased tenfold. It can be clearly seen that a slow growth was observed until 2021, after which there was a significant jump in terms of global sales growth. It is also worth noting that the number of plug-ins, which are less environmentally friendly, is always lower than the number of purely electric ones, and especially according to the trend of the last 3 years, it is constantly decreasing (45 percent in 2020, 41 percent in 2021, 37 percent in 2022 percentage). According to Statista's (2023) estimate for the future, in 2026, more than 13.5 million vehicles equipped with some kind of electric technology will be sold in the world, of which only 24 percent will not be fully electric. However, the estimates in this area should also be treated with reservations, since a period such as the current energy crisis can greatly influence the extent of the spread.



Picture 1: Number of sold Battery electric vehicles and Plug-in hybrids worldwide from 2016 to 2022
Source: own construction based on Statista, 2023

Number of Battery Electric Vehicles (BEVs) and Plug-in Hybrid Electric Vehicles (PHEVs) in Hungary

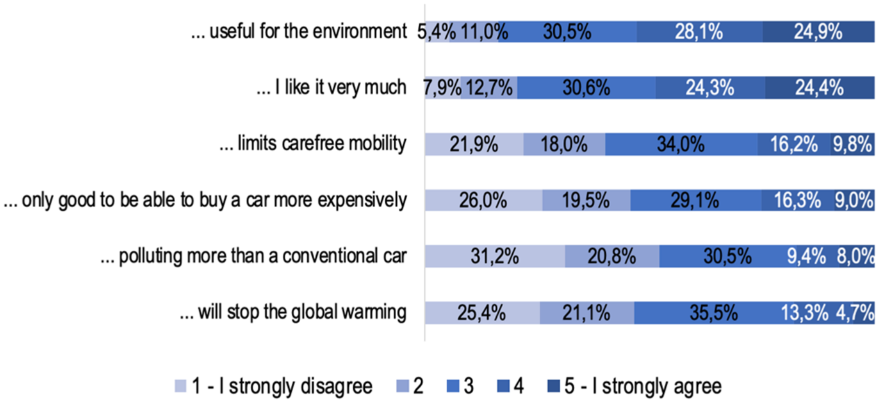
Picture 2 shows the change in the number of vehicles with green license plates in Hungary between December, 2018 and December, 2022. It can be observed that while at the end of 2018 there were less than 10 000 electric cars equipped with some kind of electric technology on the Hungarian roads, by the end of 2022, their number had increased to seven times the number four years earlier. In Hungary, from the examined period until 2021, there were several cars with plug-in hybrid systems. By the end of 2022, the number of fully electric cars had almost doubled compared to the previously more popular technology, with 34 754 of the former on Hungarian roads and 18 553 of the latter. In the case of Hungary, we have not found an estimate regarding the spread of electric cars, but we are confident that their number will increase at a similar or even stronger rate.



Picture 2: Number of Battery electric vehicles and Plug-in hybrids in Hungary from December, 2018 to December, 2022
Source: own construction based on Szűcs, 2023.

THE BARRIERS OF THE INTENSIVE SPREAD OF ELECTRIC CARS

A previous survey of 1 000 people, representative of the Hungarian adult population, which examined attitudes towards electric cars and electric car owners (Vereckei-Poór & Törőcsik, 2022), revealed that Hungarians generally support the existence of electric cars. **Picture 3** illustrates that there is no strong opinion regarding this technique, which is shown by the fact that a large number of respondents indicated medium values on the 1-5 Likert scale. The greater part of the respondents, more than half of them think that electric cars are useful for the environment, and a little less than half of the respondents also like this solution. They don't think it's more polluting than a conventional gasoline or diesel car, but they don't think electric cars will stop global warming. Only 40 percent of the respondents thought that e-cars limit the carefree mobility.



Picture 3: Attitudes toward electric car users (n=999) – What do you think about electric cars? The electric car is...

Source: own construction based on Vereckei-Poór & Törőcsik, 2022

In the studies written on the subject and in the researches, we see that many dilemmas arise in connection with electric cars (Gelmanova et al., 2018). One such example is range. We are used to the fact that after refueling our car with an internal combustion engine at a gas station, we can travel up to a thousand kilometers with one tank of fuel. If the tank were to run out, there is a good chance that we will find a petrol station in our area where we can refuel our car. In the case of electric cars, with the current technology we can only travel a few hundred kilometers with a single charge (Philipsen, Brell, Brost, Eickels, & Ziefle, 2018). Even the e-car with the most advanced battery and the lowest energy consumption is only capable of a range of 400-500 kilometers, which is far less than what we are used to in the case of a traditional car.

Another problem is the charging speed and the number of public chargers. Charging an electric car takes much longer than the usual refueling, which takes about 10-15 minutes, and since the charging infrastructure is underdeveloped, access to the charging point is sometimes limited. The number of chargers does not follow the increase in the number of electric cars, and although many people charge their cars at home, public charging points are essential for those who cannot charge at home, or who travel longer distances with their car. While in the second quarter of 2021, there were 1627 public charging stations in Hungary, 1 year later, 2031 were available, which represents a 20 percent increase (Mekh.hu, 2022). This level of spread would not be a problem in itself, but since the number of electric cars increased by 38 percent in the same period, it can be stated that the development of the charging infrastructure in Hungary does not follow the growth of electric cars.

The next possible problem that delays the spread of EVs is that the reputation of cars with green license plates are considered problematic in Hungary. Although both types (BEV and PHEV) can get a green license plate, since they only have to meet the previously indicated criteria (covering 25 kilometers electrically), at the same time, in terms of environmental impact, plug-ins are much more polluting, since there is nothing that obliges their owners to charge the electric part of their car, and in most of the cases the driver uses the car with the internal combustion engine, while this technology was developed with the aim that the car can drive electrically in the city and with the built-in engine outside the city. A fully electric vehicle, on the other hand, can operate only in electric mode, which does not involve any environmental burden. Car manufacturers are making great use of this opportunity to produce plug-in cars under the aegis of protecting our environment, but they don't oblige car owners to actually take advantage of the electric motor while still offering the same allowances as actual electric cars. Therefore, it is quite an ambivalent sight when a green license plated, fully electric Fiat 500 small city car and a 450 horsepower Porsche Cayenne SUV, also with a green license plate, stand next to each other at a red light.

Also, another reason why the spread is not so fast, is the price of electric cars. In the USA for example, in 2021, an electric version was an average $10 000 (approximately HUF 3.5 million) more expensive than a version of the same type equipped with an internal combustion engine (Lindwall, 2022). Imagine, by the time it reaches Europe and all the necessary costs are paid, the price difference will be even higher. In recent years it was possible to apply for financial support from the government, with which the government subsidized the car buyer with up to 20 percent of the purchase price. The used car market can also come to the fore, where there are a lot of used electric cars for cheaper prices, but at the same time, you cannot apply for funding for such purchases. At the time of writing this study, there are 3 500 used e-cars on the website of the largest used car dealer webpage in Hungary (hasznaltauto.hu), where the cheapest purely electric model is a 2016 Nissan Leaf with nearly 200 000 kilometers for not less, than HUF 4.2 million. Although the maintenance costs of the e-car are extremely low, this alternative is still only a compromise solution. In Hungary, the electric car is currently not suitable for serving the needs of the family as the only car. Having paid the high price, it is true that although we drive in an environmentally conscious manner, the underdevelopment of the charging infrastructure and the relatively low range make everyday life difficult.

The last, but not the least important barrier is that the range of e-cars currently available is relatively low. The automotive industry strives to place as large a battery pack as possible in the bottom of the car, thereby achieving as much range as possible, but this also means that the dimensions of electric cars are constantly increasing. Although there are cars on the market that, due to their compact size, are a practical solution for urban traffic, they also have a shorter range. Since the product is expensive and customers want a longer range, they prefer larger electric cars.
Based on the literature review the aim of our study is to better understand users' preferences towards EVs. Therefore, we use two different choice experiments: choice based conjoint analysis and MaxDiff instead of a stated preference survey. The reason for that is, that these two methods are designed for measuring user preferences during product development and can help provide products that better meet market needs.

PRIMARY RESEARCH

With stated preference surveys we ask respondents how much they agree with certain statements. It is a great method for example to measure consumer satisfaction or loyalty, where people have experience with the goods or services in question. There are several validated research models that are used with stated preference surveys. In the literature of adopting new technologies the most common ones are different versions of the Technology Acceptance Model (TAM) (Davis, 1989) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003). However, many scholars argue a significant boundary for using these models in pursuit of investigating user preferences with products that respondents don't have experience with (Palatinus et al., 2022). Until today EVs are at a very low-level market penetration so most people haven't tried them yet. Therefore, in our study we conducted Choice Based Conjoint analysis (CBC) and MaxDiff other known as best-worst scaling.

Choice Based Conjoint analysis (CBC)

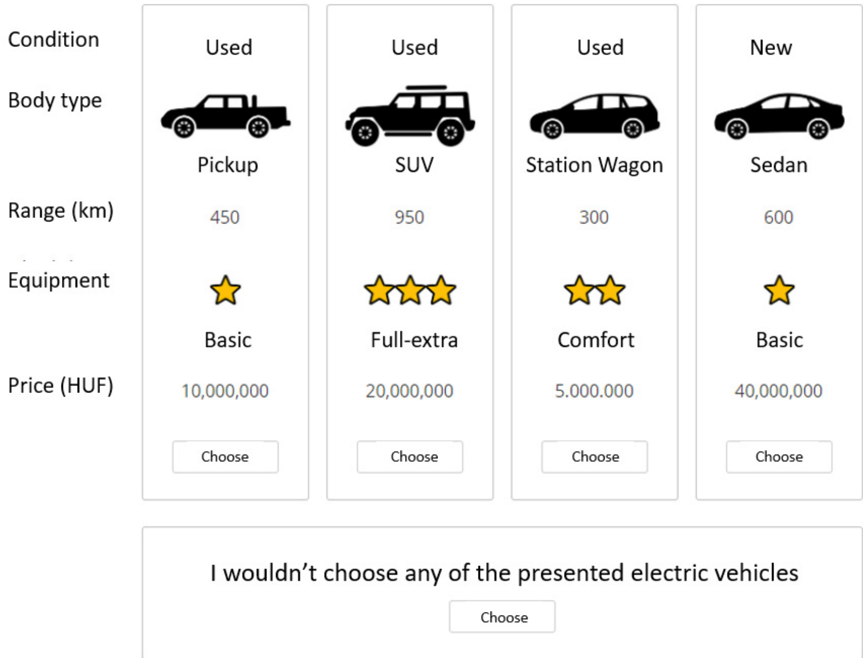
When buying goods users must decide which product or service will they choose over another. This decision is explained by the utility theory. Every product has different product characteristics like color, weight, size, smell, taste, brand, price etc. The partial utilities of these characteristics sum up to the total utility of the products (Eggers and Sattler, 2009). In Conjoint analysis these are called product attributes and each product attribute has different attribute levels. With orthogonal design we provide combinations of these attributes so each of the combinations represent a fictional product that can be presented on cards. Then we ask respondents to evaluate these cards in certain ways (DeSarbo et al, 1995). In CBC we show 2-4 cards each a total of 10 to 15 times to the respondents and ask them which they would choose if the presented products were their only option (Green et al., 2001). With the data gathered we can derive the relative importance of each attribute and the partial utilities of each attribute level. This information not only can help us better understand the decision-making process, but with it we are able to describe the most desired product (Eggers and Eggers 2022).
According to the literature review in our research we used a total of 5 attributes to describe EVs. Our first attribute is Condition with only two levels: New and Used, because in Hungary there is a very big market of used vehicles. The second attribute is Body Type with eight different levels: Hatchback, Sedan, Station Wagon, Minivan, SUV, Sport, Pickup and Cabrio which are the most common. The third attribute is the battery Range of the presented EVs from 150 km to 950 km. Our fourth attribute is Equipment with three attribute levels: Basic, Comfort and Full-extra each representing different level of in-vehicle convenience. At last, but not the least our final attribute is price in Hungarian Forints (HUF) (1Eur = app. 380 HUF) starting from 5 million HUF to 50+ million HUF. We summarize the attributes and their levels in Table 1.

Table 1: The attributes and their levels used in the research

Condition	Body Type	Range (km)	Equipment	Price (HUF)
New	Hatchback	950	Full-extra	5.000.000
Used	Sedan	600	Comfort	10.000000
	Station Wagon	450	Basic	15.000.000
	Minivan	300		20.000.000
	SUV	150		25.000.000
	Sport			30.000.000
	Pickup			40.000.000
	Cabrio			50.000.000
				50.000.000+

Source: own construction

In our research we used Sawtooth Software to create the CBC design and survey. With the random combination of the attribute levels a set of 300 cards were generated, where each attribute levels were presented equal times so our model was suitable for use. In the survey design 4 of these cards were shown at a time for each respondent a total of 12 times with a back-out option, so they were not forced to choose one of the presented cards if none of them met their expectations. This allowed our respondents to see each attribute level the same number of times so each of them was available to get chosen equally. The CBC exercise is shown in Picture 4.



Picture 4: CBC exercise for the respondents.
Source: From author.

MaxDiff (Best-worst scaling)

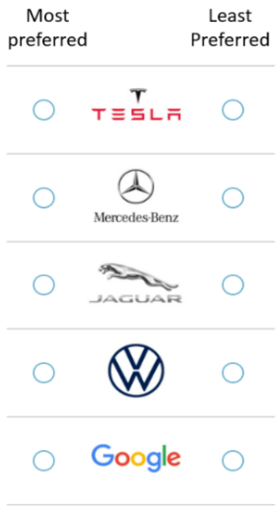
MaxDiff exercises are also choice experiments that are based on the utility theory and can lead to better understand user preferences (Kowalska-Pyzalska et al., 2022). It can be used when there are numerous products, services or brands available for satisfying the same consumer needs. With the use of MaxDiff we can determine which of these similar goods are the most and least preferred (Papadima et al., 2020). In the exercise we show our respondents a set (4-6) of the before defined list (20+) of goods in question. Then we ask them to choose which one of the presented list ex. brands is the most- and least preferred (Nickaar, Lee and Shin, 2023).
In our research we wanted to know which brands do our respondents prefer when buying an EV and which do they reject. In our MaxDiff exercise we created a list of 23 brands (Table 2.) including not only car manufacturers that are present in the EV industry but tech companies that are known for their research and development of vehicle innovation.

Table 2: The brands used in the MaxDiff exercise

Car manufacturers	Audi, BMW, Chevrolet, Ford, Honda, Hyundai, Jaguar, Karma, Kia, Lucid, Mercedes-Benz, Mini, Nissan, Polestar, Porsche, Tesla, Toyota, Volkswagen
Tech companies	Apple, Bosch, Google, Microsoft, Sony

Source: own construction

In the research design we showed 5 brands at a time for our respondents a total of 14 times. Their task was to choose which one of them do they prefer the least and the most when considering buying an EV as shown in Picture 5.



Picture 5: MaxDiff exercise for the respondents.
Source: own construction

Sample

An online survey with the above introduced CBC and MaxDiff exercises was designed with Sawtooth Software and published in social media platforms in February 2023 in which 206 respondents took part. 97% of them have a driver's license, and 87% own at least one car, or there is a car that they can use daily. Most of them own one or two cars of which 60% are petrol, 38% are diesel and interestingly 27% are electric, while 5% are Plug-in Hybrid. This may be due to the specific social media groups where we shared our survey. Only 21% of our respondents replied that they would never consider buying an EV, however 28% is not sure yet about the time when they would buy one, while 20% is still uncertain whether they would purchase an EV.
70% of our respondents are male, 29% are female and there is 1% referring their gender as other. Most of our respondents (41%) are between the ages 29-43, followed by those of 44-62 (31%) and those of 18-28 (25%), while the rest (3%) is between 63-77 years old. 59% of our respondents live in cities and 31% in rural areas. 54% have diplomas of higher education and 19% are students. 55% have a full-time job, 15% are entrepreneurs and 14% are managers.

Results

First, we analyze the results of the CBC exercise. With the use of Hierarchical Bayesian (HB) statistics we can derive the partial utilities of each attribute level. We found that our respondents would prefer their EV to be new instead of being used. The mostly preferred body type is hatchback, followed by sedan, station wagon and minivan, while the other body types are not in favor. Or respondents are open to consider buying an EV that can do distances between 950 and 450 km-s, however the mostly preferred range is 950km. Regarding the equipment of the vehicle they prefer is full-extra and comfort, and not surprisingly they would like to buy their EV at the lowest price possible. However, they are opened to pay up to 25 million HUFs. We summarize our results regarding the partial utilities of the attribute levels in Table 3.
Second, with the same statistical method the estimated relative importance of the attributes is derived. These percentages allow us to determine how much each attribute contribute to the decision-making process. We found that when considering of buying an EV the most important attribute is price (35,75%), followed by body type (33,56%), durability (19,68%), comfort (7,60%) and it seems that the least important is if it's new or used (3,40%).

Table 3: The partial utilities of the attribute levels

Condition		Body type		Range (km)		Equipment		Price (HUF)	
New	5.63	Hatchback	48.31	950	31.05	Full-extra	12.33	5.000.000	76.83
Used	-5.63	Sedan	44.22	600	19.86	Comfort	5.73	10.000.000	57.04
		Station Wagon	32.60	450	18.28	Basic	-18.06	15.000.000	48.28
		Minivan	3.64	300	-12.34			20.000.000	20.90
		SUV	-13.23	150	-56.85			25.000.000	5.13
		Sport	-26.98					30.000.000	-14.10
		Pickup	-29.49					40.000.000	-32.78
		Cabrio	-59.0					50.000.000	-75.97
								50.000.000+	-85.34

Source: own construction

Third, when analyzing the gathered data of the MaxDiff exercise we firs ran count analysis to see the times each brand was chosen as the most preferred and as the least preferred. All the brands were presented a sum of ca. 518 times with the minimum times of appearance of 516, and the maximum of 521. Those to step on the podium are Tesla (284), Audi (206) and Toyota (182), while those that were most rejected are Microsoft (265), Karma (227) and Chevrolet (181). Interestingly some of the tech companies such as Apple (63) and Bosh (35) were chosen as preferable over certain car manufacturers. Also, every tech brand was chosen as most preferred at some point with the lowest count for Microsoft (21). On the other hand, the brands that were chosen to be least preferred are Microsoft (265), Karma (227) and Chevrolet (181). We sum up the results of the count analysis in Table 4.

Table 4: The results of the count analysis

Shown each cca. 518 (min:516, max: 521)			
Best count		**Worst count**	
Tesla	284	Microsoft	265
Audi	206	Karma	227
Toyota	182	Chevrolet	181
Volkswagen	179	Google	173
Kia	171	Apple	168
Hyundai	166	Lucid	157
Mercedes-Benz	164	Sony	152
BMW	136	Polestar	120
Porsche	134	Bosch	105
Honda	115	Ford	89
Nissan	106	Jaguar	88
Ford	84	Mini	85
Polestar	77	BMW	74
Jaguar	63	Kia	70
Apple	63	Honda	64
Mini	59	Toyota	62
Lucid	44	Nissan	61
Bosch	35	Hyundai	53
Google	26	Tesla	49
Sony	25	Volkswagen	43
Chevrolet	24	Porsche	42
Karma	21	Mercedes-Benz	34
Microsoft	21	Audi	23

Source: own construction

We also used the method HB statistics when analyzing the results of MaxDiff to see which brands are the most, and the least preferred overall. We see the similar results as with count analysis. The main difference between the two methods is that with count analysis we use the aggregate number of choices like it was made by one respondent. So, it is an excellent tool to see if our model performs well. While with HB statistics we use our respondents' individual utility estimates, that gives us a deeper understanding of which brands are most preferred and least preferred. We found that the top 5 brands that people are considering when buying an EV are Tesla, Audi, Volkswagen, Toyota, and Mercedes-Benz, while the least preferred 5 brands are Karma, Microsoft, Chevrolet, Sony, and Google (Table 5.). Again, two of the tech brands Apple and Bosh were able to finish in the middle of the list.

Table 5: The results of the HB statistics

Rescaled Scores (0 to 100 scaling)			
	Average	**95% Lower**	**95% Upper**
Audi	9.44882	8.69573	10.20192
Volkswagen	8.48231	0.76663	1.21474
Toyota	7.56955	2.95986	3.94713
Mercedes-Benz	7.34728	5.82414	6.99557
Hyundai	7.32534	6.72599	7.92469
Kia	6.97004	5.16481	6.50268
Porsche	6.73357	7.8782	9.08642
BMW	6.40985	6.94248	8.19663
Honda	5.83374	2.27252	3.12581
Nissan	5.26528	4.27757	5.38674
Ford	4.83216	4.64418	5.88637
Jaguar	3.4535	6.2671	7.67299
Polestar	3.18586	6.69112	8.00345
Apple	2.97557	2.72894	3.64279
Mini	2.72341	5.97125	7.49588
Bosch	2.69916	1.40161	2.2691
Lucid	1.84276	0.57742	1.06182
Google	1.83535	2.43545	3.51568
Sony	1.27885	2.15251	3.29431
Chevrolet	1.14035	1.52316	2.16236
Microsoft	0.99068	0.99114	1.56656
Karma	0.83693	0.89885	1.38186
Tesla	0.81962	0.57354	1.10032

Source: own construction

DISCUSSSION AND CONCLUSIONS

Mobility is one of the greatest polluters of the environment therefore there is a great need for a radical change in the way vehicles operate. The electrification of vehicles is a promising alternative to internal combustion engine motors because they don't produce harmful gases during operation. We understand that the advantages of EVs can be only achieved if people accept and use them. These cars are already available for purchase for end users. However, their market penetration is still very low for multiple reasons, as we indicated earlier. Therefore, in our study we conducted CBC and MaxDiff analysis to better understand users' preferences towards EVs. Our online survey was answered by N=206 respondents.

In our CBC analysis 5 attributes were used (Condition, Body type, Range, Equipment, and Price) with different attribute levels to create a sum of 300 cards each representing a fictional EV. We showed 4 of these cards to our respondents and asked them to choose which one of them would they buy if there were their only option. Also, we provided a back out option, so our respondents were not forced to choose every time through the experiment which was made of 12 sets. With HB statistics the relative importance of the attributes and the partial utilities of the attribute levels can be derived. We found that Price is the most important factor when buying an EV, followed by Body type, Durability, Equipment and Condition. According to the partial utilities our results show, that our respondents would like their EV to be new. The most preferred Body Types are Hatchback, Sedan and Station wagon. The preferred range is between 950km and 450 km, and the most preferred Equipment level is Full-extra and comfort. Not surprisingly the lower prices have the highest partial utilities, however our respondents would be opened to pay as much as 25 million HUFs for an EV.

In our MaxDiff analysis we used a set of 23 brands including car manufacturers and tech companies. A choice experiment was created where we showed randomly 5 of these brands to our respondents a sum of 14 times. Each brand was shown approximately 518 times. Our results show that Tesla, and Audi are the most preferred brands when considering of buying an EV. We also found that some tech companies also performed well. Apple and Bosh both finished in the middle of our respondents' preference list. Meaning that People already know that these brands are into vehicle development, and they are opened to buy cars from these companies when they are introduced to the market.
By combining the results of the CBC and Maxdiff exercises we can describe the most desired vehicle. For our respondents this would be a new Tesla, that costs 5 million HUFs, is a Hatchback, and can do 950kms with one charging, while it is equipped with all the possible extras (Full-extra).

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