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Five user types of autonomous driving in Hungary

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ABSTRACT

One of the most socially impactful innovations of the near future will be the proliferation of self-driving vehicles, which will have a major impact not only on the passengers in the vehicle but on all road users and even on society as a whole, transforming cityscapes. This study aims to contribute to the social acceptance of self-driving vehicles. As society is not unified in its attitude towards self-driving vehicles, the authors believe that successful social acceptance requires different messages to be delivered to different types of consumers. This research segmented consumers based on their acceptance of self-driving technology, thereby providing a basis for targeted communication in the future. Cluster analyses were used on a sample of 517 Hungarian consumers to identify five segments based on attitudes towards self-driving vehicles. The analysis identified five distinct segments of consumers: (1) tradition-loving dismissers, (2) open-minded adventurers, (3) uncertain optimists, (4) distrustful sceptics, and (5) abstentious observers. These segments can be targeted with differentiated communication strategies. This paper contributes to the literature on self-driving technology acceptance by providing a detailed segmentation of the consumer market, highlighting the importance of targeted communication to enhance technology adoption. It offers a novel approach by focusing on specific consumer segments rather than society in general. By identifying the needs and characteristics of different consumer segments, marketers can develop more effective communication strategies to promote the acceptance of self-driving technology. Using a more targeted marketing approach instead of mass-marketing may result in a smoother spread of innovation and maximise social welfare benefits from technological advancements.

KEY WORDS

autonomous vehicles, sustainable mobility, smart mobility, EGD, technology acceptance

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Introduction

The 21st century is full of revolutionary changes and radical innovations. New products, technologies, and services appear daily and are integrated into everyday lives with significant impacts. Self-driving technologies are perhaps the most outstanding of these innovations and will greatly affect daily lives and habits throughout human civilisation. Self-driving technologies will affect people's lives regardless of whether they are drivers, cyclists, or pedestrians (Cohen et al., 2020).

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The technological development of self-driving vehicles is in the stage of mass street testing: self-driving vehicles can be seen tested in road traffic in nearly 200 cities around the world, where they are part of everyday traffic and the lives of citizens. The advancement of self-driving technology is also indicated by the fact that 53 institutions have already procured road test licenses in California.

In recent years, social scientists have begun to more intensively study how advances in self-driving technology relate to societal preparedness. Research related to consumer acceptance of self-driving vehicles has found heterogeneous attitudes towards self-driving vehicles and a high frequency of extremist views by identifying the most rejecting groups: women, the elderly, the less educated, and those living in rural areas (Schoettle & Sivak, 2014; Kyriakidis et al., 2015; König & Neumayr, 2017; Hulse et al., 2018; Liljamo et al., 2018; Havlíčková et al., 2019; Rovňák et al., 2022; Szpilko et al., 2023; Raue et al., 2019; Wang et al., 2020).

It was also observed that most respondents offered an opinion even though they had little information about the technology (Keszey, 2020). In addition, the level of acceptance and the amount of information were directly proportional (Lukovics & Gábor, 2021).

The international literature agrees that the question is not whether self-driving vehicles will come into general use but when (Grindsted et al., 2021). From a social point of view, it is important to make this transition as smooth as possible. In the diffusion of innovation, however, researchers have shown that the complexity of innovation is inversely proportional to the speed of adoption (Csizmadia, 2017) because if acceptance requires a great deal of new information and different ways of thinking, the spread of innovation is slower and has a higher likelihood of rejection.

Rogers's (2003) well-known theory, the diffusion of innovation, demonstrates that consumers respond differently to new technologies and have different personal characteristics. Piskóti et al. (2013) stated that the key to successful innovation is focusing on customer benefits and effective market penetration. Customer benefits will always be relevant, recognisable, and easy to communicate. Vágási (2002) also emphasised that well-identified consumer preferences and needs play a significant role in success.

It is also important to note that Rogers (2003) perceived the diffusion of innovation as a communication process in which information about technology reaches members of society through specific channels. This communication process can come to fruition effectively if well-targeted messages about the technology are delivered to consumers. The theory defines diffusion as a communication process with four key elements: innovation, communication channels, time, and a social system (Miller, 2015; Dearing & Cox, 2018). This process involves reducing uncertainty about an innovation through information exchange (Rogers, 1964). The central assumption of the study described in this article is that just as the effectiveness of communication, in general, is enhanced by segmenting the target market, so it should be done in the self-driving vehicle market.

This study aims to classify Hungarian consumers into homogeneous groups and determine their main characteristics. The relevant literature on self-driving technology acceptance is reviewed first to achieve the research purpose. Next, the methodology is presented, including the use of mathematical-statistical methods, such as factor and cluster analyses. The Results section identifies and describes the five distinct consumer segments. Personas were set up for the formed segments, and each of them was characterised. Finally, the Discussion and Conclusion sections analyse the implications of research findings and summarise the study's contributions. Research results may serve as important inputs for differentiated marketing communications that indirectly contribute to a smooth societal transition to self-driving technologies.

1. Literature review

Generally, models examining technology acceptance try to explain the intention to use as a dependent variable with various independent variables (Davis, 1989). The two best-known models — the technology acceptance (TAM) and unified theory of acceptance and use of technology (UTAUT) model — and their adaptations examine nearly a dozen such independent variables. Of these factors, the international literature identifies "perceived ease of use" as a significant influencing factor (Davis, 1989; Venkatesh & Davis, 2000). Using the technology acceptance model, Buckley et al. (2018), Panagiotopolous and Dimitrakopoulos (2018), and Xu et al. (2018) found that perceived ease of use plays a direct role in predicting consumer behaviour. Based on the UTAUT model, expectations (regarding performance and effort) and experience are key factors that influence behavioural intention and, through this, actual usage as well (Venkatesh

& Davis, 2000; Venkatesh et al., 2003, 2012). Deb et al. (2017) have shown that men have more positive attitudes than women towards autonomous vehicle[1] technology. Results differ by age because while Liu et al. (2019) concluded that respondents of the younger generation have a more positive attitude than members of the older generation, Hartwitch et al. (2018) found a strong positive attitude in the case of the older generation towards the acceptance of autonomous vehicle technology. This strong positive attitude may be influenced by the fact that before the survey, Hartwitch et al. (2018) invited respondents to experience the feeling of travelling in a self-driving vehicle using a simulator.

Panagiotopoulos and Dimitrakopoulos (2018) have shown that people exhibiting high confidence in self-driving vehicles are less affected by social norms than those with low confidence. According to various surveys, trust varies from generation to generation. Gold et al. (2015) concluded that the older generation has higher confidence, while Bansal et al. (2016) found that members of the older age group could be characterised by lower levels of confidence. Age may also be related to risk-taking. Liu et al. (2019) have shown that perceived risk appears more strongly in the older generation than in the younger generation, which was explained by changes in risk tolerance with age. Generally perceived risk has a strong negative effect on acceptance, so as perceived risk increases, people's intention to use the technology decreases.

Kyriakidis et al. (2015) found that people using a driving support system are likelier to adopt self-driving vehicles. This means that people's past behaviour may influence their future willingness to accept.

Experience (which is a key factor in the TAM and UTAUT models) is strongly connected with awareness. With more experience or information about a new technology, people tend to become more familiar with its potential benefits, strengthening trust and leading to a smoother adoption process (Lukovics & Gábor, 2021; Páthy, 2019). In this context, it is important to note that society comprises groups with different characteristics, expectations, attitudes, and knowledge. Identifying these groups is crucial for developing an appropriate communication strategy.

Only several articles in the international literature are related to consumer segmentation concerning autonomous vehicles (Audi, 2019; Berrada et al., 2020; Rahimi et al., 2020). Audi (2019) and Berrada et al. (2020) identified five groups after examining different factors and characteristics of the respondents. These researchers surveyed respondents' opinions on self-driving vehicles, their concerns, and how informed they were about self-driving vehicles (Audi, 2019; Berrada et al., 2020). In contrast, Rahimi et al. (2020) identified three user classes based on respondents' modality style and attitudes.

As discussed above, the adoption of self-driving vehicles is influenced by a number of factors (as indicated by the TAM and UTAUT models). Some researchers (Audi, 2019; Berrada et al., 2020; Rahimi et al., 2020) have already identified different consumer groups based on factors mentioned in technology acceptance models and other characteristic issues (e.g., modality style). This study aims to provide a deeper insight into Hungarian respondents' attitudes towards autonomous vehicles, their intention to try them, and how informed they are (awareness) about the topic to classify them into homogeneous groups. The segmentation is based on a survey (variables in Table 3) covering four main topics: attitude, intention to use, acceptance of changes, and awareness.

2. Research methods

The research aimed to identify distinct segments within the general population; therefore, quantitative research was conducted based on an online questionnaire with 16 questions. The Google questionnaire was used to examine the attitudes, expectations, and awareness of the Hungarian sample regarding self-driving vehicles and classify them into homogeneous groups with the help of factor and cluster analyses.

The online questionnaire formed the basis of quantitative research. It was published on the social media platform with the largest user base, Facebook (Statista, 2024), which is suitable for conducting public surveys in scientific studies (Kalimeri et al., 2020). The platform's advertising tools allow researchers to target specific demographics, behaviours, and interests, making it particularly useful for reaching niche and hard-to-reach populations (Iannelli et al.,

[1] The diverse array of pertinent technologies has sparked intricate — and sometimes conflicting — classifications of vehicle automation. Among these, the International Society of Automotive Engineers' (SAE) 5 Levels of Driving Automation represent the emerging descriptive consensus (SEA, 2014; ITS, 2015): 1. Driver assistance, 2. Partial automation, 3. Conditional automation, 4. High automation, and 5. Full automation. These levels are descriptive rather than prescriptive and focus on technical rather than legal distinctions. The study described in this article defines autonomous driving as encompassing Levels 4 and 5, and research subjects were informed accordingly.

Tab. 1. Distribution of age groups in the sample

Age group	N
17 or younger	5
18–20	89
21–29	213
30–39	48
40–49	88
50–59	49
60 or older	25
Sum	**517**

Tab. 2. Values of KMO and Bartlett's test

KMO index		0,888
Bartlett's test	Sig. Value	0,000

2018; King et al., 2014). In the first part of the questionnaire, questions focused on driving and driving license; the second part asked questions about self-driving vehicles; and in the last part, questions were posed about the demographic characteristics of the respondents. The questionnaire was available on Facebook from 22 September 2020 to 11 October 2020. During this period, 517 respondents took part in the survey. In terms of demographic characteristics, the sample comprised 62.3 % female and 37.7 % male respondents. The age distribution is illustrated in Table 1 below.

The IBM SPSS statistical program was used to evaluate the responses received during the quantitative research and to define the segments. Factor analysis and cluster analysis were applied for data analysis and group formation (Harman, 1961; Mulaik, 1972; Jain et al., 1999).

Tab. 3. Rotated factor weight matrix

Questions involved in the study (variables)	Factors			
	1	2	3	4
1. Suppose that you have the opportunity to test a self-driving vehicle on a CLOSED TEST ROAD. Would you try it?	0.847			
2. Would you like to try a self-driving vehicle?	0.798			
3. Suppose that you have the opportunity to test such a vehicle in TRAFFIC. Would you try it?	0.781			
4. How much would you like to try a self-driving vehicle in traffic with a driver sitting in the driver's seat who could take control of the vehicle at any time?	0.723			
5. When would you try a self-driving vehicle for the first time?	0.615			
6. Do you consider self-driving vehicles to be safe?		0.760		
7. How true are the following feelings when you think of self-driving and self-driving vehicles? 1 — not true at all; 5 — very true [I'm optimistic]		0.749		
8. Do you think that self-driving vehicles would have a positive effect on our daily lives?		0.747		
9. How true are the following feelings when you think of self-driving and self-driving vehicles? 1 — not true at all; 5 — very true [I'm curious]		0.62		
10. How interested are you in self-driving vehicles?		0.606		
11. How happy would you be with the following changes (brought about by the use of self-driving vehicles)? 1 — I would not be happy at all; 5 — I would be very happy [There would be fewer accidents on the roads.]			0.885	
12. How happy would you be with the following changes (brought about by the use of self-driving vehicles)? 1 — I would not be happy at all; 5 — I would be very happy [There would be more parking spots.]			0.885	
13. How happy would you be with the following changes (brought about by the use of self-driving vehicles)? 1 — I would not be happy at all; 5 — I would be very happy [The transport system would be more predictable and the number of delays would be reduced.]			0.867	
14. How happy would you be with the following changes (brought about by the use of self-driving vehicles)? 1 — I would not be happy at all; 5 — I would be very happy [The time spent on driving would be free.]			0.619	
15. How informed do you feel yourself in connection with self-driving vehicles?				0.878
16. How often do you read about self-driving vehicles?				0.856

Tab. 4. Mean values of factors in each cluster

Clusters and their characteristics Intention to Test		Factors			
		Intetntion to test	Attitude	Accepting Changes	Awareness
1	Cluster size	44	44	44	44
	Mean	-0.31	-0.45	-2.39	0.15
2	Cluster size	107	107	107	107
	Mean	0.62	0.17	0.26	1.37
3	Cluster size	166	166	166	166
	Mean	0.68	0.32	0.10	-0.63
4	Cluster size	130	130	130	130
	Mean	-1.09	0.57	0.25	-0.19
5	Cluster size	70	70	70	70
	Mean	-0.33	-1.78	0.42	-0.32

The factor analysis used 16 variables[2]. The correlation matrix of the variables and the values of the Bartlett's test and KMO index (Harman, 1961; Horn & Engstrom,1979) was examined to explore the applicability of the method.

Based on the values in Table 2, the variables are suitable for creating factors, as the KMO value is above 0.7, and the result of Bartlett's test is also adequate.

Based on the Kaiser criteria, those with an eigenvalue above 1 were retained among the resulting principal components. Four factors were identified that retained 70.281 % of the amount of information in the original 16 variables, reaching a minimum of 60 %.

Table 3 lists the questions ("items") involved in the study and the factors that were created. Varimax rotation, the rectangular rotation method of IBM SPSS, was used to reduce the number of high-weighted variables per factor. This method is suitable for determining values and using the factors further in cluster analysis (Hunyadi, Mundruczó & Vita, 2000). Items in the first factor were mainly related to testing of self-driving vehicles, so they were named "Intention to Test". The second factor contained items related to the respondents' presuppositions, feelings, and attitudes, so the second factor was named "Attitude". The third factor included items about the acceptance of changes generated by self-driving vehicles, so this factor was called "Accepting Changes". The last factor covered items about respondents' awareness and how informed they were about self-driving vehicles, so the fourth factor was named "Awareness".

[2] The list of the 16 variables can be found in Table 3.

After the factor analysis, the next step was cluster analysis. The four factors were used, which were obtained from the factor analysis. Before the analysis, three important preparatory steps were performed: handling outliers, standardising variables, and examining multicollinearity (Haitovsky, 1969; Kim, 2019).

From the two-step cluster analysis, the system separated five clusters based on the variables included in the study (Table 4): Cluster 1 = 8.5 %, Cluster 2 = 20.7 %, Cluster 3 = 32.1 %, Cluster 4 = 25.1 %, and Cluster 5 = 13.5 %. The average attitude (mean = (−0.45)) and willingness to try (mean = (−0.31)) of the first cluster are low, but their average awareness (mean = 0.15) is relatively high compared with the other clusters. Despite this, this group does not really like changes (mean = (−2.39)) compared with the average for the whole population. The members of this cluster also have a much more negative opinion about self-driving cars than members of the other four clusters. The members of the second cluster have a positive attitude on average (mean = 0.17), a high willingness to try (mean = 0.62), they receive changes very well (mean = 0.26), and this cluster is the best informed (mean = 1.37) about self-driving vehicles. The third cluster also has a positive attitude on average (mean = 0.37), and changes are well received by them also (mean = 0.10). The average value of their intention to test (mean = 0.68) is very close to that of the second cluster, but their level of awareness (mean = (−0.63)) is lower. The members of the fourth group have a positive attitude (mean = 0.57) but a relatively low intention to try (mean = (−1.09)). They receive changes well (mean = 0.25), but they are not very informed (mean = (−0.19)) about the topic compared to the other clusters. The fifth cluster has a negative

attitude on average (mean = (−1.78)), a low willingness to try (mean = (−0.33)) and a low level of awareness (mean = (−0.32)). Despite these, they are quite open to changes (mean = 0.42)).

3. Research results

After performing the cluster analysis, cross-tabulation analyses (the summary results are given in Table 5) were used to identify the segments in greater detail. The formed segments can be characterised as follows:

- Segment 1 — Traditional dismissers: 59.1 % of the segment is female, and 40.9 % is male. The majority is 40–49 years of age, but this segment also has the highest proportion of members who are 60 and above. This group proved to be the most pessimistic about self-driving vehicles. In addition, 54.4 % of the cluster said they were not interested in self-driving at all, and 65.9 % said they would definitely not buy such a vehicle. The group members are not passionate about novelties, and would only try self-driving vehicles if they were already completely widespread. Moreover, most of the segment was completely against using self-driving cars. More than 80 % would not sit in such a vehicle even when tested in traffic. A significant proportion does not consider self-driving vehicles safe at all. This group is the most distrustful and the least curious among the segments. The most positive reception was related to the statement, "There would be fewer accidents on the roads".
- Segment 2 — Open-minded adventurers: Men (72 %) and young people dominate this segment. Most belong to the 21–29 year age group, but a large proportion comprises 18- to 20-year-olds. Of the group, 58.9 % are students. Generally, members of the segment have no worries about self-driving vehicles and proved to be both the most optimistic and the most interested. The majority would also like to buy such a vehicle for themselves in the future. Most are very open to novelties and like to share their experiences with others. They would be among the first to try out a self-driving vehicle. More than 80 % of the segment would try them out in traffic, and more than 50 % without (an emergency) driver. Most of the group's respondents are excited to use self-driving vehicles in traffic and consider them safe. This group is the least distrustful and the most curious.
- Segment 3 — Uncertain optimists: This segment contains the highest proportion of women (79.5 %) and is predominated by respondents aged 21–29 and 18–20. They are not really concerned and have a relatively optimistic opinion about self-driving vehicles. The members are interested in the topic but not as much as the members of the second segment. The majority are not sure if they would buy such a vehicle for themselves, but they would think about it. They like to gather information about novelties before they try them out, so they would only sit in such a vehicle if others had already done so. They would like to try self-driving vehicles even in traffic. If they had to sit in a vehicle without a driver, they would think more about it than would members of the second segment, but based on the answers, they would still try it out. Members of the group are positive about change, but they would be most pleased to see a reduction in pollution. Like the second segment, they are curious but a little less trusting.
- Segment 4 — Distrustful sceptics: This segment has a higher percentage of women (69.2 %), and most of the segment is aged 21–29 and 30–39. They are less optimistic and less interested in self-driving vehicles than members of the third segment. They are more worried and probably would not buy a self-driving vehicle for themselves. Typically, they would only try such a vehicle if many people had already done so, and many positive reviews might make them more interested. They might try a self-driving vehicle in traffic, but only with an emergency driver. The group can be best characterised by neutral feelings regarding the use and safety of self-driving vehicles. Most people in this group are positive about the topic but have doubts. A significant percentage do not want to see self-driving vehicles in traffic and do not yet see the point in having them. Most could not decide how safe self-driving vehicles were or did not consider them safe. This group typically receives change well, but they would be most pleased with reduced pollution and more green zones in cities. They are not curious and do not trust this technology.
- Segment 5 — Abstentious observers: This segment is best characterised by females (62.9 %)

Tab. 5. Segments and their characteristics

Questions	Segments				
	1. Tradition-loving dismissers	2. Open-minded adventurers	3. Uncertain optimists	4. Distrustful sceptics	5. Abstentious observers
Gender ratio	59.1 % female	72 % male	79.5 % female	69.2 % female	62.9 % female
Age group	40–49 60+	18–20 21–29	18–20 21–29	21–29 30–39	40–49 50–59
Ratio of students and workers	77.3 % worker	58.9 % student	54.8 % student	50 %–50 %	75.7 % worker
Are they worried?	Not really	Not at all	Not really	More than the 3. (yes)	Not really
Are they optimists?	Not at all	They are the most optimistic	Yes	Less than the 3.	Not really
Are they interested in self driving?	Not at all	They are the most interested	Somewhat	Less than the 3.	Somewhat
Would they buy such a vehicle?	No	Yes	Maybe yes	Probably not	They do not know
When would they try a self-driving vehicle?	Only if they are already considered widespread	Among the firsts or shortly after their appearance	If they have enough information	If a lot of people have tried it	If they have enough information
What is their attitude towards the use of self-driving vehicles?	They absolutely reject the use of self-driving vehicles	They are excited	Positive, but they have reservations	Neutral	Positive, but they have reservations
Would they try such a vehicle in traffic?	No	Yes, of course	Yes, of course	Maybe yes	More than the 4
Would they try such a vehicle without a driver?	No	Yes, of course	Maybe yes	Probably not	More than the 4
Do they consider self-driving vehicles safe?	Not really	Yes, of course	Yes, they are probably safe	They do not know	Neutral feelings
Are they distrustful?	They are the most distrustful	Not at all	Yes, but not to a great extent	Yes, they are distrustful	Not at all
Are they curious?	Not at all	They are the most curious	They are really curious	No	They are moderately curious
Accepting changes	There would be fewer accidents on the roads	They would be happy with all the changes	Reduction of environmental pollution	Reduction of environmental pollution and more green areas	They receive changes neutrally

and people aged 40–49 and 50–59. They are not optimistic, but they are not worried either. They would only try the vehicles if others had already done so and if they had enough information about the technology. They would be more likely to try out such a vehicle than members of the fourth segment. Most members have a positive opinion about the topic but have doubts or neutral feelings about it, too, and they are also concerned about vehicle safety. They receive change just as well as the members of segment 4. They are moderately curious and not distrustful at all. So, although they would try this novelty if they had enough information about it, they do not yet have an opinion on this topic that is clearly negative or positive. Based on this, abstentious behaviour is coupled with some curiosity.

Overall, the sample can be divided into five groups (segments). For a better overview, the characterisation of the segments is summarised in Table 5.

As a research result, segments were successfully identified for which targeted communication can

contribute to widespread societal acceptance of self-driving technology. Below, communication suggestions for each segment are summarised:

- Traditional dismissers: As they have a strong negative opinion and say they would certainly not sit in such a vehicle, it may be worth emphasising the benefits of "other self-driving vehicles". This segment has the highest proportion of those who do not have a driving license. If members of the group become more accepting over time, the emphasis could be placed on the benefits of travelling by a self-driving vehicle for the elderly or those who do not have a driving license (or car). The goal here is not to encourage trying self-driving technology but to ensure they do not become active barriers to spreading the technology. The communication of factual information through mass media may be appropriate.
- Open-minded adventurers: This young, interested, and mostly male group can be reached through social media with messages that provide up-to-date information, a chance to try out the technology, and some technical details. "Self-driving ambassadors" may come from this segment.
- Uncertain optimists: These young women can be reached mainly through social media with educational content that enhances their sense of safety and raises awareness of the positive environmental impacts of self-driving vehicles. Involving influencers can also be effective in convincing this target group. It is worth noting that car-sharing is quite common among members of this group.
- Distrustful sceptics: Personal communication and the convincing role of the previous two segments play key roles in this segment. Uncertainty and mistrust must be reduced here. As they are sceptical and have low risk-taking appetites, they are likely to use this innovation only if it is already widespread. As passive players (pedestrians, transporters, etc.), they will be less affected by this technology. However, their attention can be drawn to the fact that that they can also indirectly benefit from it (e.g., parcel delivery, food delivery, and blood transport).
- Abstentious observers: In their case, the goal is to increase awareness and emphasise the benefits through mass media. The goal is to tilt neutral feelings in a positive direction. Because safety is important to them, and they are curious to some extent, the goal can be achieved with gradual involvement (providing the possibility to test).

4. Discussion of the results

The study aimed to identify consumer segments of autonomous vehicles by utilising an online survey based on the factors of the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) model. The survey comprised 16 questions, from which four distinct factors were composed: intention to test, attitude, accepting changes, and awareness.

In alignment with previous studies, such as Audi's driver classification (2019) and the research by Berrada et al. (2020), this study revealed five distinct consumer groups. These groups ranged from open-minded adventurers, who exhibit high enthusiasm and readiness to test and accept autonomous vehicles, to traditional dismissers, who demonstrate an extremely low level of awareness and a negative attitude towards the changes brought by this technology.

Berrada et al. (2020) asked people in Palaiseau (France) about their socio-demographic issues, mobility habits, and use of autonomous vehicles, then applied hierarchical cluster analysis to segment their sample. The study by the Audi research team (2019) surveyed respondents' opinions, knowledge, and concerns about self-driving vehicles in nine countries across three continents and revealed how users could be grouped according to the factors studied. Rahimi et al. (2020) examined people mainly from Florida and hypothesised that individuals' decisions towards autonomous vehicles vary by their modality style. The researchers used a latent class clustering analysis model and identified three distinct user classes.

Comparing the five consumer segments identified in our research with the findings of other researchers (Audi, 2019; Berrada et al., 2020), some similarities can be found in the characteristics of certain groups:

- Open-minded adventurers have a very positive attitude towards autonomous vehicles and are eager to try new technologies. This segment is similar to the "tech-savvy passengers" and "status-oriented trendsetters" groups identified by the Audi research team (2019) and shares characteristics with the "explorers" group identified by Berrada et al. (2020).
- Uncertain optimists have a positive attitude and are curious about this new technology, though not as much as open-minded adventurers. This segment is similar to the "open-minded co-pilots" identified by Audi (2019), and Berrada et

al. (2020) described "early adopters" in a similar way.

- Distrustful sceptics are unsure about the safety of self-driving vehicles or do not consider them safe. This segment is not curious and does not trust this technology, similar to the "suspicious drivers" group identified by Audi (2019) and the "sceptics" identified by Berrada et al. (2020).
- Abstentious observers do not know much about autonomous vehicles and are characterised by abstention coupled with a little curiosity, similar to the "safety-oriented reluctant" group (Audi, 2019) and the "late adopters" identified by Berrada et al. (2020).
- Traditional dismissers do not consider self-driving vehicles safe at all; they are the most distrustful and would never try an autonomous vehicle. Berrada et al. (2020) identified a similar group called "conservatives", but the Audi research team (2019) did not describe such a rejecting segment.

Rahimi et al. (2020) focused on their respondents' modality style, segmenting and describing their sample based on this criterion.

Identifying these segments highlights the diverse consumer landscape and the necessity for targeted communication strategies in the field of autonomous vehicles. Providing appropriate information to the proper groups could help facilitate a smoother adoption process. For instance, increasing awareness, providing more information, and offering hands-on testing opportunities could convert sceptics and uncertain consumers into more accepting and engaged users.

Conclusions

The spread of self-driving technologies may be a defining trend of the 21st century and increasingly seems limited not by technical but by social constraints. So far, only a narrow circle of society is affected by self-driving technology, typically innovative-type consumers who are curious and have a positive attitude towards self-driving. If this technology becomes more widespread, groups not necessarily open to it will inevitably be confronted with self-driving vehicles and their effects. The primary goal of the research was to identify segments and attitudes towards self-driving vehicles that could later serve as a basis for developing educational and communication materials for technology diffusion. As the results are based on an online survey of an unrepresentative population, it is important to remember the limitations of this method. In particular, individuals' attitudes can change significantly during an actual test drive and, moreover, attitudes are often influenced by emotional factors that can be explored in only a limited way through a questionnaire. Additionally, a limitation of the study is that the data collection occurred relatively distant from the time of publication. However, this may be mitigated by the fact that there have been no significant changes in the deployment of autonomous vehicles in Hungary since the data collection, suggesting that attitudes may not have changed significantly. Nevertheless, the five identified segments may guide future marketing research and marketing communication activities.

The main managerial implication of the study is to draw the attention of decision-makers to the need to prepare for and support social dissemination of self-driving technologies, for which appropriate, targeted communication is very important. To achieve this goal, it is essential to identify the groups that should be approached in different ways to support them with different messages and channels so they may see the spread of self-driving technology as an opportunity and not a threat. According to the research results, this goal can be achieved by providing groups that are more open to self-driving (open-minded adventurers; uncertain optimists) with detailed insights into the possibilities offered by this technology while systematically building confidence in those who may be distracted. The study offers an excellent opportunity for further exploration by delving deeper into the defined theoretical segments. Practical creation of the five user types could be pursued, allowing for a more profound qualitative or quantitative investigation of each group's characteristics. This approach could lead to deeper insights into consumer attitudes towards accepting autonomous vehicle technology. This is undoubtedly a long process; the present research seeks to take the first steps as an early guide.

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