



BRAVE

BRidging gaps for the adoption of Automated VEHicles

No 723021

D2.2 Report on the findings of the expert online survey

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Deliverable nature:	Report (R)
Dissemination level: (Confidentiality)	Public (PU)
Contractual delivery date:	29/02/2020
Actual delivery date:	24/02/2021
Version:	V3.0
Total number of pages:	25
Keywords:	Automated driving, autonomous driving, acceptance, organised stakeholders, ethical aspects, legal aspects, social aspects, economic aspects, road safety

Disclaimer

This report is part of a project that has received funding by the European Union's Horizon 2020 research and innovation programme under grant agreement number 723021.

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Abstract

This deliverable summarizes the findings of expert interviews and the BRAVE stakeholder survey. The aim of these studies was to explore stakeholders' expectations, concerns and needs of a large-scale introduction of automated vehicles at SAE Level 3. Applying a mixed method approach, expert interviews were conducted to design the questionnaire of the online stakeholder survey.

The survey shows that stakeholders have strong expectations that vehicles with lower SAE-levels will remain in traffic for about 15 to 20 years and that automated vehicles will adhere to traffic rules. Stakeholders' greatest concern is the ability of the automated vehicle in automated mode to react quickly if needed. Expressed needs are mainly legal aspects, cyber security and the digital infrastructure. There is a tendency for differences in the assessments depending on the organisational affiliation of the stakeholders, but a larger sample is required to make inferential statistical analyses.

The literature presents different predictions of the time horizon for a widespread introduction. In the BRAVE stakeholder survey, it is expected that about 70% of all new passenger cars will have SAE Level 3 technology and 50% SAE Level 4 technology by 2050.

Executive summary

This deliverable summarizes the findings of expert interviews and the BRAVE stakeholder survey addressing stakeholders' expectations, concerns and needs for a large-scale introduction of automated vehicles at SAE Level 3. Issues related to acceptance, road safety, as well as ethical, legal, social (ELSI) and economic considerations in the scope of vehicle automation are discussed.

The online BRAVE stakeholder survey provides a differentiated insight into the politics of organised interests on European and Member State as well as organizational level regarding the needs and concerns towards automated vehicles. The survey among relevant stakeholders will reflect the requirements of automated vehicles from the institutional level.

In order to investigate the acceptance of the European organizations regarding automated vehicles referring to SAE Level 3 of vehicle automation, a stakeholder survey has been conducted within WP2 of BRAVE. Expert interviews were conducted to gain insights about stakeholder organisations' views on expectations, concerns and needs regarding a widespread introduction of automated vehicles at SAE Level 3. Statements made by experts were then used to design an online stakeholder survey, to broadly examine these views of stakeholders.

The BRAVE stakeholder survey shows a strong expectation among stakeholders that vehicles with lower SAE Levels will remain in traffic for 15 to 20 years and that automated vehicles will adhere to traffic rules. However, stakeholders are concerned about the ability of the automated vehicle in automated mode to react quickly in case of emergency. Also, stakeholders are concerned about mixed traffic – i.e. where automated vehicles with SAE Level 3 technology mix with manually driven vehicles – in the foreseeable future. Legal aspects are raised as needed by stakeholders and include international regulations, liability and insurance laws and issues of data protection. The findings of the work completed are concluded and discussed at the end of the report.

Document Information

IST Project Number	723021	Acronym	BRAVE
Full Title	BRidging gaps for the adoption of Automated VEHicles		
Project URL	www.brave-project.eu		
EU Project Officer	Georgios Sarros		

Deliverable	Number	D2.2	Title	Report on expert survey
Work Package	Number	WP2	Title	Multidisciplinary study and specification of the road users and stakeholders requirements

Date of Delivery	Contractual	29/02/2020	Actual	24/02/2021
Status	version 3.0		final X	
Nature	report X demonstrator <input type="checkbox"/> other <input type="checkbox"/>			
Dissemination level	public X restricted <input type="checkbox"/>			

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Version Log			
Issue Date	Rev. No.	Author	Change
08.04.2020	V1.0	Gabriella Eriksson (VTI)	First draft
09.04.2020	V1.1	Ingrid Skogsmo (VTI)	Review with comments and suggested modifications
09.04.2020	V2.0	Gabriella Eriksson (VTI)	Final draft
24.02.2021	V3.0	Bernhard Schrauth (IfeS), Walter Funk (IfeS)	Re-formulation according to broader data basis
25.02.2021	V3. <u>1</u>	Ingrid Skogsmo (VTI)	Final quality check

Responsible authors	
Name and Organisation	Chapter
Gabriella Eriksson (VTI)	All chapters

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Abbreviations

ACASA	Automobil Club Assistencia SA
AMZS	Avto-moto zveza Slovenije (Automobile and Motorcycle Association of Slovenia)
BRAVE	BRidging gaps for the adoption of Automated Vehicles
D	Deliverable
DAS	driver assistance system
DoA	description of action
EC	European Commission
ELSI	Ethical, legal and social implications
EU	European Union
cf.	confer
e.g.	exempli grata / for instance
et al.	et alii / and others
etc.	Et cetera / and so on
i.e.	id est / that is to say
IfeS	Institut für empirische Soziologie an der Friedrich-Alexander-Universität Erlangen-Nürnberg
N	number of participants
p /pp	page / pages
T	Task
VRU(s)	Vulnerable Road User(s)
VTI	The Swedish National Road and Transport Research Institute
WP	work package

1 Introduction

Technologies that enable a higher degree of automation are developing fast. Conditionally and highly automated cars (SAE levels 3 and 4) will be introduced on the market in a near future. To ensure that the launch of automated vehicles is successful, the acceptance of all road users and organised stakeholders needs to be assured. The BRAVE project employs a user centric approach where the technical aspects are in line with societal values, user acceptance, behavioural intentions, road safety, ethical, legal, social (ELSI) and economic considerations.

This report, Deliverable D2.2, summarises the findings of expert interviews and an online stakeholder survey, addressing ethical, legal, and social aspects as well as road safety and economic implications from the view of organised stakeholders. The online stakeholder survey will provide a differentiated insight into the politics of organised interests on an institutional level regarding the expectations, needs and concerns towards automated vehicles. Thereby, the survey reflects the requirements of automated vehicles from the perspective of organized stakeholders (cf. T2.3).

Chapter 2 is a summary of the research on the expert interviews. The online stakeholder study is then introduced in Chapter 3 and its findings are presented in chapter 4. The final chapter 5 draws a conclusion from this research study.

2 Expert interviews

2.1 Objective

The expert interviews were conducted to gain insights about stakeholder organisations' views on expectations, concerns and needs regarding a widespread introduction of automated vehicles at SAE Level 3. Statements made by experts were then used to design the questionnaire of the online stakeholder survey, to further examine how common these views are among stakeholders.

Interviews as a methodology are useful in exploring different themes and in this study, the expert interviews generated a set of expectations, concerns and needs. Although interviews are useful in providing information about expert views, we are not able to draw conclusions about experts' views in general with a small sample. Therefore, a survey was designed to enable analyses with larger samples. We used the expert interviews to design the stakeholder online survey and the statements by experts were used to develop the survey.

2.2 Composition and number of experts

In total, 15 expert interviews were conducted by the partner organizations VTI, IfeS, ACASA and AMZS and the organizations that participated in the study are shown in Table 1. The organizations included in the study represent governmental and non-governmental organizations, academia, insurance associations and different interest groups including Vulnerable Road Users.

Table 1: Participating stakeholder organizations

VTI	IfeS	ACASA	AMZS
1. SRA (Swedish Road Administration) [M]	1. German Federal Ministry of Transport [M]	1. Servei Català de Trànsit (Spanish authority) [M]	1. ACS-GIZ Automobile club [M]
2. NTF (Swedish NGO in road safety) [M]	2. German Police	2. IMPACT Connected Car (EU) [M]	2. AVP Slovenian Traffic Agency [M]
3. SMC (Swedish motorcycle association)	3. ADFC (Bicycle association)	3. CARNET (Spanish research organization) [M]	3. DARS Slovenian Highway authority
		4. Assurances du credit mutuel (Insurance company) [M]	4. Institute of Josef Stefan (Slovenia research organization)
		5. IFSTTAR (French research organization) [M]	

[M] = Member of mirror group.

2.3 Topics of the expert interviews

In the beginning of the interview, the interviewer explained the definition of automation at SAE Level 3 to ensure that the participants had the same understanding of the concept. Then, the experts were asked to describe their organisation's *expectations* and *concerns* of a large-scale introduction of automated vehicles at SAE Level 3. Furthermore, the experts were asked to describe what their organisation thinks is *needed* for a successful introduction of automated vehicles at SAE Level 3.

The interviewee was also asked to elaborate on social (different effect on different road user groups), psychological (subjective safety among different road user groups), road safety (objective safety among different road user groups), economic, legal, ethical aspects concerning expectations, concerns and needs.

Then, the interviewer would give the definition of automation at SAE Level 5 and repeat the same questions for automated vehicles at SAE Level 5

2.4 Brief summary of the results of the expert interviews

The experts were positive to a large-scale introduction of automated vehicles at SAE Level 3. However, some interviewees did not believe that a large-scale introduction of automated vehicles at SAE Level 5 will be possible. Instead, automated vehicles at SAE Level 5 will only be used in limited areas, such as warehouses¹. Experts expect that SAE Level 3 will lead to less accidents. Concerns that were raised by interviewees include phases where traffic with automated vehicles and non-automated vehicles mix, the human and car interaction, safety for vulnerable road users and cyber security. Interviewees also gave their view on what would be required for a large-scale introduction of automated vehicles such as infrastructure investments and the issue of who should pay for the investments. A concern that taxpayers will need to pay for new infrastructure was mentioned and that this would be unfair as the technology will exist in high-end cars and not be accessible to all. Technological advances related to the human and car interaction was also mentioned as a requirement.

¹ Author's note: by definition SAE Level 5 should be able to move without driver involvement under all conditions.

3 Online stakeholder survey: Study design

The online survey focused on the “official” positions of the organized stakeholders to cover the aggregate level of institutionalized stakeholder interests.

3.1 Objectives

The online stakeholder survey aims to provide a differentiated insight into the politics of organized interests on an institutional level regarding the expectations, needs and concerns towards automated vehicles. The survey among relevant stakeholders reflects the requirements of automated vehicles from the institutional level.

3.2 Recruitment and sample

For the purpose of this survey a wide variety of organized stakeholders, in mainly EU Member States, was identified by intensive desk research, activating BRAVE partners research networks, employing lobby registers, conferences and consortia members on the national and European level. The BRAVE partners and the members of the BRAVE Mirror Group were activated to scan their networks for potential stakeholders.

The online stakeholder survey focused primarily on the countries represented in BRAVE and it was accessible in four languages: English, French, Spanish and German. We targeted stakeholders in governmental and non-governmental organizations, industry/supplier companies, academic/research organizations and insurance associations.

3.3 Questionnaire and survey

From the expert interviews described in section 2, statements about the expectations, concerns and needs for a widespread introduction of automated vehicles at SAE Level 3 and 5 were derived. A large number of statements was generated in this manner and in an iterative process among researchers within WP2, the number of statements was significantly reduced. Respondents were asked to consider each statement from the viewpoint of their organisation and rate each expectation, concern and need on a scale ranging from 1 to 5.

A decision was made to focus on SAE Level 3 to keep the answer time up to 15 minutes.

After a first draft of the survey was completed, a pre-test was conducted among BRAVE partners and members of the Mirror Group to test for clarity and receive input from stakeholders on the content. Some amendments to the survey were made after the pre-test and were included in the final survey: The final questions are listed in the following:

- Background of the organization (Country, type and size of the organization)
- **Expectations** on large-scale introduction of automated vehicles at SAE Level 3:
 1. SAE Level 3 technology will be present in all high-end vehicles within the next 5 years
 2. Automated driving modes at SAE Level 3 will first be introduced in a large scale on the highway
 3. Automated vehicles with SAE Level 3 will adhere to traffic rules
 4. Insurance premiums will decrease because there are less accidents due to the SAE Level 3 technology
 5. Vehicles with lower SAE Levels than Level 3 will still be part of the traffic for about 15 to 20 years
 6. In case of an accident while driving in automated mode, the responsibility will fall on the driver because the driver is the one who must take the controls of the car at a time of risk
 7. In case of an accident while driving in automated mode, the responsibility will fall on the car industry because the industry is responsible for the technology at a time of risk

8. Automated vehicles with SAE Level 3 technology, when established, will lead to less congestion (traffic jams)

- **Concerns** with a large-scale introduction of automated vehicles at SAE Level 3:
 1. Drivers will lack knowledge about using Level 3 technology in the intended manner
 2. When you are driving without monitoring traffic it is difficult to react quickly in case of emergency
 3. Acceptance of automated vehicles SAE Level 3 technology will be low among cyclists and pedestrians, as additional obligations could be imposed on them, such as carrying transmitters for detection
 4. Road users cannot make eye contact to communicate with the driver in critical situations, for example at junctions, so they may be unsettled
 5. The proportion of accidents caused by technical errors in SAE Level 3 technology will increase
 6. For the foreseeable future there will be areas where automated vehicles SAE Level 3 technology and driver-controlled vehicles share the same traffic area
 7. Insurance premium will increase because automated vehicles SAE Level 3 technology become expensive due to the assistance systems
 8. The users overestimate the abilities of the assistance systems at SAE Level 3
 9. Congestion (traffic jams) will increase when automated vehicles SAE Level 3 technology begin to be introduced, particularly with mixed traffic
 10. There is an increased vulnerability to cybercrime with automated vehicles SAE Level 3 technology
 11. Taxpayers will need to pay for the infrastructure for the introduction of SAE Level 3 automation that is only used by owners of high-end/expensive cars

- **Needs** of a large-scale introduction of automated vehicles at SAE Level 3:
 1. Improvement of digital infrastructure is needed
 2. Improvement of physical infrastructure is needed
 3. The price of Level 3 technology needs to be at a level that allows them to be standard equipment in new vehicles
 4. International regulation needs to be created that states the requirements that automated vehicles SAE Level 3 technology need to fulfil to be authorized to drive in traffic
 5. SAE Level 3 technology need to be legally presented as Level 2 technology until accidents are almost eliminated in an automated driving mode
 6. The rights of other road users, such as cyclists and pedestrians, must not be restricted
 7. Error messages from the assistance systems must be reported to the driver without delay
 8. SAE Level 3 systems need to be included in driver education for new drivers or drivers who buy a new car with such systems
 9. Specific applications are necessary for specific road user groups, i.e. assistance systems must be adapted to these groups (e.g. everything must be clearly recognizable for seniors)
 10. The liability law and insurance law should be clearly formulated
 11. When driving a vehicle at Level 3, enormous amounts of data are generated, and it should be legally defined who should have access to data
 12. The data infrastructure should be highly secure to protect the driver from unauthorized access to the automated vehicle data

- Estimated percentage of new passenger cars with SAE Level 3 technology in 2025, 2030, 2040, 2050

- Estimated percentage of new passenger cars with SAE Level 4 technology in 2025, 2030, 2040, 2050

3.4 Data collection and data analysis

The survey was programmed with the online survey tool Netigate to enable respondents to answer the survey online. All project partners were involved in creating lists of stakeholder contacts for participation in the online stakeholder survey. These contacts were invited to the survey by email and after a week, they received a friendly reminder to participate. In addition, project partners and European stakeholders' organizations spread the survey link in social media (LinkedIn and Twitter). The online stakeholder survey was launched on February 20th, 2020 and closed two weeks later.

Given the sample size ($n = 78$, see section 4.1) and the method of recruitment the data cannot be generalized and should therefore be interpreted exploratively. Thus, inferential statistical methods of quantitative data analysis will not be applied.

4 Online stakeholder survey: Results

4.1 Composition and number of experts

A total of 108 respondents initiated the survey and chose their preferred language. In the next page of the questionnaire, respondents were given information about the study and a consent form. Only 78 stakeholders proceeded and gave their consent to participate and so the sample is reported as 78. The survey was voluntary and there was no payment for participation. Therefore, it was expected that not all respondents would proceed and finish the survey, which explains that only 78 out of the 108 stakeholders entering the survey gave their consent to participation and only 56 out of the 78 stakeholders proceeded to the very end of the survey. Table 2 shows the characteristics of the stakeholders who decided to participate in the study.

Table 2: The sample of the online stakeholder survey

Criteria	Number of stakeholders	Percent of stakeholders
Country of the organization	78	100.0
Austria	1	1.3
Belgium	1	1.3
Croatia	9	11.5
Finland	1	1.3
Germany	31	39.7
Greece	4	5.1
Italy	3	3.8
Lithuania	2	2.6
Portugal	1	1.3
Romania	1	1.3
Slovenia	10	12.8
Spain	3	3.8
Sweden	9	11.5
United Kingdom	2	2.6
Type of organization	76	100.0
Governmental agency	14	18.4
Non-governmental organization	13	17.1
Academia/Research	19	25.0
Industry/Supplier	24	31.6
Insurance association	1	1.3
Other	5	6.6
Size of the organization	74	100.0
1-100	30	40.5
101-500	15	20.3
501-1000	4	5.4
1001-5000	18	24.3
>5000	7	9.5

4.2 A large-scale introduction of automated vehicles SAE Level 3

4.2.1 Expectations

Respondents were asked to rate 8 statements concerning expectations of a large-scale introduction of automated vehicles at SAE Level 3. The responses were given on a scale from 1 to 5, where 1 is “Not expected at all” and 5 is “Strongly expected”. Figure 1 shows the percentage of responses in each category.

Results show that there is a strong expectation among stakeholder that vehicles with lower SAE Levels will remain in traffic for 15 to 20 years and that automated vehicles will adhere to traffic rules. There are also higher expectations that SAE Level 3 will first be introduced on the highway. The stakeholders do not anticipate that insurance premiums will decrease because there are less accidents due to the SAE Level 3 technology. Moreover, SAE Level 3 technology is not expected to lead to less congestion (traffic jams) when introduced on the streets.

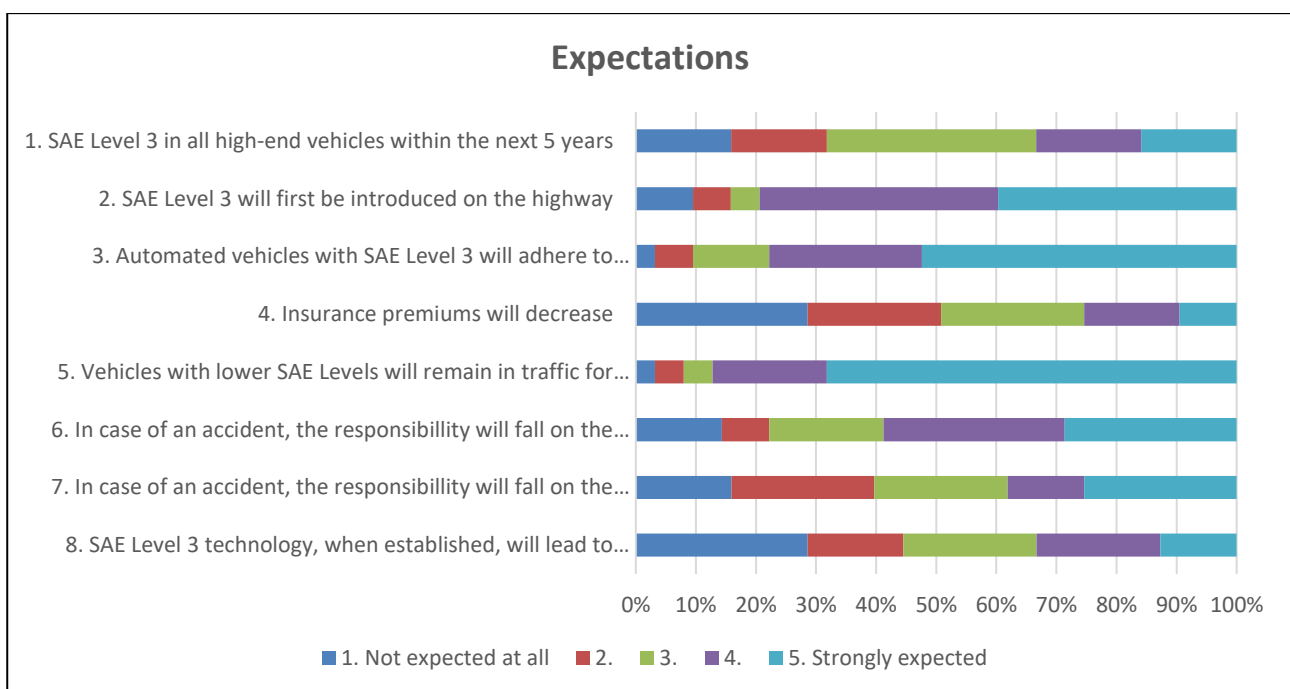


Figure 1: Average expectations rated by stakeholders

The average expectations differentiated by the type of organization is shown in Table 3. The number of stakeholders in each type of organization is small and inferential statistical analyses would require a larger sample (see section 3.4). Nevertheless, there are five items where the differentiation by the organization type reveals divergent assessments that are outlined exploratively. First, stakeholders from industry/supplier tend to anticipate more effects from the automated vehicles with SAE Level 3 on the reduction of congestions than other stakeholder types. The industry/supplier stakeholders in our sample also expressed a different opinion regarding the reduction of insurance premiums. On the contrary, stakeholders from academia/research do not expect that SAE Level 3 technology is installed in all high-end vehicles within the next five years. Furthermore, the stakeholders surveyed see the responsibility in case of an accident differently as shown by the statements six and seven in Table 3.

Table 3: Average expectations by type of stakeholder organization²

Expectations	Type of organisation				
	Government (n = 10)	Non- government (n = 11)	Academia/ Research (n = 16)	Industry/ Supplier (n = 20)	Other (n = 5)
1. SAE Level 3 technology in all high-end vehicles within the next 5 years	3.20 (1.48)	3.36 (0.67)	2.56 (1.26)	3.05 (1.36)	2.80 (1.48)
2.SAE Level 3 will first be introduced on the highway	3.90 (1.56)	3.82 (1.08)	3.94 (1.12)	4.00 (1.30)	3.80 (1.64)
3. Automated vehicles with SAE Level 3 will adhere to traffic rules	3.80 (1.14)	4.45 (0.93)	4.19 (0.91)	4.15 (1.27)	4.20 (1.30)
4. Insurance premiums will decrease	2.40 (1.51)	2.45 (0.82)	2.13 (1.15)	3.05 (1.50)	2.80 (1.30)
5. Vehicles with lower SAE Levels will remain in traffic for about 15 to 20 years	4.30 (1.65)	4.27 (1.19)	4.75 (0.78)	4.35 (1.14)	4.40 (0.89)
6. In case of an accident the responsibility will fall on the driver	4.00 (1.33)	4.27 (0.65)	3.00 (1.37)	3.10 (1.52)	3.80 (1.10)
7. In case of an accident the responsibility will fall on the car industry	3.30 (1.42)	2.45 (1.21)	3.25 (1.48)	3.45 (1.54)	2.40 (0.55)
8. SAE Level 3 technology, when established, will lead to less congestion	2.50 (1.51)	2.73 (1.42)	2.19 (1.05)	3.40 (1.43)	2.60 (1.52)

Note: Standard deviations in parentheses.

4.2.2 Concerns

Respondents were asked to rate eleven statements about concerns of a large-scale introduction of automated vehicles at SAE Level 3. The responses were given on a scale from 1 to 5, where 1 is “No concern at all” and 5 is “Extreme concern”. Figure 2 shows the percentage of responses in each category. Results indicate that stakeholders expressed their concerns about automated vehicles with SAE Level 3 and possible difficulties to react quickly in case of emergency when being in automated mode. Additionally, a major concern of the stakeholders in our survey is that in the foreseeable future automated vehicles with SAE Level 3 technology and driver controlled vehicles will share the same roads. Furthermore, another major concern refers to users potentially overestimating the abilities of the assistance systems at SAE Level 3.

The stakeholders surveyed are comparatively less concerned about increasing congestions due to mixed traffic of automated and manually driven vehicles. ~~In contrast to other assessments~~ Additionally, they also express less concerns about an increasing proportion of accidents caused by technical errors and increasing insurance premiums as vehicles with SAE Levels 3 are expected to be more expensive.

² Here and in the following tables, respondents from insurance companies are not shown separately due to the low number of cases.

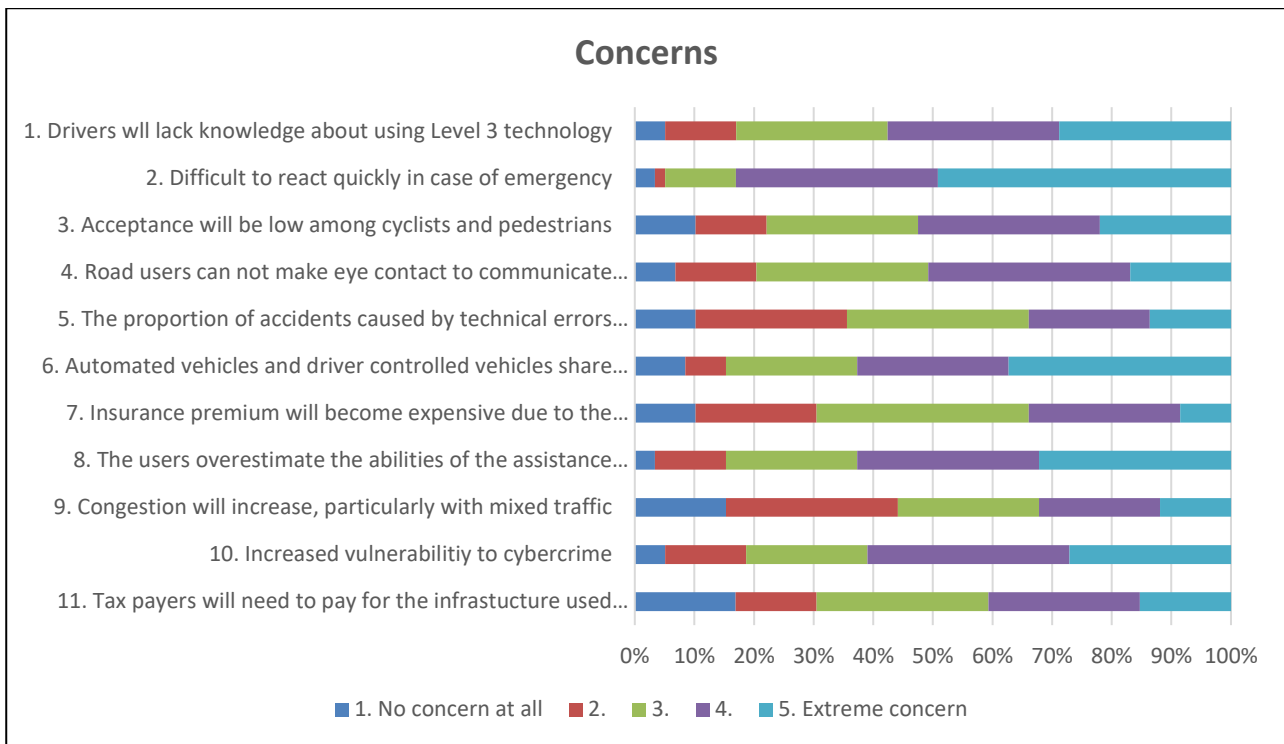


Figure 2: Average concerns rated by stakeholders

The average concerns differentiated by the type of organization is shown in Table 4. Concerns about the large-scale introduction of conditionally automated vehicles diverge more than the expectations between the stakeholders’ organization type. Often, stakeholders from academia/research assess concerns differently: Regarding e.g. the proportion of accidents caused by technology, the overestimation of the abilities of the assistance systems or the investments in infrastructure at the expense of taxpayers they express stronger concerns than other stakeholders.

Table 4: Average concerns by type of stakeholder organization

	Type of Organisation				
	Government (n = 10)	Non- government (n = 11)	Academia/ Research (n = 13)	Industry/ Supplier (n = 19)	Other (n = 5)
1. Drivers will lack knowledge about using Level 3 technology	4.00 (1.05)	3.55 (0.93)	3.77 (1.10)	3.37 (1.46)	4.20 (0.84)
2. Difficult to react quickly in case of emergency	4.30 (0.82)	4.36 (0.67)	4.08 (1.32)	4.26 (1.05)	4.20 (0.84)
3. Acceptance will be low among cyclists and pedestrians	3.40 (1.71)	3.91 (0.94)	3.46 (0.66)	3.16 (1.43)	3.40 (1.52)
4. Road users cannot make eye contact to communicate with the driver	3.60 (0.97)	3.82 (0.98)	3.00 (1.23)	3.58 (1.17)	2.60 (1.14)
5. The proportion of accidents caused by technical errors will increase	3.10 (0.88)	3.09 (1.45)	3.46 (1.20)	2.74 (1.24)	2.60 (1.14)
6. automated vehicles and driver controlled vehicles share the same traffic area	3.80 (1.23)	3.73 (1.42)	3.92 (1.04)	3.68 (1.38)	3.80 (1.64)
7. Insurance premium will become expensive due to the assistance systems	3.00 (1.25)	3.18 (0.75)	3.23 (1.01)	2.68 (1.20)	3.40 (1.52)
8. The users overestimate the abilities of the assistance systems	3.70 (1.25)	3.91 (0.94)	4.46 (0.66)	3.37 (1.34)	3.40 (0.89)
9. Congestion will increase particularly with mixed traffic	2.70 (1.25)	3.09 (1.14)	3.23 (1.17)	2.47 (1.35)	2.80 (1.48)
10. Increased vulnerability to cybercrime	3.40 (1.58)	3.73 (1.27)	4.00 (0.71)	3.63 (1.07)	3.40 (1.52)
11. Tax payers will need to pay for the infrastructure used by owners of high-end/expensive cars	3.00 (1.70)	3.55 (0.82)	3.62 (0.87)	2.63 (1.34)	2.80 (1.79)

Note: Standard deviations in parentheses.

4.2.3 Needs

Respondents were asked to rate twelve statements about what is needed for a large-scale introduction of automated vehicles at SAE Level 3. The responses were given on a scale from 1 “Not needed at all” to 5 “Strongly needed”. Figure 3 shows the percentage of responses for each statement. Regarding the results from our sample, the stakeholders surveyed consider error messages from the assistance systems being reported to the driver without delay as strongly necessary. Strong needs also include legal aspects, such as international regulation that must be enforced by the national states. Further legal aspects mentioned here are the formulation of a liability and an insurance law as well as issues on access to data generated when driving and data protection in general. As another major need it is stated from the stakeholders that the digital infrastructure needs to be protected from unauthorized access to the vehicles’ data.

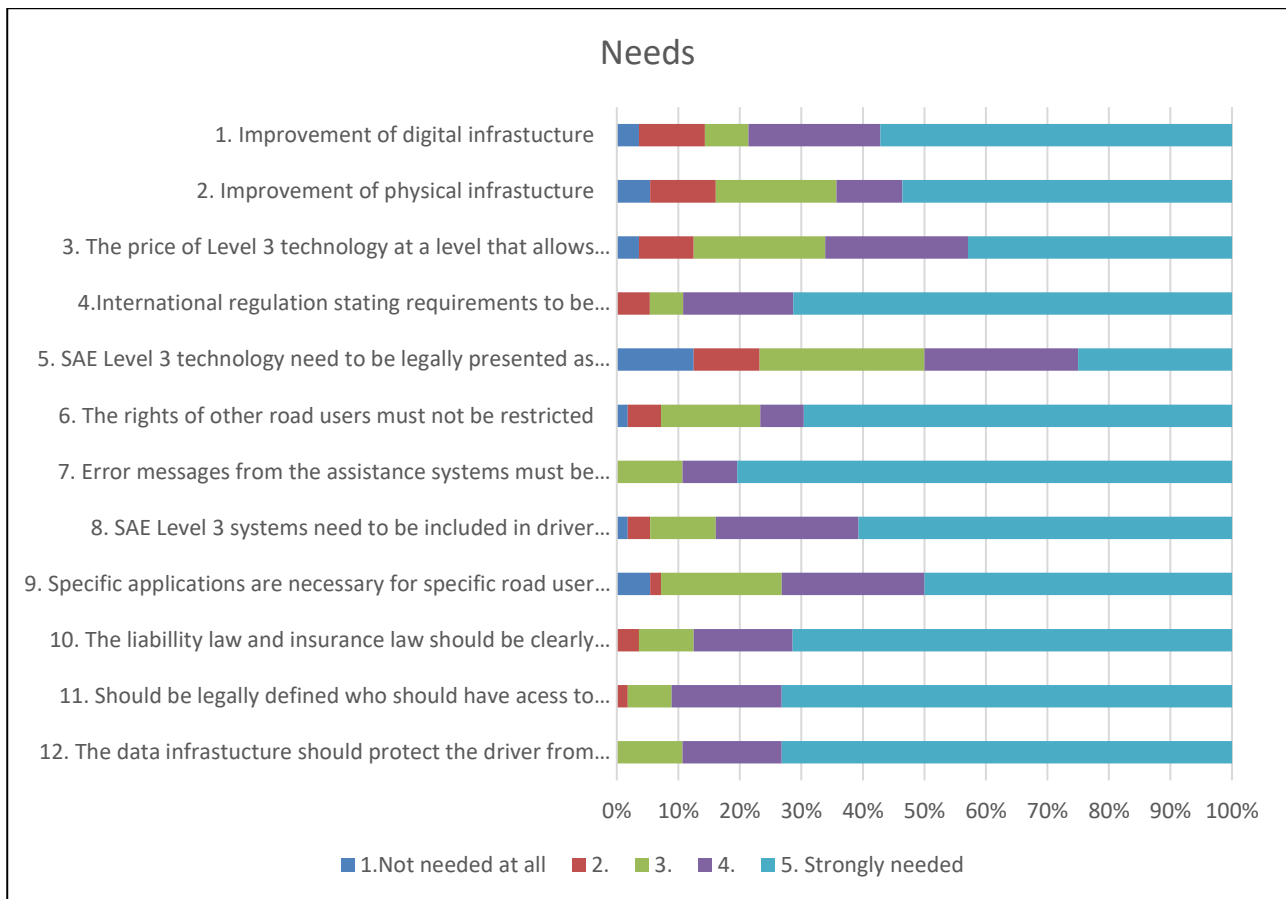


Figure 3: Average needs rated by stakeholders

The differentiation of the stakeholders’ needs by their organizational affiliation is shown in Table 5. Here, too, only exploratory reference is made to the differences; inferential statistical methods are not used. It is at first noticeable, that an improvement of legal regulations but also of the data protection is considered equally necessary by all stakeholders.

However, in three statements, stakeholders from the government fall short of the demands of the other organizations: in improving the digital infrastructure, in improving the physical infrastructure and in the necessity of specific applications addressing the needs of the distinct road user groups.

Table 5: Average needs by type of stakeholder organization

	Type of organisation				
	Government (n = 9)	Non- government (n = 11)	Academia/ Research (n = 12)	Industry/ Supplier (n = 19)	Other (n = 5)
1. Improvement of digital infrastructure is needed	3.56 (1.81)	4.64 (0.51)	4.17 (0.94)	4.26 (1.15)	4.00 (1.41)
2. Improvement of physical infrastructure is needed	3.22 (1.79)	4.18 (0.87)	4.00 (0.95)	4.05 (1.39)	4.40 (1.34)
3. The price of Level 3 technology needs to be at a level that allows them to be standard equipment in new vehicles	3.89 (1.45)	3.91 (1.04)	3.58 (1.87)	4.11 (1.04)	4.20 (0.84)
4. International regulation needs to be created that states the requirements that automated vehicles SAE Level 3 technology need to fulfil to be authorized to drive in traffic	4.44 (1.13)	4.91 (0.30)	4.17 (0.94)	4.63 (0.83)	4.60 (0.55)
5. SAE Level 3 technology needs to be legally presented as Level 2 technology until accidents are almost eliminated in an automated driving mode	3.78 (1.30)	4.09 (0.83)	3.08 (1.38)	3.16 (1.34)	2.80 (1.64)
6. The rights of other road users, such as cyclists and pedestrians, must not be restricted	4.78 (0.67)	4.64 (0.92)	4.33 (1.073)	4.16 (1.17)	4.00 (1.41)
7. Error messages from the assistance systems must be reported to the driver without delay	4.67 (0.71)	4.82 (0.60)	4.58 (0.67)	4.74 (0.65)	4.60 (0.89)
8. SAE Level 3 systems need to be included in driver education for new drivers or drivers who buy a new car with such systems	4.33 (1.00)	4.91 (0.30)	4.25 (1.06)	4.05 (1.08)	4.80 (0.45)
9. Specific applications are necessary for specific road user groups, i.e., assistance systems must be adapted to these groups (e.g., everything must be clearly recognizable for seniors)	3.67 (1.50)	4.36 (0.81)	4.33 (0.78)	3.95 (1.31)	4.40 (0.89)
10. The liability law and insurance law should be clearly formulated	4.22 (0.83)	4.91 (0.30)	4.42 (1.00)	4.58 (0.84)	4.60 (0.89)
11. When driving a vehicle at Level 3, enormous amounts of data are generated and it should be legally defined who should have access to data	4.11 (1.17)	4.64 (0.67)	4.83 (0.39)	4.68 (0.58)	4.80 (0.45)
12. The data infrastructure should be highly secure to protect the driver from unauthorized access to the automated vehicle data	4.44 (0.88)	4.73 (0.65)	4.75 (0.45)	4.58 (0.69)	4.60 (0.89)

Note. Standard deviations in parentheses.

4.3 Future market share SAE Level 3 and 4

In a final question, respondents of the stakeholder survey were asked to estimate the percentage of new passenger cars with SAE Level 3 and 4 technology for the years 2025, 2030, 2040, 2050. The responses were given on a scale from 0 to 100 percent and the respondents were asked to leave a marker at their estimated percentage. Figure 4 shows the estimated market share for the SAE Levels. According to the respondents, 24.6% of the new passenger cars will have SAE Level 3 technology in 2025 compared to 70.2% in 2050. About half of the new cars in 2050 will have SAE Level 4 technology.

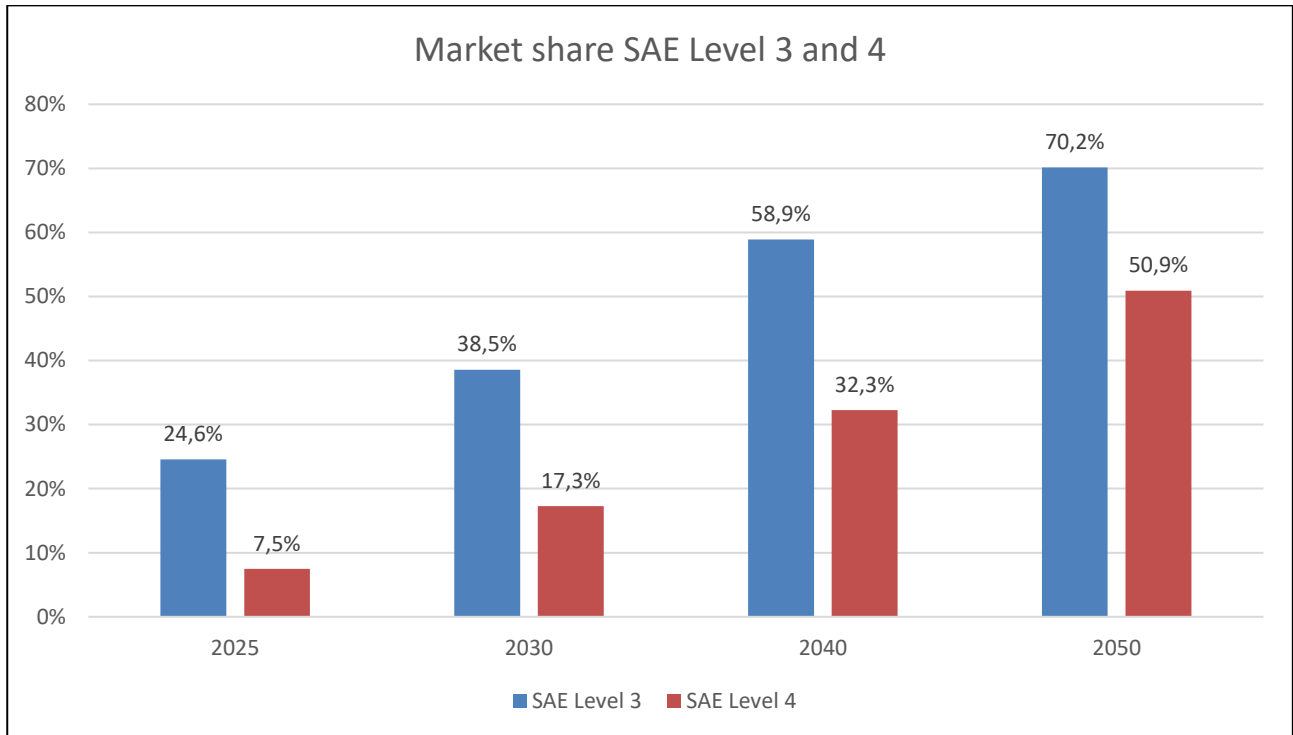


Figure 4: Estimated market share of new passenger cars with SAE Level 3 and 4

5 Conclusions

The online stakeholder survey shows a strong expectation among stakeholders that vehicles with lower SAE Levels will remain in traffic for 15 to 20 years and that automated vehicles will adhere to traffic rules. However, there are concerns that SAE Level 3 systems will have difficulties to react quickly in case of emergency in automated mode. Also, stakeholders were concerned about mixed traffic with automated vehicles with SAE Level 3 technology and manually driven vehicles sharing the roads in the foreseeable future. Legal aspects are raised as needed by the stakeholders in our survey which include e.g. international regulations, the formulation of liability and insurance laws, as well as a secure data infrastructure and the protection of data gathered while driving.

In a study by Neubauer and Schauer (2018), stakeholders reported that it is essential to tackle different expectations on automated transport among stakeholders. In BRAVE stakeholder survey, there is a diverging in stakeholders' views depending on their organizational affiliation. However, more data needs to be collected to be able to make meaningful analyses of the differences between types of stakeholders' organizations.

Stakeholders in the BRAVE survey are cautious in their predictions with 70% of new passenger cars with SAE Level 3 technology in 2050. In comparison, other studies have addressed the stakeholder views on technology readiness of automated vehicles. Penttinen et al. (2014) report that some stakeholders in the industry aim to launch fully automated vehicles by 2020 and predict that there will be 70 % fully automated vehicles by 2030. In contrast, in a study by Sun et al. (2017), a scenario is presented where it would take 30 years from the introduction to reach a 95 % penetration in traffic for automated vehicles.

Insights from the BRAVE stakeholder survey can be discussed and used to drive technological developments in other WPs of the project. There is a strong need that error messages from the assistance systems must be reported to the driver without delay. Another concern that needs to be addressed is the driver's ability to react in cases of emergencies and that users overestimate the abilities of the assistance systems at SAE Level 3. It is also important to consider cyclists and pedestrians and avoid designing systems that lead to additional obligations on vulnerable road users, such as carrying transmitters for detection.

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