Social Acceptance of CAD in Japan and Germany: Conceptual Issues and Empirical Insights

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Abstract It is widely acknowledged that social acceptance of automated vehicles (AVs) is a crucial factor for the future development and deployment of the technology in mobility systems. In general, mobility systems are sociotechnical systems. Their design and development depend on a multitude of technical and non-technical factors, including aspects of public or social acceptance. However, as will be shown in this chapter, social acceptance can have different meanings and can be addressed by various approaches. Different objects of acceptance (e.g. trust in robots, AVs as a useful means of transport etc.) as well as different subjects of acceptance (users, citizens, industrial interest groups etc.) can be distinguished. In addition, the subjects can be in different relationships to the objects (use, approval, protest etc.). Against this backdrop, we start this chapter with an in-depth conceptualization of social acceptance. Following this, we present empirical material that sheds lights on different dimensions of acceptance. We draw on two surveys carried out in Japan and Germany in recent years. The surveys provide insights on relevant public perceptions and attitudes towards AVs, and make it clear that not only public perceptions but also the views and attitudes of many other actors are relevant for acceptance and diffusion of

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C. Eisenmann et al. (eds.), *Acceptance and Diffusion of Connected and Automated Driving in Japan and Germany*, https://doi.org/10.1007/978-3-031-59876-0_5

AVs. To give an additional perspective on this topic, we provide insights on media reporting on AVs in Japan and Germany.

1 Conceptual Issues of Social Acceptance

If automated vehicles (AVs) are increasingly used in the next few years, then citizens will encounter them in different contexts, and whilst in different roles, for example as passengers of these vehicles, as non-users participating in road traffic (drivers, cyclists or pedestrians), as buyers, or as citizens with demands on the use of public space or different varying safety expectations. Acceptance issues can become relevant anywhere, since the mobility system is a sociotechnical system in which almost every citizen participates, and everyone is affected by changes to it.

Nevertheless, from the perspective of innovation and innovation policy research, the recurring recourse to the "social acceptance" of automated driving (AD) (or, as it called in some jurisdictions, connected and automated driving (CAD)) in public statements by business leaders or politicians, in consulting studies and policy papers is surprising. For example, in 2017 the German Federal Ministry of Transport argued in its report on the implementation status of the strategy for CAD that "*social dialogue and the creation of acceptance are central prerequisites for the successful introduction of automated and connected vehicles in public road transport*" [1]. This view is also supported in the Action Plan for Research on Automated and Connected Driving 2019: "*A systemic view of mobility reveals suitable starting points and indications of necessary framework conditions [for automated and connected driving]. It is clear that technical progress in the service of safety, sustainability and user-friendliness must not be at odds with affordability, availability and social acceptance*" [4]. In the same vein, Guy Pratt, CEO of the Toyota Research Institute, commented in 2017 that, "*Social acceptance is another challenge. Not everyone is ready to embrace AD/AI. However, we start to see a change in mindset*." [22]. The Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society (IT Strategic Headquarters) within the Japanese Cabinet also stated *"[W]hen introducing automated driving systems into society as a new technology, it is indispensable not only to develop institutions as mentioned above but also to secure social acceptance*" [12].

What usually remains open is what exactly is meant by acceptance, or specifically by social or societal acceptance, in terms of CAD. Various authors have pointed out the multi-layered nature of the term on closer examination [15]. This also applies to its use in the sociotechnical system of mobility [3, 8], and in the context of AD [8, 9]. In the German context, a definition of "social acceptance" is rarely provided, and the definition does not seem to have been actively discussed and pursued by academia or policymakers in Japan either. A Japanese dictionary, Digital Daijisen, provides a rather simple definition, "companies, facilities, new technologies, etc. to be accepted with the understanding and approval/endorsement by a local community

or the public." [26], which does not distinguish between acceptance and acceptability in either terminology or meaning.

The attention to CAD in research policy circles as well as in the media during recent years has initiated a whole series of acceptance studies, which refer to automated- or autonomous driving; despite the differences in technical implementation and potential use cases, these terms are also mostly used interchangeably in the academic literature on acceptance. The acceptance studies in turn have become the subject of numerous review publications (like Becker and Axhausen [2], Gkartzonikas and Gkritza [10], Nastjuk et al. [21]). These studies focus on different acceptance topics: Consumer acceptance, customer acceptance, end-user acceptance, public acceptance, and social acceptance are among the terms regularly used.

Our own qualitative analysis of public and academic discourses on AV/AD/CAD has shown that the term "social acceptance" is used in this context with at least three different meanings:

- as a prerequisite for the deployment or diffusion of AD technologies and services to achieve related policy goals such as fulfilling the "four societal promises" of AD (improve traffic safety, make traffic and the transportation system more efficient and reduce its environmental impact, enable (individualized) mobility even for those population groups that have been excluded from it up to now, and permit new forms of time use while moving around), or strengthening the national innovation system ("public policy perspective"),
- as a prerequisite for the successful introduction and diffusion of AD technologies and services to achieve business goals such as new products and services, profits, avoiding sunk costs, acquiring a social license to operate AV-based services, or meeting corporate social responsibility goals ("business perspective"); and
- as a metaphor for dealing with moral issues, value conflicts, and acceptability [11] in the context of AD ("ethical perspective").

Accordingly, the impressive corpus of the acceptance literature offers a variety of interesting insights in detail. At the same time, it also presents a number of areas for improvement:

- Many studies avoid presenting an explicit definition of the concept of acceptance they have used. For experts, this can often be derived from the content and goal of the work, or at least plausibly assumed, but this makes comparison between the results of different studies difficult. Especially in an interdisciplinary discussion context, this approach remains a challenge for many readers, and makes the discourse and its media interpretation susceptible to misunderstandings.
- In many acceptance studies, the objects of acceptance (see below) remain underconceptualized. Our qualitative empirical research on perceptions of and attitudes toward AD suggests that the argumentation structures of citizens may be focused on at least three different groups of acceptance objects: (a) the vehicle itself, including its safety aspects as well as its situational behaviour in traffic, (b) expectations of mobility services as part of daily life and the ascribed potential of AV to fulfil them, and (c) foundational ideas about a liveable environment and a "good

life", and the role that mobility, mobility services, and mobility technologies play in this. These three levels are closely intertwined, and their relative importance in shaping attitudes and intentions to use the technology is still unclear. For quantitative studies, however, it is of central importance to take these constellations into account when formulating questions and considering the quality and scope of the results.

- A large proportion of quantitative acceptance studies are based on convenience samples, and many were conducted in the context of vehicle demonstrations and field trials. Both of these conditions create empirical "blind spots". In many cases, convenience samples overrepresent academically educated, economically better-off, younger subjects who are known to be fundamentally more tech-savvy and less risk-averse than the general population. Surveys as part of field trials, on the other hand, target a subpopulation that has positioned itself as interested in technology simply by participating in the trials.

As stated above, there is as yet neither a definition of "social acceptance" of AD nor a general agreement on the similarities and differences between related concepts such as "public acceptance" or "user acceptance". We have therefore attempted to develop a proposal for the former. In doing so, we started from an initially rather simple idea: We use a structural approach first proposed by Doris Lucke in 1995 [15], and complement it with insights from innovation and transition research as well as from mobility studies for the case of AD.

Doris Lucke's extensive research found that most acceptance phenomena are based on a relationship (what exactly does 'accept' mean? Benefit, support, tolerate, ignore, etc.?) between acceptance subjects ('Who accepts?') and acceptance objects ('What should be accepted?'), embedded in a specific acceptance context. Behind this apparent simplicity lie more complex, interdependent structures. If one assumes, for example, that considerations and concepts of "social" acceptance are only meaningful if they go beyond the adoption perspective of the individual, then the results of diffusion research come into view [24]. From these, it is known that adoption decisions are regularly made by individuals within, and influenced by, their social networks. Therefore, it is important to better understand these actor networks and their influences on AD adoption and rejection. Qualitative empirical research has also shown that it is equally important to gain insights into the extent to which, and under what circumstances, citizens are willing to accept the use of AD by others in their immediate living environment, even if they themselves are not thinking of using it ("non-user acceptance"), and how the availability of AD could/would change their own social contexts of mobility and mobility technology decisions ("mode choice").

It is widely recognized in innovation research that the relationships and interactions between innovation actors are governed by shared habits, routines, or established practices rooted in both informal constraints (sanctions, taboos, customs, traditions, and codes of conduct) and formal rules (constitutions, laws, rights)—patterns which are summarized as institutions [25]. It has further been noted that transformative or disruptive innovations—almost by definition—require substantial redesign of existing institutional arrangements, or even the creation of new ones [17]. In the

mobility field, many of these arrangements are highly stable and habitualized, and some of them are emotionally charged [27]. Externally-imposed interventions in these arrangements are in many cases perceived as unwelcome disruptions and are therefore often rejected. Against this background, the ability of networks of innovation actors to modify existing institutions, or create new ones (largely) unchallenged should also be considered as an element of social acceptance.

A similar broadening of perspective arises when considering the range of acceptance objects in the context of AD. What should be accepted? Is it a specific, clearly-defined driving function, or an AV with a range of different driving functions? Is the discussion focused on handover/acceptance strategies for partially autonomous vehicles, or on concerns about fully automated vehicles interacting with humans on the road? Is a new flexible mobility service to be based on vehicles with AD capabilities? How is the set of rules designed which will determine the behaviour of AV (and any consequences) in the event of an impending collision? Altered everyday routines due to changed mobility services and tools, or even the idea of a fully transformed, sustainable mobility system, are among the many ways in which "automated driving" is depicted, represented, or sometimes just imagined in empirical studies or public and political debates.

Our qualitative research to date shows that citizens' expectations and attitudes are often not only oriented toward the technology itself. Rather, the associated performance expectations, consequences of use, service concepts, or local "mobility futures" are usually addressed. Especially in quantitative surveys, it must be assumed that such framings implicitly influence response behaviour, but these are usually not made explicit in (or cannot be captured by) the methodology.

The considerations and findings presented above allow us to propose a working definition for further research on the social acceptance of a technology and to apply it to the scientific and social discourse on AD:

> Social acceptance of a technology can be defined as a favourable or positive response (like attitude, stated preference or action) by a given actor group or actor network (e.g. nation state, region, local community, organization), relating to a proposed or emerging technology or an imaginary of a socio-technical regime or socio-technical system modified by this technology, and the reasonable expectation to find explicit or tacit approval of the related processes of its institutionalization within specific spatial-temporal boundaries [8].

To capture the full scope of what we consider to be elements of social acceptance, consideration of acceptance subjects should be extended to professional actors (such as decision-makers in public administration and companies), whose "acceptance" in their specific roles—due to their influence on technology and system designs and procurement decisions—is also likely to be of considerable importance for successful adoption/dissemination of AD [23]. Additional attention should be paid to the role of organizations (such as public service companies, research institutes, civil society organizations (CSO), or regulators) as actors in innovation networks. Which variants of AV technologies and services they "accept" (or reject) and why they do so, will influence the acceptance heuristics of other individual or professional innovation actors.

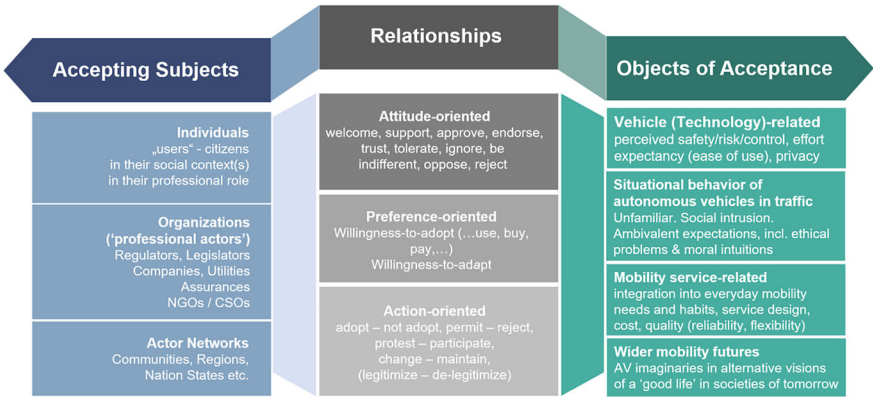

Fig. 1 Relationships between subjects and objects of acceptance in the context of automated driving

We have systematized and summarized the elements of social acceptance definition in Fig. 1. Individual research approaches cannot fully capture and illuminate the complex fabric that lies behind the concept of social acceptance. Empirical work must focus on a subset of both acceptance subjects and acceptance objects. However, the presentation should help to situate different research approaches and thus clarify which aspect or constellation of the structure of effects is being focused on.

To underline the relevance of a differentiated interpretation of social acceptance, we would like to briefly conclude this conceptual discussion with the results of a qualitative study from Japan. From May to September 2016, interviews were conducted (AT, KT, SN) with a total of 35 members of the general public, of varying ages and occupations, in Japan [29]. As the purpose of this study was to determine the current state of willingness of ordinary citizens, the questions did not specify the technical level of the AVs[1] (for levels of AD see the introduction). Many of the female (20/35) respondents (17/20) said that they would like to leave driving up to the self-driving vehicle because they did not feel confident about their driving. In addition, senior citizens, persons who did not have many opportunities to drive, and other individuals who seemed to lack confidence in their driving tended to be favourably disposed toward AVs. However, many respondents expressed unease or concerns, saying they thought AVs were "*not trustworthy*" and mentioning the problem of determining

[1] In order to describe the capabilities of automated driver assistance systems and autonomous vehicles, regulatory authorities and standardization organizations have introduced systems based on so-called 'levels". Most commonly used is the terminology proposed by SAE International in its standard SAE J3016. Although its 6-level systematics suggests that the higher the level, then the better, or more advanced the automated system is, this is not exactly the case. The levels only clarify the division of tasks between the human and the automated system during the operation of a vehicle. Within the context of AVs, especially the levels 3–5 are of importance. Quite simplified, level 3 vehicles still rely on human drivers taking over the driving task when the automation requests while level 4 vehicles are able to perform the entire driving task without human support within a predefined system of infrastructural and environmental conditions.

responsibility in the event of an accident. Some respondents had separate assessments for their own attitudes and needs, and the needs of society, such as, "*I like driving so I don't need AVs now, but they would be useful for senior citizens and people who cannot drive*." In order to organize these qualitative differences, multiple similar responses were plotted on a graph with support—oppose and like driving—dislike driving axes (Fig. 2) [30]. As Fig. 2 shows, most interviewees were in favour of AVs. However, some respondents did not like AVs very much personally, but were supportive of a society in which AVs had been achieved out of consideration for their convenience and utility to society. There were no opinions in the fourth quadrant of "*liking AVs but being opposed to them* (*for some reason*)".

In this way, even some interviewees who did not like AVs personally and did not have a need for them, "*can understand that some people such as senior citizens need them and think that they are useful to society*." This result illustrates one aspect of the diversity of the objects of acceptance and the relationships with the subjects of acceptance, and suggests that the social acceptance of AVs can be interpreted not only by intention to purchase ("*want to buy*"), or intention to use ("*want to use*"), but can be extended to "*willingness to support a society in which AVs have been achieved*".

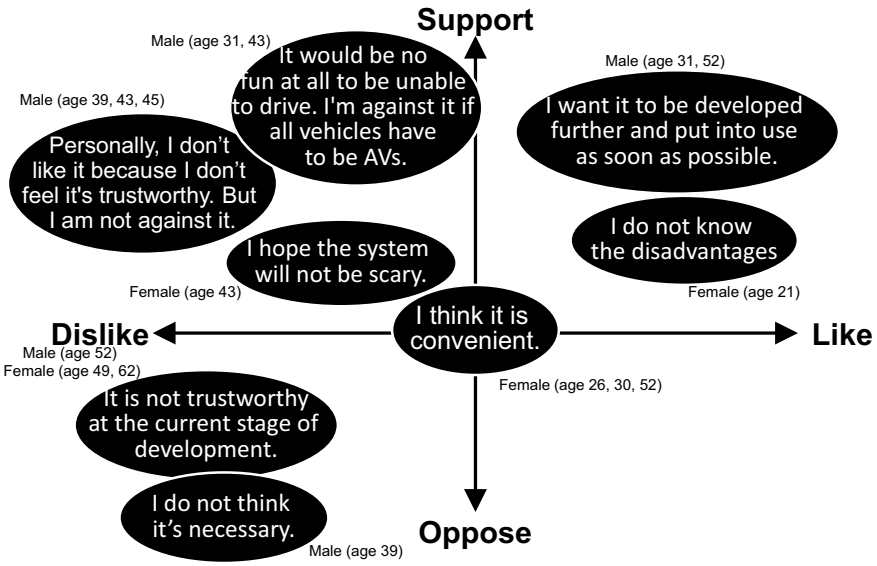

Fig. 2 Results of interviews (n = 35) in 2016 (organized on *like driving—dislike driving* and *support—oppose* axes)

2 Empirical Insights from Quantitative Surveys

In this section we present the results of two comparative surveys. The first was carried out in May 2020 with about 500 people each in Japan and Germany on questions related to the societal acceptance of AVs. Based on the results and experiences of this explorative study, the research team developed a questionnaire for a second, larger-scale survey that was carried out in November 2021.

2.1 Explorative Survey 2020: International Comparison of Willingness to Support AVs

How do members of the general public perceive topics and issues relating to AVs? This section presents examples from an analysis of the results of an online survey conducted among citizens in Japan and Germany. For this exploratory study, 1000 participants (250 each from four regions: Greater Tokyo and Aichi in Japan, and Berlin and North Rhine-Westphalia in Germany) were questioned on the relationship between Tones relating to AVs, and their willingness to support AVs [7, 20].

Figure 3 shows the willingness to support the implementation of AVs in society for Japan and Germany by the level of automation. For respondents in both Japan and Germany, the degree of approval dropped as the level of automation increased (cf. footnote in Sect. 1), but this trend was particularly significant in Germany. A previous survey conducted in Germany in 2018 had similar results. As noted elsewhere, for specialists, the higher the level of automation, the greater the perception of safety, but the reverse is true with regard to acceptance on the part of the general public. The general public in Japan are more positive toward AVs than in Germany to a statistically significant degree. This result was the same in previous surveys conducted in 2017 and 2018 [30, 31].

As Tones in the discussion related to AV, the 14 items shown in Table 1 were selected based on results of a preliminary analysis of how AVs have ever been discussed in articles in Japanese newspapers. Figure 4 shows the histogram, mean values and standard deviation for the results tabulated for Japan and Germany.

In general, as Fig. 4 shows, in Japan respondents tended to choose the "middle way" of choice 3, "*Neither Agree Nor Disagree*", while more respondents in Germany tended to select choice 1, "*Strongly Disagree*". Moreover, as in Fig. 3, in Japan respondents were more likely to be in agreement with all Tones than in Germany.

On closer examination, Tone 5 and Tone 13 are particularly distinctive to examine individual Tone assessments and the determining factors in those assessments. In Germany, 53% of respondents agreed with Tone 5, "*AVs should be introduced to reduce CO_2 emissions by making the entire transport system more efficient*". Conversely, the mean value for Tone 5 as assessed in Japan was not high. As a possible interpretation, we suggest that there may be a high(er) awareness of the environment in Germany, partly as a result of education from a very young age,

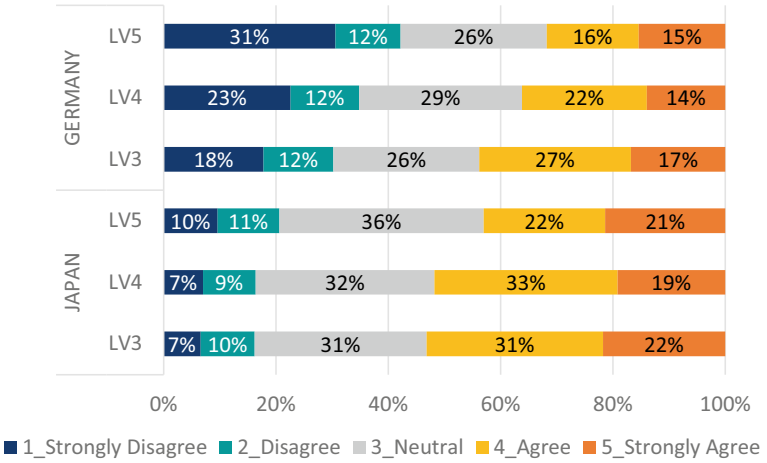

Fig. 3 Degree of support for AVs by the general public in Japan and Germany by level of vehicle automation

and "Stop Climate Change" may function as a "power word" that can get people to respond on an emotional level.

For Tone 13, "*In order to implement AV technology, the government of our country should relax road traffic safety regulations*", more than 40% of German respondents were strongly opposed, selecting choice 1, "*Strongly Disagree*". Conversely, although the mean value for degree of agreement on the part of respondents in Japan was the lowest of all of the 14 Tones, more than 40% of respondents selected choice 3, "*Neither Agree nor Disagree*". Despite the fact that the question text was worded to relax "safety-related" road traffic regulations, many respondents in Japan were hesitant to express their opinions explicitly. This may be because respondents feel that it is a complicated issue whether regulations should be relaxed in order to introduce AVs into society. However, the proportion of respondents in favour of relaxing (safety-related) regulations is much higher than in Germany. This would appear to be the result of a climate and atmosphere in Japan over the past few decades in which any relaxation of restrictions is good. In Japan, reforms such as postal reforms have been promoted based on neoliberal economic policies that advocated "small government", and deregulation is still very often used as a slogan or policy tool in relation to economic policies. As a result, the association that deregulation leads to economic growth may be widely-established and accepted by the public. In Japan, the term "deregulation" might be a "power word" that conjures up a positive impression. In response to other Tones, compared to respondents in Germany, responses in Japan suggest that the perception that "*AVs are needed to stimulate the economy and strengthen international competitiveness*" may have a major impact on support for AVs. Moreover, in every country and city where the survey has been conducted, people with higher confidence in AV technology tended to show greater support for

Table 1 Item list for questions about 14 Tones in discussions relating to AVs

Question:	The following is a discussion regarding the implementation of an Autonomous Vehicle System (AVs) in society. Do you agree with each Tone? (Select from among five responses)
Tone 1	For the purpose of reducing the number of traffic accidents between road vehicles, the safety of cars should be improved through automated driving systems
Tone 2	For the purpose of reducing the number of traffic accidents in which pedestrians are the victims, the safety of cars should be improved through automated driving systems
Tone 3	AVs should be introduced to alleviate traffic congestion
Tone 4	AVs should be introduced to support the elderly going out
Tone 5	AVs should be introduced to reduce CO_2 emissions by making the entire transport system more efficient
Tone 6	AVs should be introduced to support the vulnerable in depopulated areas
Tone 7	AVs should be introduced for effective use of travel time
Tone 8	AVs should be introduced to reduce the cost of transport services such as buses, taxis and trucks
Tone 9	AVs should be introduced to solve the shortage of drivers of transport services such as buses, taxis and trucks
Tone 10	Progress should be made in the social implementation of AV technology to revitalize the domestic economy
Tone 11	Progress should be made in the social implementation of AV technology so that the domestic automobile industry does not lose to international competition
Tone 12	The government of our country should invest to support the social implementation of AV technology
Tone 13	In order to implement AV technology, the government of our country should relax road traffic safety regulations
Tone 14	In order to implement AV technology, the government of our country should conduct AV trials on public roads as soon as possible

AVs. This suggests that confidence in AV "technology" will be extremely important for fostering social acceptance of AVs and that, conversely, if confidence in AV technology is shaken, support for AVs is likely to drop [20].

2.2 Large-Scale Quantitative Survey 2021

In order to better understand expectations and attitudes among the general public towards CAD and related changes in mobility patterns and the regulatory environment, as well as to review and expand the results of the explorative survey presented in Sect. 2.1, we designed a more in-depth quantitative survey for Germany and Japan. The questionnaire used here included the following topic areas: general questions about everyday mobility patterns of the respondents, their own experiences with AVs, individual expectations of the longer-term effects of the use of autonomous road

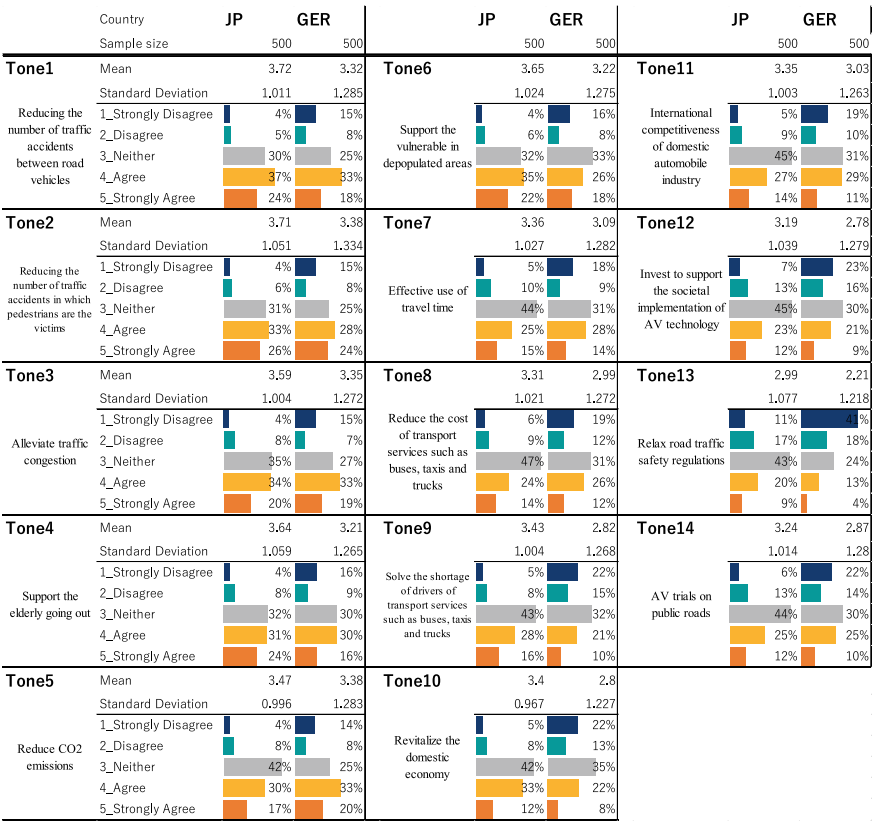

Fig. 4 Attitudes towards societal and/or policy goals linked to AVs in public debates in Japan and Germany

vehicles, perceptions of different AD use cases, expectations regarding future framework conditions and regulations in connection with the increased use/deployment of autonomous road vehicles, and the perceived potential of autonomous road vehicles to fulfill individual mobility needs. The items were collectively developed by a Japanese-German research team and presented to the respondents in their respective languages.

Because the general population was to be surveyed within the framework of this study, we expected that a substantial number of those questioned were not familiar with the concept of AD. Therefore, the questionnaire opened with a short text explaining it:

> Worldwide, work is underway to develop autonomous vehicles for road traffic. These vehicles are controlled by a computer. They should be able to travel at least as safely and flexibly as today's vehicles. Because they do not need a human driver, they no longer have a steering wheel or pedals. We are particularly interested in how such vehicles could change our

everyday lives in the future. Your answers are therefore very valuable to us—even if you feel you don't know much about them so far

Fieldwork in both countries was conducted in November 2021. Because of methodological challenges and limited resources, we had to apply different data collection methods. In Germany, a total of 2,001 interviews among the German-speaking population aged 16 and over were conducted, of which 1,001 were telephone (CATI) interviews in a dual-frame approach, with 50% mobile phone interviews and 1,000 online (CAWI). This mixed-mode methodology and the large sample size, among other things, reduces some empirical effects of the different usage patterns of telecommunication technologies across different demographic subpopulations while maintaining sufficiently large sample sizes in contingency tables, especially those that use dominant mode choice as a variable. Disproportionalities arising in the course of the sample design or survey implementation were compensated for by complex, iterative weighting of the net sample based on the latest data from the German Federal Statistical Office (as of December 31, 2019) and taking the characteristics of household size, age, gender, highest school-leaving qualification and federal state into account. With respect to these characteristics, the sample can be considered representative.

In Japan, a total of 1,058 CAWI interviews were used for this analysis. The sample was composed using stratified random sampling by proportional allocation relative to three socio-demographic variables: gender (two groups), age (seven groups), and place of residence (eight groups), based on their respective demographic composition ratio. This limits the full comparability of the Japanese data with the German study, but in our view is still sufficiently informative to provide some deeper insights.

A complete presentation of the results of the survey is not possible within the space available here. We therefore limit ourselves to an initial analysis of the topic areas, 'Individual expectations on the longer-term effects of the use of autonomous road vehicles' (Question Set 4), 'Perceptions of different AD use cases' (Question Set 5), and 'Attitudes towards future framework conditions and regulations in connection with the increased use / deployment of autonomous road vehicles' (Question Set 6). This is mainly because we think these will provide helpful insights into public expectations regarding the design of future AVs and the mobility services that use them, and hence will be of particular interest in the context of social acceptance.

2.2.1 Longer-Term Effects of AV Deployment

In order to evaluate individual expectations of the longer-term effects of the widespread use of autonomous road vehicles and to capture how respondents assess the importance of the "four promises" of CAD, survey participants were asked: "*Please imagine that in the future there would be autonomous road vehicles that would be able to participate in public road traffic just as independently as vehicles with human drivers do today. What would you expect from such a development in the longer term?*", on an 11 point Likert scale with 0 (= "*I would not expect that in any*

case") and 10 (= "*I would definitely expect that*") as verbal labels for the endpoints. Thirteen items were offered (Table 2). The core statistical measures for all items are shown in Table 3.

The range of both the statistical average (between 4.78 and 6.58 for Germany and 5.03 and 6.29 for Japan) and the median values (between 5 and 7) suggest that, in general, the expectations of longer-term impacts in both countries are rather muted. Among the presented items, none was seen as outstandingly likely or extremely polarizing. Values for standard deviation and the Box2-values indicate that the answers in the German sample tended to be partially more definitive, while the answers in the Japanese sample have a stronger tendency towards the middle of the scale.

Table 2 Item list for Question Set 4: individual expectations of the longer-term effects of the use of autonomous road vehicles

No.	Short	Full item wording
4.1	Reduced number of accidents	The number of traffic accidents will decrease
4.2	Reduced severity of accidents	The severity of traffic accidents (the number of people killed and seriously injured in them) will decrease
4.3	Smoother road traffic	Road traffic will run more smoothly overall, and there will be fewer traffic jams
4.4	Fewer parked cars	There will be fewer parked cars than today
4.5	Children will travel independently	Children will travel more distances independently, i.e., without being accompanied by their parents or other adults
4.6	Elderly people will travel independently	Elderly people and people with limited mobility will make more trips independently
4.7	Improved public transport services	Public transport services will improve, especially in less densely-populated areas (such as on the outskirts of cities, in small towns and in rural areas)
4.8	Mobility services cheaper overall	Mobility services will become cheaper for customers overall
4.9	More traffic on the roads	There will be more traffic on the roads
4.10	Economic competitiveness will be strengthened	The competitiveness of the German (for survey in Germany)/ Japanese (for survey in Japan) economy will be strengthened as a result
4.11	Climate gas emissions will be reduced	Climate gas emissions from transport will be reduced
4.12	Time in traffic used productively	I will use the time I spend on the road for productive purposes (such as working, doing homework, or attending meetings)
4.13	Mobility services cheaper for me	Mobility services will become cheaper for me overall

Table 3 Core statistical measures for Question Set 4: expectations regarding longer-term effects of AV deployment among the German (left column) and Japanese (right column) populations

Item	Germany					Japan				
	Averages			Top2-Box		Averages			Top2-Box	
	ArMean	*StdDev*	*Med*	*Top* (%)	*Bottom* (%)	*ArMean*	*StdDev*	*Med*	*Top* (%)	*Bottom* (%)
4.1	5,95	3,14	6	23	12	5,71	2,60	6	14	7
4.2	5,99	3,09	6	23	11	5,73	2,64	6	14	8
4.3	6,33	3,10	7	28	11	5,52	2,49	6	11	7
4.4	6,11	3,19	7	25	12	5,49	2,54	6	11	7
4.5	4,86	3,02	5	12	16	5,03	2,55	5	8	10
4.6	6,58	3,03	7	30	9	6,29	2,47	7	20	4
4.7	6,16	3,06	7	24	10	6,17	2,40	6	16	5
4.8	5,10	3,12	5	15	16	5,69	2,49	6	12	7
4.9	4,78	2,93	5	11	13	5,24	2,32	5	8	6
4.10	5,50	3,00	5	16	12	5,52	2,37	6	9	6
4.11	6,10	3,21	7	26	12	5,64	2,60	6	14	8
4.12	5,54	3,35	6	22	17	5,22	2,63	5	10	10
4.13	4,88	3,18	5	14	19	5,48	2,49	5	10	8

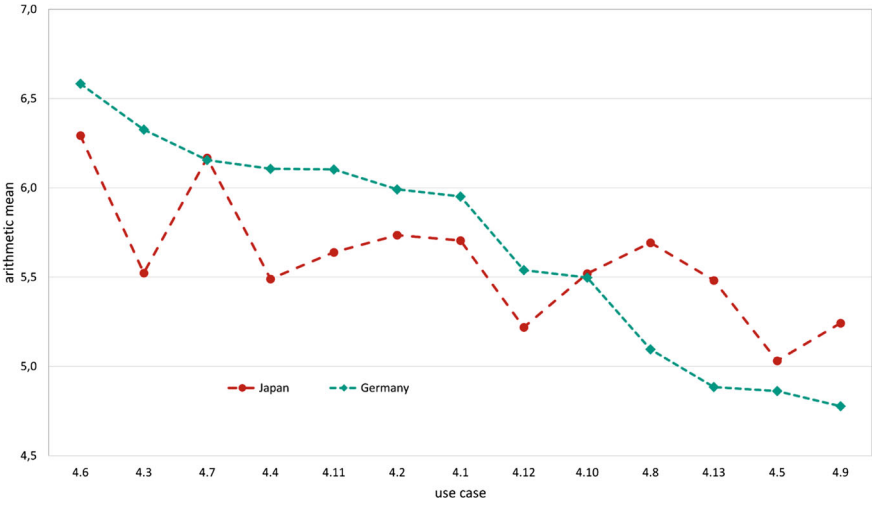

Fig. 5 Mean values for Question Set 4 for Germany and Japan, presented in descending order of German items

This tendency can also be seen in Fig. 5, where the x-axis represents the approval ratings of items within the German sample in descending order. In addition, respondents in Japan are more optimistic about cost reductions for mobility services stimulated by the introduction of AVs, while respondents in Germany are more optimistic about the implications for stationary and flowing traffic.

As shown in Fig. 6, about one third[2] of the respondents in Germany and one quarter in Japan were quite sure that the introduction of AVs will bring improvements with regard to traffic safety, measured both as number (Q4.1) and severity (Q4.2) of traffic accidents. About 15% in Germany and 12% in Japan remained rather skeptical.

Asked about potential mobility improvements for groups who are not able to drive themselves, almost half of the German and one third of the Japanese respondents expected that AVs will enable elderly people and people with limited mobility to make more trips independently (Q4.6). They were rather unsure and divided with respect to the independent use of AV by unaccompanied children (Q4.5).

The picture remains rather undecided in both countries, and even shows an element of polarization in Germany, with regard to two service implications of AV deployment: the opportunity to use time in traffic for productive purposes (Q4.12), and the reduction of mobility cost (Q4.8).

With respect to improvements of transportation efficiency, about 45% of German respondents expected that the introduction of AVs will contribute to a reduction of the number of traffic jams and a smoother traffic flow (Q4.3). This is in line with the result that a little less than 40% of respondents in Germany expected that the introduction of AVs will lead to a reduction of climate gas emissions from transport

[2] When referring to distribution data, we report on the Top-3- (8–10) or Bottom-3- (0–2) Boxes.

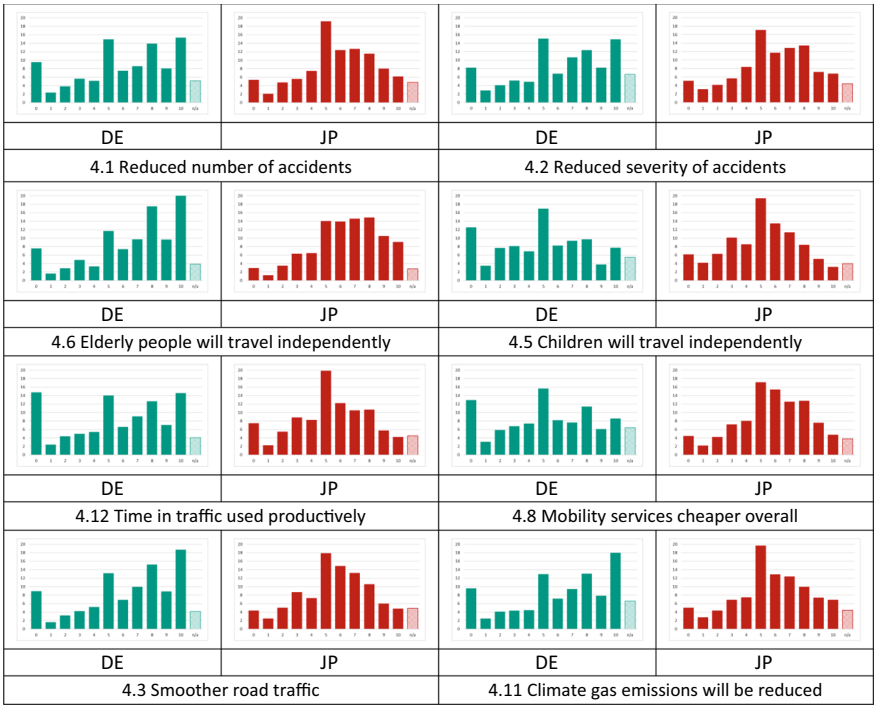

Fig. 6 Selection of histograms of the responses to items in Question Set 4: expectations regarding longer-term effects of AV deployment

(Q4.11). In Japan, respondents were a little more hesitant here: ca. 20% shared these expectations.

The dataset shows some variations with respect to sociodemographic factors. As a tendency (but not a rule), the expectations are slightly higher among younger respondents, people with a higher level of completed education, and men. The averages for the male subpopulation differ by 0.5 or more (when compared to the female subpopulation) for Q4.1 to 4.5 (men higher) within the German dataset, while the differences are smaller than 0.3 for all other items. The differences are somewhat smaller within the Japanese dataset, but follow similar trends with few exceptions (Fig. 7). So, e.g., the differences between men's and women's expectations regarding economic effects (Q4.10) and productive time use (Q4.12) were much larger in Japan than in Germany. There are only one (Germany) or two items where expectations are higher among women than among men: climate gas emissions from transport will be reduced (Q4.11—both countries), and public transport services will improve, especially in less densely-populated areas (Q4.7—Japan only).

Correlation analysis for the German dataset showed that the Pearson correlation coefficient (PCC) for any pair of 12 of the 13 items was 0.4 or higher (significant

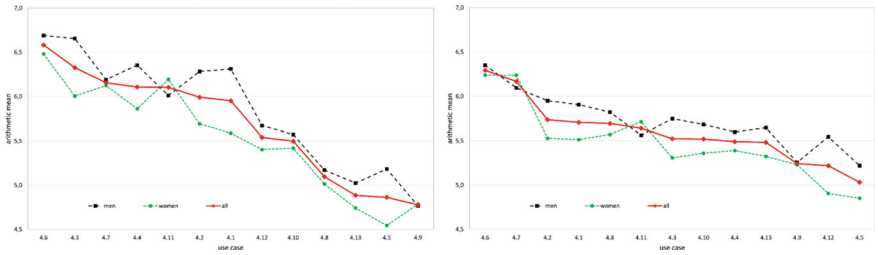

Fig. 7 Mean values for Question Set 4, presented in descending order and differentiated by gender, for Germany (left) and Japan (right)

at the 0.01 level (2-tailed)), generally indicating a moderate to strong positive relationship between two variables. The only exception is Q4.9 ("*There will be more traffic on the roads*"), which does not appear to correlate with any of the other 12 items. This observation is also confirmed by an Exploratory Factor Analysis (EFA) where the same 12 items load on one factor. This suggests that most of the current expectations regarding longer-term effects of AD might be shaped by a single latent factor. Correlation analysis with the Japanese data set provides a basically similar picture. Here, the Pearson coefficient showed significant (at the 0.01 level (2-tailed)) correlation for all 13 items. Its values were, like in the German case, 0.4 or higher. Q4.9 again proved to be the exception. Other than in the German case where there was no correlation, it is correlated to the other 12 items but the PCCs were in the range of 0.3 and hence somewhat smaller than among the other items.

2.2.2 Framework Conditions and Regulatory Adaptation

It is well-known both from the innovation research literature as well as from policy practice that the large-scale deployment of new, presumably transformative technologies requires adaptations of the regulatory framework. In highly-regulated fields (like road transportation) this is usually the case before the introduction of a new technology. Non-acceptance of a technology might be rooted in skepticism about changes in the framework conditions and the perceived impact on one's own lifestyle, rather than in the characteristics of the technology itself.

In an attempt to capture some of these effects and to gain further insights into the expectations regarding future framework conditions and regulations in connection with the increased use/deployment of AV, participants were asked: "*To make such a development toward autonomous driving possible, some framework conditions of today's traffic might have to be changed. Assuming that would include the following changes: Would you be more likely to welcome or more likely to oppose them*?". Analogous to Question Set 4, an 11 point Likert scale was offered, in this case with 0 (= "*I would definitely reject this*") and 10 (= "*I would definitely welcome this*") as verbal labels for the endpoints. The following thirteen items were presented (Table 4); the core statistical measures for all items are shown in Table 5.

Table 4 Item list for Question Set 6: attitudes towards future framework conditions and regulations in connection with the increased use/deployment of autonomous road vehicles

No.	Short	Full item wording
6.1	Financial support to purchase AVs	The government should provide financial support for private individuals to purchase autonomous vehicles
6.2	Type approval framework should be relaxed	The existing regulatory framework for the type approval of motor vehicles should be relaxed to make it easier to offer new mobility services with autonomous vehicles
6.3	Liability with manufacturers	If autonomous vehicles are involved in an accident, their manufacturers should assume liability for damages
6.4	Liability with owners	If autonomous vehicles are involved in an accident, their owners should assume liability for damages
6.5	DPR should be relaxed	Data protection regulations (DPR) should be relaxed
6.6	Users can intervene in AD	Users should also be able to intervene in autonomous driving if accidents are imminent
6.7	AVs only in segregated lanes	Autonomous vehicles should only be allowed to drive in their own lanes, which must be structurally separated from other road traffic
6.8	AVs immediately identifiable	It should be easy for every road user to recognize at all times whether a vehicle is driving autonomously
6.9	AVs may violate traffic rules	Autonomous vehicles should be allowed to violate traffic rules if this could prevent accidents
6.10	AVs tested on public roads	Autonomous vehicles should be allowed to be tested in transparent field trials on public roads
6.11	Citizens involved in field trials	Citizens should be involved in planning and conducting field trials of autonomous vehicles
6.12	Generous testing opportunities for private sector	Private mobility providers should be given generous opportunities to test new services with autonomous vehicles
6.13	AVs should adapt to VRU	Autonomous vehicles should drive carefully when they perceive children or elderly people (vulnerable road users, VRU) in their vicinity

Compared to Question Set 4, the responses were much more diverse and, in some cases, very definitive. This is indicated by the fact that statistical averages range from 3.96 to 8.44 for Germany and between 4.87 and 7.43 for Japan. Median values lie between 4 and 10 for Germany and 5 and 8 for Japan. Q6.3 and Q6.4 were removed from further analyses since we found that the way the questions were presented in the survey does not meaningfully capture the actual regulatory situation. As was the case for Q4, values for standard deviation and the Box2-values signal that the answers in the German sample tended to be partially more definitive, while the answers in the Japanese sample have a stronger tendency towards the middle of the scale.

This tendency can also be seen in Fig. 8, where the x-axis represents the approval ratings of items within the German sample in descending order. As a tendency, regulatory measures that would improve (perceived or actual) safety (6.13, 6.6., 6.8)

Table 5 Core statistical measures for Question Set 6: attitudes toward changes in framework conditions and regulatory adaptations among the German (left column) and Japanese (right column) populations

Item	Germany					Japan				
	Averages			Top2-Box		Averages			Top2-Box	
	ArMean	*StdDev*	*Med*	*Top* (%)	*Bottom* (%)	*ArMean*	*StdDev*	*Med*	*Top* (%)	*Bottom* (%)
6.1	5,70	3,50	6	26	17	5,95	2,44	6	14	5
6.2	5,20	3,15	5	15	16	5,72	2,42	6	12	6
6.3	7,33	2,85	8	41	5	6,52	2,34	6	21	3
6.4	5,55	3,62	5	27	19	6,06	2,52	6	16	6
6.5	3,96	3,39	4	11	32	4,87	2,60	5	8	11
6.6	7,88	2,80	9	54	5	7,03	2,39	7	30	3
6.7	5,65	3,41	6	25	16	6,24	2,43	6	19	4
6.8	8,01	2,73	9	57	5	6,85	2,31	7	27	3
6.9	5,96	3,35	7	25	15	6,03	2,39	6	14	5
6.10	6,74	3,04	7	34	9	6,85	2,31	7	25	3
6.11	7,29	2,77	8	39	6	6,51	2,24	7	19	3
6.12	6,27	2,91	7	22	10	6,30	2,24	6	16	3
6.13	8,44	2,40	10	63	3	7,43	2,33	8	38	2

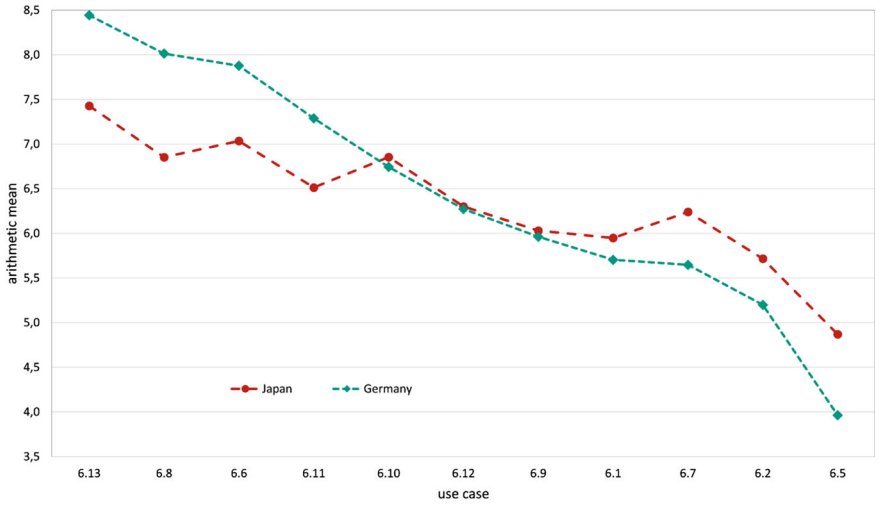

Fig. 8 Mean values for Question Set 6 for Germany and Japan, presented in descending order of German items

are most welcome in both countries, and even stronger in Germany than in Japan, while measures that aim at the relaxation of regulatory frameworks (like 6.5 or 6.2) are those that were most opposed.

The most unambiguous results are related to the situational behavior of AVs in road traffic. A majority of the survey participants (75% in Germany, 53% in Japan) would support that AVs should drive carefully when they perceive children or elderly people in their vicinity (Q6.13) and that they should be easily identifiable as driving autonomously at all times and for every road user (Q6.8). While meeting the first expectation would create substantial challenges for technology developers and traffic management, the second could be met rather easily by making respective indicators a part of the design criteria and the type approval process of AV.

About two thirds of the German respondents and 45% of the Japanese participants would welcome the ability to intervene in AD if accidents were imminent from their perspective (Q6.6). Allowing AVs to violate traffic rules if this could prevent accidents (Q6.9) was seen to be much more controversial, but with a slightly supportive tendency.

As shown in Fig. 9, roughly half of all German respondents agreed that testing strategies for AVs should support transparent field trials on public roads (Q6.10), and even more would welcome citizens' involvement in planning and conducting these field trials (Q6.11). In Japan, the picture was reversed. The overall agreement with field testing was even higher than in Germany, but the support for citizens' participation was remarkably lower. We hypothesize that this might be rooted in different political traditions in the two countries (for further discussion, see chapter "Governance, Policy and Regulation in the Field of Automated Driving: A Focus on Japan and Germany").

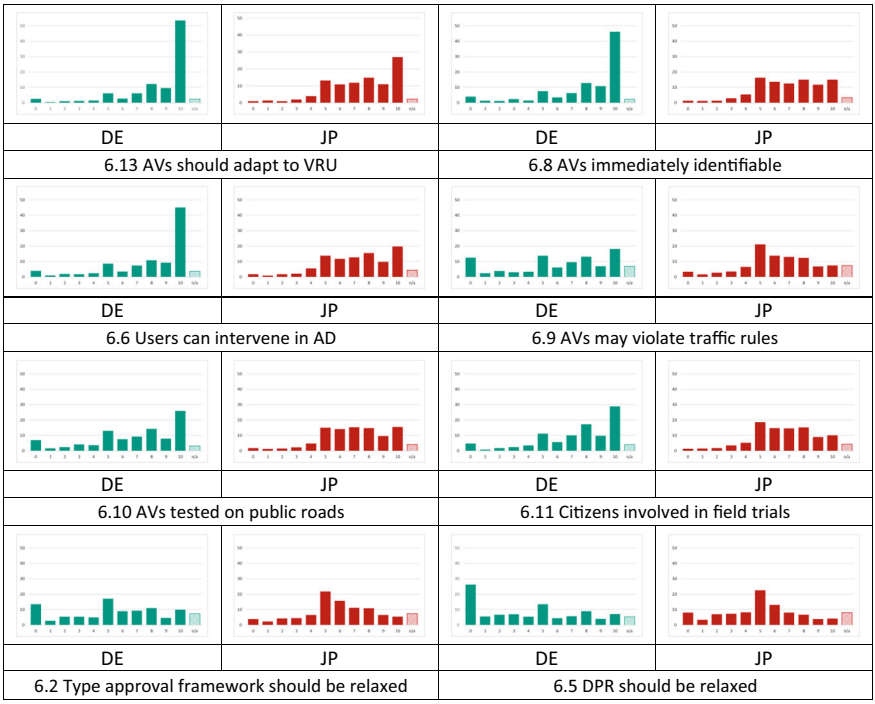

Fig. 9 Selection of histograms of the responses to items in Question Set 6: attitudes toward changes in framework conditions and regulatory adaptations

Finally yet importantly, two views on the overall regulatory framework should be mentioned: Respondents were rather undecided whether type approval regulations should be relaxed (Q6.2) in order to allow for a faster diffusion of AVs. This might be due to that fact that most participants possibly do not know that these regulations exist, and which role they play for traffic and product safety. Asked about data protection rules (Q6.5), respondents were much clearer. For both countries, this was the only item within Question Set 6 where the mean fell below the center of the answer scale. For German respondents the reaction was much stronger than in Japan, and even somewhat polarized: A little less than 40% were rather opposed to relaxations of these rules, while 20% supported easing them. In Japan, responses showed a stronger tendency towards the scale center, with 15% being in favor of relaxing data protection rules and 18% opposing it.

When comparing the answer sets between male and female respondents in both countries (Fig. 10), the differences overall are rather small, but women appear to be more supportive of measures improving (perceived or actual) safety, and more opposed to the relaxation of regulations than men. In both countries, the largest difference between male and female respondents occurs for Q6.7 ("*Autonomous vehicles should only be allowed to drive in their own lanes, which must be structurally separated from other road traffic*").

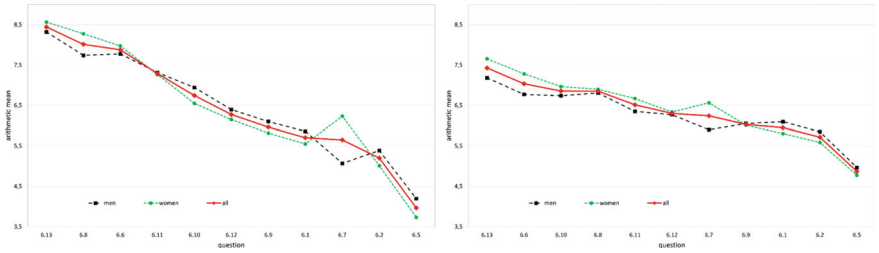

Fig. 10 Mean values for Question Set 6, presented in descending order and differentiated by gender, for Germany (left) and Japan (right)

Correlation analysis and EFA for Germany suggest that the answers might be shaped by at least two latent factors. One could be described as a 'pro-innovation/ deregulation stance' and was especially supported by men and younger respondents. The other factor, linked to items 6.6, 6.8, 6.11 and 6.13, could be understood as a 'risk reduction / risk aversion attitude' and found stronger support especially among women and older respondents. The latter differences can be identified when comparing the two country datasets. Both follow similar general trends, although the German respondents appear to be more opinionated and hence the overall differences between the items are slightly higher than in the Japanese sample. At the same time, deregulation-related items find more support among men than among women in both countries, while safety-related items find more support among women than among men. In both countries, item Q6.13 ("*Autonomous vehicles should drive carefully when they perceive children or elderly people in their vicinity*") gained strongest support among all items, while the relaxation of data protection rules (Q6.5) found least support overall. The graphs also confirm the relatively higher support for public participation in field trials with AV (Q6.11) in Germany. Beyond this, support for public testing was higher among women than among men in Japan, while in Germany support was higher among men.

2.2.3 Use Cases

A third Question Set was dedicated to the presumed wellbeing of respondents in the course of using different mobility options enabled by CAD technologies: "*Imagine that in the future there would be autonomous road vehicles that would be able to participate in public traffic just as independently as vehicles with human drivers do today. In which constellation would you feel comfortable driving such a vehicle*?". In analogy to the other two Question Sets discussed here, an 11 point Likert scale was offered, in this case with 0 (= "*I would not feel at all comfortable*") and 10 (= "*I would definitely feel comfortable*") as the verbal labels for the endpoints. Seven different use cases were offered, varying by occupancy, type of mobility service and traffic environment (Table 6). These seven cases cover the new mobility services commonly discussed today for urban transport (robotaxi, automated mini-shuttle for

ridesharing, own vehicle) and add further variations and options. The core statistical measures for all items are shown in Table 7.

The first thing to notice is that both the mean and the median are close to the center of the distribution and the differences are rather small overall, i.e., there was no pronounced preference for or aversion to individual use cases in the population as a whole. This is also made clear by the graphical representation of the distributions, of which only a selection can be presented here for reasons of space.

At the same time, as shown in Fig. 11, it can be seen that in certain cases even small changes in the imagined system design lead to measurable changes in wellbeing, such as the introduction of a teleoperator in a robotaxi (5.3 and 5.4), or the change from public bus to streetcar (5.6 and 5.7). The follow-up hypothesis is therefore that wellbeing in new mobility services (and thus their acceptance) is not determined solely by the automation concept and the degree of automation (level), but that other design and service factors must also be taken into account.

Further insights are provided by differentiating the response behavior according to sociodemographic characteristics, such as gender and age. Regardless of the use case, and in both countries, women state that they would feel comfortable in automated means of transportation significantly less frequently than men (Fig. 12).

A substantially more complex outcome emerges from a comparison between age groups. For German respondents, the picture is rather clear-cut: independent of the use case, subjective wellbeing while using automated transport is significantly lower among the older population than among younger people (Fig. 13). In Japan, the differences among age groups are remarkably smaller than in Germany. Regardless of the use case, among the youngest respondents (16–29) subjective wellbeing is

Table 6 Item list for Question Set 5: attitudes towards future framework conditions and regulations in connection with the increased use/deployment of autonomous road vehicles

No.	Short	Full item wording
5.1	Private AV on highway	Alone in my private autonomous vehicle on a highway driving at the speed of the advisory speed limit
5.2	Private AV in city traffic	Alone in my private autonomous vehicle in city traffic
5.3	Robotaxi in city traffic	Alone in a hired autonomous vehicle in city traffic
5.4	Monitored robotaxi in city traffic	Alone in a hired autonomous vehicle in city traffic, where the journey is constantly monitored by a tele-operator
5.5	Mini-Shuttle ridesharing	Together with two to five other passengers in an autonomous mini-bus in city traffic
5.6	Autonomous city bus	In a half-full autonomous bus the size of today's city buses in urban traffic
5.7	Autonomous streetcar	In a half-full autonomous streetcar in urban traffic

Table 7 Core statistical measures for Question Set 5: Subjective wellbeing when using different AV-based mobility services among the German (left column) and Japanese (right column) population

Item	Germany					Japan				
	Averages			Top2-Box		Averages			Top2-Box	
	ArMean	*StdDev*	*Med*	*Top* (%)	*Bottom* (%)	*ArMean*	*StdDev*	*Med*	*Top* (%)	*Bottom* (%)
5.1	4,76	3,51	5	17	26	4,96	2,71	5	8	14
5.2	5,26	3,47	5	22	21	5,13	2,67	5	9	12
5.3	4,86	3,36	5	16	23	4,89	2,63	5	7	13
5.4	5,07	3,27	5	16	20	5,03	2,63	5	9	13
5.5	5,10	3,14	5	14	18	5,22	2,54	5	9	10
5.6	5,34	3,14	6	16	16	5,20	2,52	5	8	10
5.7	5,66	3,19	6	20	15	5,47	2,58	6	11	9

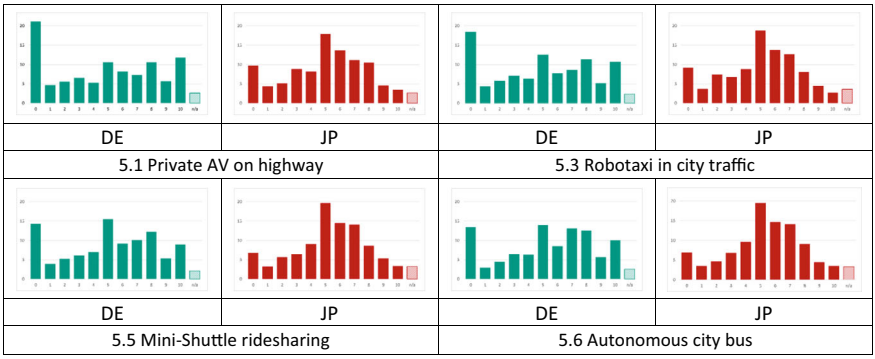

Fig. 11 Selection of histograms of the responses to items in Question Set 5: subjective wellbeing for hypothetical cases of different future AV-based mobility services

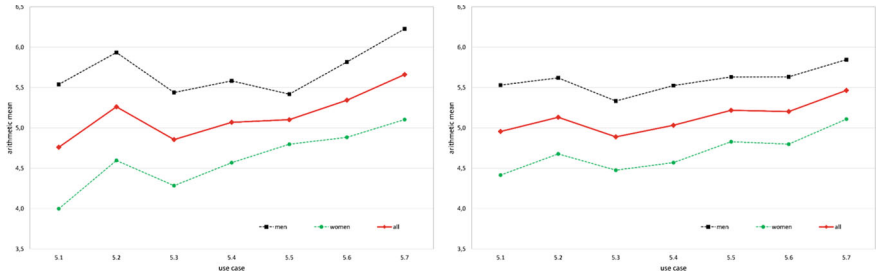

Fig. 12 Mean values for subjective wellbeing for different use cases, differentiated by gender, for Germany (left) and Japan (right)

higher than in the average population, while it is lower among the age group 45–59. For older respondents (60 and above), subjective wellbeing while using collective automated mobility service options (5.5–5.7) is higher than in the average population, while it is lower for individual mobility service options.

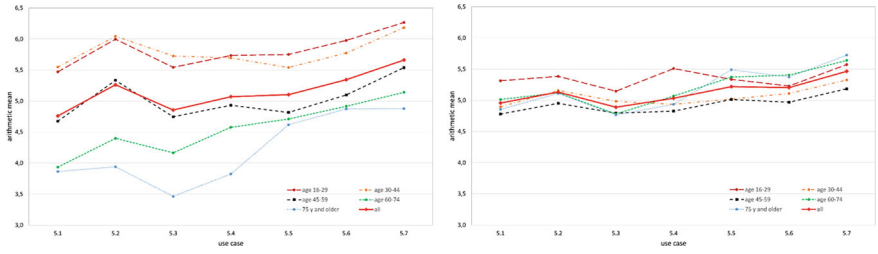

Fig. 13 Mean values for subjective wellbeing for different use cases, differentiated by age group, for respondents in Germany (left) and Japan (right)

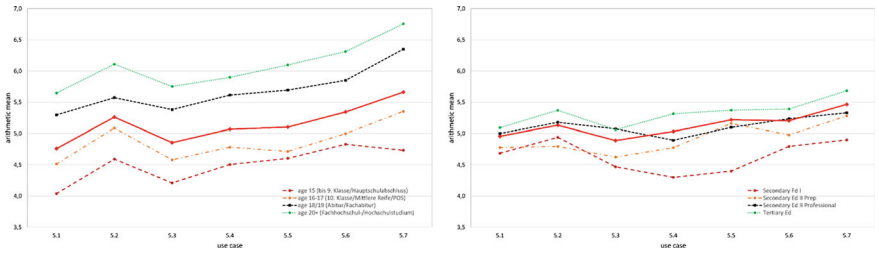

Fig. 14 Mean values for subjective wellbeing for different use cases, differentiated by level of education, for Germany (left) and Japan (right)

Subjective wellbeing for different use cases of AVs appears to increase with increasing levels of formal education, in both countries (Fig. 14). The most important difference is that German respondents with completed academic (tertiary) education judged their subjective wellbeing considerably higher than their peers in Japan.

3 Perceptions of Field Trials on Public Roads—Indicators for a NIMBY-Like Effect?

Field trials on public roads are indispensable to bring forward the integration of AVs into mobility systems. Such tests have been conducted for several years in both Japan and Germany in many different contexts. For many citizens, AVs are becoming more concrete and tangible only through such field trials. In this section, we report on how such tests are perceived by citizens, and how they can influence the perception of AVs.

3.1 The "NIMBY" Issue in Field Trials

Do you support the implementation of self-driving buses in society, and do you support the conducting of field trials to that end? If you are supportive, will you allow a test to be conducted on the road in front of your home? Even people who say they are in favour of AVs and want these systems to be further promoted may not want tests to be conducted on the road in front of their own homes. This problem is referred to by the phrase Not In My Back Yard, abbreviated to NIMBY. The phrase is said to have been coined by Walter Rogers of the American Nuclear Society in the 1980s to describe people who wanted to receive the benefits of nuclear power generation while at the same time being opposed to the building of nuclear power plants in their area [5]. Does the NIMBY problem exist with regard to AV field trials? Based on this research question, in May 2020 an online survey was conducted with

1,000 members of the general public,500 in Japan and 500 in Germany. The results were as follows [28].

Figure 15 shows a graph with measurements of the NIMBY level in Japan and Germany with regard to, (a) willingness to support the implementation of AVs in society, and (b) willingness to support a field trial being conducted in front of the respondent's own home. If, for example, the respondent expressed support for the implementation of AVs in society and assigned a score of 4 or 5, and yet was opposed to an AV test being conducted in front of their own home, assigning a score of 2 or 1, this would be considered to be an example of a NIMBY attitude and would be coloured orange. Conversely, if the respondent was opposed to the implementation of AVs in society but would support a field trial being conducted in front of their own home, that would be considered to be an example of a YIMBY (Yes In My Back Yard) attitude and would be coloured green. There is room to debate how to interpret the term YIMBY. It may mean permitting the introduction of AVs into a limited area such as in front of one's home, but being against introduction throughout the whole of society. Or respondents may have the following attitudes: They do not support the implementation of AV for now, because they do not yet like, trust, or know the current plan and technology. But by doing the field trial in front of their house, they can learn more about AV, and maybe even have a chance to get involved in transport planning in the way that they want. It could also be interpreted as the following attitudes: They do not support the implementation of AV for now, because they do not like, trust, or know the current plan and technology yet. But by doing the field trial in front of their house, they can know more about AV, and maybe even have a chance to get involved in transport planning in the way that they want.

Moreover, the views shown in the section running diagonally from upper left to lower right were considered by the researchers to be consistent either in favour of or opposed to both implementation in society and testing in front of one's home. The

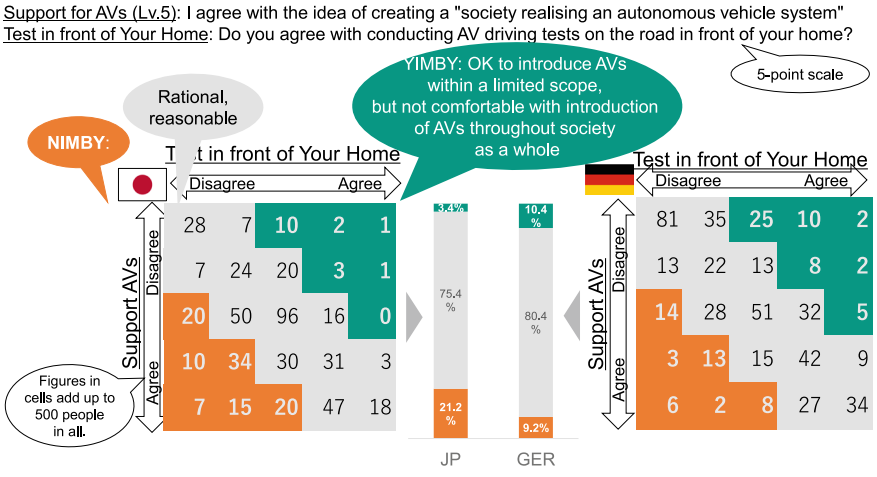

Fig. 15 Comparison of NIMBY factor for AV field trials in Japan and Germany

vertical bar graphs in the centre compare the percentages of NIMBY, YIMBY and 'consistent' responses in Japan and Germany. These graphs show that the proportion of NIMBY attitudes in Japan is at least double the proportion in Germany. While many German respondents gave consistent responses, in Japan, with its high proportion of NIMBY responses, care is needed, as it is possible that the number of people in opposition will increase when concrete plans for field trials on public roads are established.

Next, the same analysis was conducted, but the measure was changed so that instead of willingness to support the field trial held in front of one's home, one's own child would be placed unaccompanied onboard a Level 5 AV (when it becomes available). Figure 16 shows the results. Compared to Fig. 15, the proportion of NIMBY responses increased approximately 1.6 times for Japanese respondents and 2.5 times for German respondents. In addition, the proportion of YIMBY responses from both Japan and Germany dropped to the 1% level. These results may show that only when respondents were asked about their own children did they begin to think about AVs as something that affected them personally. In other words, it is necessary to recall that the responses to the questionnaire survey about willingness to support AVs, intention to use and intention to purchase are only stated preferences (SP) in a hypothetical situation. These may be different from the action taken in the event that AVs are actually implemented, and while we currently have to depend on SP to measure social acceptance, there are limits to its utility.

In the study by Tanaka et al. [28] to determine the characteristics of people who tended to provide NIMBY responses, the difference between a Level 5 response in Fig. 16 for willingness to support AVs and the degree of acceptance of the respondent's own child being placed unaccompanied on board the test vehicle as a passenger was used as the NIMBY factor (dependent variable), and the impact on the NIMBY value of sex, age, presence of children 12 or younger, vehicle ownership, travel behaviour, trust, perception of risks with regard to AD (fear, unknowability) and other factors were analysed (multiple linear regression analysis). The authors

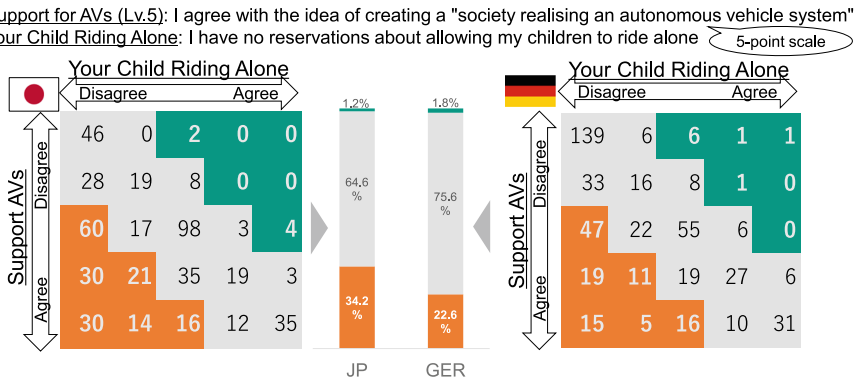

Fig. 16 Comparison of NIMBY factor for a scenario assuming one's own child riding unaccompanied as a passenger on AVs in Japan and Germany

(Tanaka et al. [28]) have previously reported that respondents with a high NIMBY factor have insufficient knowledge of AVs (high degree of unknowability with regard to risk perception) and think that AVs are frightening (high degree of fear with regard to risk perception). Acquainting people with the mechanism and limitations of AVs will be important to decrease the tendency for people to take a NIMBY approach and possibly impede the implementation of field trials.

3.2 Is Social Acceptance of AVs Different After Field Trials? A Study from Japan

In the following we report a study that was carried out only in Japan, where in 2017, field trials of AVs on public roads began. AT assisted in the opinion survey of social acceptance conducted with onboard monitors, and local residents who participated in "Field trials of Automated Driving Service in Hilly and Mountainous Areas Based at Michi-no-Eki etc." conducted by the Ministry of Land, Infrastructure, Transport and Tourism [13, 14]. Of the region-designated type and open-bid type field trial regions, Fig. 16 shows the tabulated results for 1,346 persons in nine regions for whom data could be obtained before and after the test. The four indicators (5 point Likert scale, 1 = negative, 5 = positive) that were measured were:

(1) Willingness to support AVs (whether the person was in favour of introducing public transport using self-driving vehicles to the region).
(2) Intention to use AVs (whether the person wanted to use public transport using AVs in the future).
(3) Trust in AV technology (does the person think the automated driving technology is trustworthy?).
(4) Trust in AV administration (does the person trust the administration or company building the social mechanisms relating to automated driving?).

Figure 17 shows there was a positive change in all four indicators after the test compared to before the test for the onboard monitors participating in the field trials. In contrast, for the local residents who did not participate in the field trial, only the indicator for trust in AV technology changed to positive. Compared to those who did not participate in the field trials, even before their participation the monitors were clearly more positive about the introduction of AVs into the local public transportation network, and already had a higher intention to use them in the future (cf. Sect. 1). The field trials can be said to have influenced test participants to be more supportive of a society in which public transport using AVs has been achieved.

In addition, Fig. 18 shows the results of path analysis of the relationship of these four psychological indicators [14]. As these results show, not only trust in AV technology but trust in the administration or company building the social mechanisms for AVs has an impact on the intention to use AVs; and the intention to use AVs has an impact on the willingness to support AVs. The development of AV technology is of course important, but these results also indicate the importance of

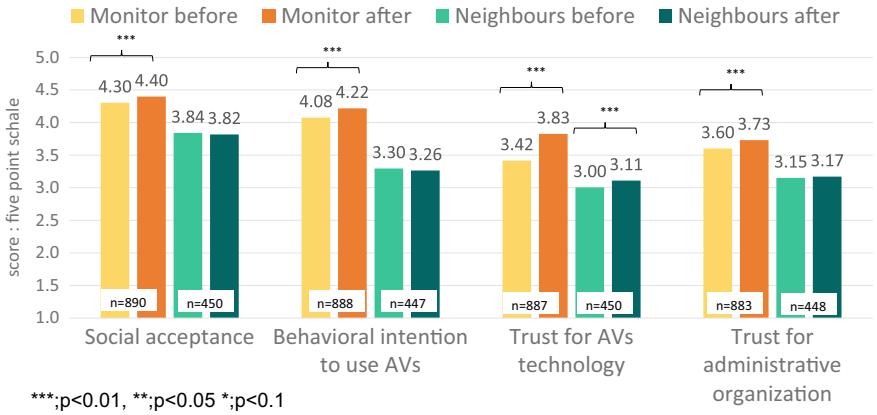

Fig. 17 Changes in attitude on the part of onboard monitors and local residents after AV field trials

constructing legal systems, insurance and other social mechanisms, and ensuring a thorough understanding of these mechanisms to increase trust in administrative agencies.

However, the field trials in 2017 were conducted for a short period of one to two weeks. In the long-term field trials in 2018–2019, which were conducted for a period of one to two months, there was no change in attitude after as compared to before the test [18]. This is thought to be because the attitude of the test participants toward AVs from the outset was high at 4.2–4.3 out of 5. In these long-term tests, the number of times that the AVs avoided vehicles parked on the street, detected weeds and planted areas (weeds and trees can change the 3D map as they grow overgrown, and this poses a major problem for the operation of AVs), stopped to yield to following vehicles and so on, or in which manual intervention by the driver was needed, were counted as incidents. The results showed that the more such incidents were encountered,

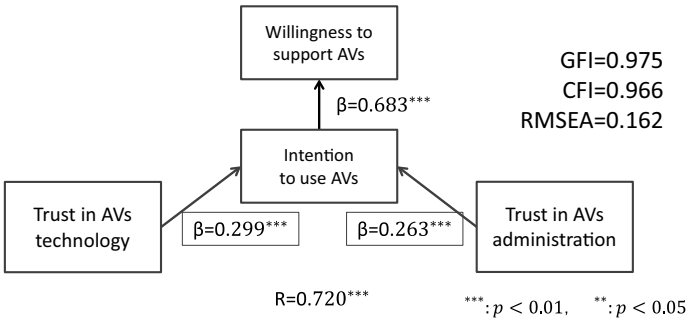

Fig. 18 Relationship of willingness to support AVs, intention to use AVs, and trust in AV administration

the more people had "near-miss" experiences, and this had a negative impact on confidence in the technology and the administration.

Based on the above, providing widespread opportunities to experience AVs through field trials has the effect of increasing positive attitude, at least among those who have a preliminary interest in participating in such tests. However, revealing the limits of the technology through incidents can adversely affect confidence, so careful planning and efforts to reduce incidents will be essential.

4 Media Coverage of AVs

This section presents the results of media analyses, particularly newspaper presentation of AVs in Japan and Germany. The media plays a role in directing the public's attention to topics related to AVs, and certain aspects of AVs, while not covering many other aspects. The results of the analyses show that the number of articles on AVs has increased significantly over recent years and identifies which topics and expectations of AVs have been shared.

4.1 The Japanese Study on AVs in Newspaper Reports

In Japan, AVs have become more familiar to the general public since the field trials on public roads began in 2017, and after driving-support technologies began to be implemented in vehicles. In addition, the discussions regarding AVs and the problems involved have become increasingly diverse. To study the social acceptance of AVs in this phase, it will be important to determine people's past and present understanding of the issues and problems relating to AVs. Even if mass media reporting may have little effect on directly changing people's attitudes, the media plays a role in setting the agenda for what issues should be discussed by selecting certain features of reality and making them more salient in the communicating text [6, 16]. Tracking the changes in the content of media reporting about AVs can help to determine what the media feels people should be discussing about AVs. This section covers a research study about media reporting in Japan [19].

The study focused on newspapers. Newspaper readership has been declining in recent years, but in many cases TV news and news reports on social networking services (such as Facebook, twitter etc.) use newspapers as a news source, so even if people do not read newspapers directly, they are exposed to newspaper articles indirectly. In addition, newspaper articles dating back to the Meiji period (1868–1912) have been archived in the form of text data, so this approach has the advantage of making it possible to conduct an analysis over a long period of time. Below is a discussion of the changes in the topics relating to AV development and introduction that have been provided to society by newspaper reporting in Japan.

4.1.1 Study Overview

First, newspaper articles on AVs were gathered from the Yomidasu Rekishikan archives of the Yomiuri Shimbun newspaper, which as of 2019 had the highest circulation. The search was conducted by searching for "automated driving + automobile" in the Yomidasu Rekishikan search engine and excluding words such as "railway". An analysis was then conducted for the total of 1,026 articles located, which were published between October 31, 1989 and December 31, 2019.

The articles were read carefully, and categorized according to the AV occurrence described in the article, the purpose of development and introduction and issues encountered, and the point of view and opinions expressed in the article. In addition, the analysis traced and considered the article content based on the historical backdrop. The topics included in the article were identified and the articles were classified into two major categories: those that dealt with the objectives of AV development, and those that dealt with problems relating to AVs. The articles were read by one author and then the classification and considerations were discussed by the co-authors [19].

4.1.2 Number of Newspaper Articles and Changes in Topics

Changes in the Number of Newspaper Articles

Figure 19 shows the changes in the number of newspaper articles relating to AVs. The first article to mention "automated driving" appeared in 1989, and between 1995 and 2005 such articles appeared as part of a discussion of Intelligent Transport Systems (ITS). In 2005, a self-driving bus was used as a means of transport at the site of Aichi Expo 2005 held in Aichi Prefecture, and as a result the number of articles increased in the years before and after this event (although system errors forced the suspension of operation prior to the conclusion of the Expo). Subsequently, between 2006 and 2012, the number of articles about AV dropped to between 0 and 4 per year. In 2009, there were zero articles for the first time in 16 years (since 1993). It is possible that this was because the news was dominated by the so-called "Lehman Shock" and the subsequent financial crisis. In August 2013, the Nissan Motor Company announced that it would begin sales of a self-driving automobile in 2020, and as a result the number of articles increased dramatically. Moreover, around the year 2016, field trials on public roads were actively conducted, and the number of articles increased.

Changes in Newspaper Articles About the Objectives of AV Development

Table 8 shows the objectives of AV development, and the categories for development objective as determined by the analysis of newspaper articles. Based on [19].

The years in which articles on the objectives of AV development first appeared, can be divided into two periods: the 1990s and the 2010s. Objectives that appeared during the 1990s include "Dreams and Romance", "Safety", "Economic stimulation",

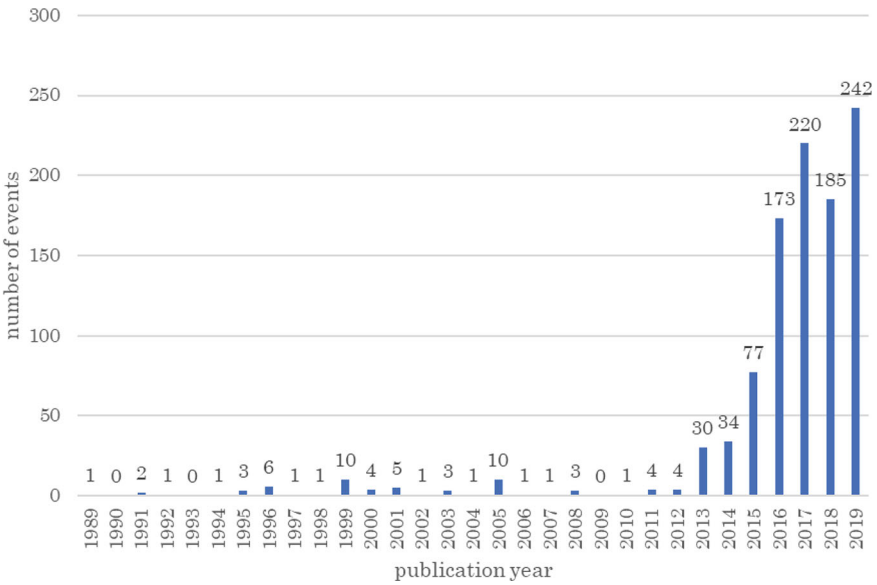

Fig. 19 Number of articles on AVs in Japanese newspapers

Table 8 Categories for objectives of AV development

Major classification	Sub-classifications (number of Articles)
Competition	International competition (135), Competition in the automobile industry (131), Competition with other industries (76)
Safety	Traffic accidents (106), Safety (61), Transit issues (1)
Economy	Economic benefits (68)
Traffic congestion	Easing congestion (30)
Going-out support	Going-out support (50)
Driver issues	Resolving the driver shortage (37), Driver burden (10), Transit in depopulated areas (9), Reducing public transport operating costs (5), Pick-up and drop-off (2)
Dreams and Romance	Dreams and Romance (21), Lifestyle (5)
Effective use of travel time	Effective use of travel time (5)
Other services	Various services (4), Vehicle dispatch (3), ATMs (1), Vending machines (1), Services in individual regions (1), Ride-sharing (2)
Protecting the natural environment	Protecting the natural environment (7)
Other	Other (25), Regional appeal (1)

"Traffic congestion", "(International) competition" etc. It appears that "Protecting the natural environment" and "Driver issues" were not recognized as major development objectives, as a period of 20 years or more elapsed between their first and second appearances. In the 2010s, new development objectives were mentioned, such as "Going-out support", and "Effective use of time." Beginning in 2015, there was a dramatic increase in the number of articles that mentioned "International competition" as an objective of AV development, and since 2013 this issue has surpassed the previously most-frequently cited issue of "Traffic safety." Judging from the analysis of newspaper articles, the major objective of AV development appears to have changed from "Traffic safety" to "Winning the international competition."

In addition, since 2016, the use of AVs to provide new services such as delivery and product sales has been much talked about, and expressions such as "AVs development to provide new services" have appeared. The background to the appearance of these objectives is discussed in detail in Sect. 4.1.3.

Changes in Reported Problems Relating to AVs

Table 9 shows the problems relating to AVs, arranged and classified in the same manner as the development objectives. Over the entire time period, the largest number of articles regarding problems concerned "development funds." With regard to the development of legal systems (laws and regulations), many articles discussed this issue, together with "Determination of responsibility". The most active discussion of "Developing international standards" occurred in 2014, and it is possible that during this period the "technical issues" relating to AVs were seen to be gradually being resolved. Moreover, it was in 2016 that a discussion first emerged regarding adverse effects, such as "relying too much on AVs", and "difficulty to change smoothly between the human driver and the system". It is possible that this occurred because field trials on public roads had begun to increase at around the same time. There was widespread detailed discussion not only of the technical problems of the individual AVs, but also of conflicts between the AVs and users. Since 2015, the number of articles has increased and a greater diversity of problems is being discussed—changes that are a point of commonality with articles about the objectives of AV development.

4.1.3 The First Appearance of "Automated Driving", and Newspaper Articles that Became a Turning Point

A qualitative analysis of characteristic articles was conducted as described below.

First Appearance of "AVs" in Newspaper Articles

The phrase "self-driving vehicle" first appeared in a Yomiuri Shimbun newspaper article in 1989. In this article, AVs were referred to as the ultimate automobile, and

Table 9 Classification of AV problems

Major classification	Sub-classifications (number of Articles)
Technology	Technology (68)
Social acceptance	Social acceptance (33)
Development of international standards	International standards (25)
Infrastructure construction	Infrastructure (18)
Funding	R&D funding (90), Financial matters (2)
Laws and insurance	Laws and regulations (70), Determination of responsibility (51), Insurance (17)
Discomfort with non-human driver	Pleasure of driving (11), Machine substituting for human driver (9)
Type of development organization	No entity to take charge domestically (8), Speeding up the decision-making process (1)
Adverse effects	Over-reliance (8), Adverse effects (5), Switching between human driver and AVs (1)
Price	Price (6), Maintenance costs (1)
Ethical issues	Ethics (5), Reason for human existence (1), Balance between convenience and safety (1)
Labour shortage	Labour shortage (5), Researcher shortage (3)
User knowledge	Education (3), Explanations (2), Licensing (2), Construction (1)
Nature of new technology	Nature of means of transport (2), New types of accidents (1)
Other	Other (20), Period of introduction (1), Time (1), Data leakage (1), Military use (1)

a vehicle exhibited at the Tokyo Motor Show was introduced as being a step closer to the dream of AVs. As can be seen from the terms “the ultimate automobile” and “dream,” at that time the practical achievement of AVs was considered to be a far-off prospect.

Autonomous Vehicles as a Symbol

From November 1995 to June 2003, AV was frequently used in newspaper articles as an example of ITS technology. Nowadays, Vehicle Information and Communication System (VICS) and Electronic Toll Collection (ETC) are recognized as examples of ITS technology, but at the time, it was difficult to explain these developments in simple terms. In contrast, “automated driving” was a straightforward expression that was easy for people to picture, and presumably this is the reason that it was used as an example of ITS technology. Since 2015, AVs have been introduced as an example of the use of state-of-the-art technologies that include IoT (Internet of Things), AI, deep learning and 5G. Of the ITS technologies, VICS and ETC

have been developed for practical use and have been disseminated. In contrast, AVs are still in the process of being developed, and have become an example of the application of not just automotive technology but of technologies in various other fields (communications, IT, surveying and maps, space and satellites etc.,), and as a result AVs can be considered to have become a symbol of technical development overall.

Development Objective: Preventing Traffic Accidents

The first newspaper article to express the hope that AVs could prevent traffic accidents was the Editor's Notebook that appeared in Yomiuri Shimbun on July 22, 1991. This article noted that the world's first automobile traffic accident was caused in 1769 by the world's first automobile, and it lamented that we are still plagued by traffic accidents today (1991). It then introduced the features of AVs and expressed the hope that they could reduce traffic accidents. At the same time, the article expressed doubt that an advanced unit could handle all operations instead of a human being, and expressed the view that coordination of people, vehicles and facilities would be needed to ensure road safety.

Development Objective: Economic Stimulation

Between 1996 and approximately 1999, the view of the Japanese Ministry of Construction that the economic benefits of ITS would amount to JPY 50 trillion over 20 years appeared several times in articles mentioning ITS. The mood in Japan at that time was unsettled due to the collapse of the "bubble" economy in 1992, and the Great Hanshin-Awaji Earthquake and the sarin gas attack on the Tokyo subway in 1995. Therefore, it is possible that expectations for an economic rebound due to ITS were high. In addition, twelve articles mentioned "automated driving and other ITS", implying that a climate of expectation regarding the economic benefits of AVs through ITS had been established.

Development Objective: International Competitiveness (Trauma Regarding the "Galapagos Phone" Fiasco)

The analysis of newspaper articles reveals that the development objective of international competitiveness has been mentioned since the 1990s, but it was around 2014 that a deeper discussion began. At the time, there were active efforts to formulate international standards for AVs, and nations were competing to take the lead. Japan was therefore working to take the lead in international standards formulation, and the background to this effort was indicated in the title of an article dated June 24, 2014: "Strategic move to establish a superior position for Japanese automobiles: Avoiding

the "Galapagos Phone" fiasco in proposing standards for automated driving". Moreover, an article dated September 27 of the same year, entitled "IoT international standard: Learning the lessons of Galapagos-ization (analysis)", discussed the risks in these terms: "Standards wars require a great deal of time and costs, and when you are defeated, all of that effort goes right down the drain".

As noted in these articles, Japanese mobile phone manufacturers that had pursued an independent development path fell behind overseas smartphones and were knocked out of the market one after another. These "Galapagos" mobile phones did not become the international standard and were defeated in the international competition. Based on this lesson, the newspaper appears to have laid out an agenda recommending the pursuit of AV development in order to avoid going down the same path. However, there was no explanation as to why it was necessary to win the international competition. There were also many articles that limited themselves to saying that there was intense international competition, something that might lead to confusing means and objectives, or turning the means into an objective.

Development Objective: Support for Senior Citizens and Vulnerable Transport Users

Since around 2015, articles about the use of AVs to assist senior citizen mobility have appeared. At that time, accidents involving elderly drivers and the increase in the fatalities of elderly drivers in traffic accidents had become an issue. In some cases, going-out support for senior citizens was talked about in the same way as supporting disabled persons, indicating expectations for AVs as a means of providing freedom of mobility to people without being dependent on their physical abilities.

Problem: Accidents Caused by Over-Reliance on AVs

In April 2017, an article entitled "If you trust 'refraining from braking'—Self-driving vehicle drives into people without stopping" appeared. In November of 2016, a person riding in a test vehicle was prompted to use the braking assist feature, but the system failed to function and the vehicle plowed into people, resulting in injuries. The article cited this incident and also introduced a notification from the police in April 2017 about this incident. The article said that, in some cases, the commercially-available AD features do not function properly due to weather or ambient conditions, but sales personnel and drivers have used these features without understanding their limitations, with the result that such incidents have occurred. In all, eight articles sounded the alarm about the fact that such incidents have been increasing each year, and that drivers must not place too much reliance on automated driving features. As vehicles equipped with AD features become more and more popular, finding a way to prevent drivers from excessive reliance on AVs is seen as a problem that needs to be resolved.

Problem: Determination of Responsibility for Accidents and Development of Legal Systems

The first newspaper article to contain a discussion of the determination of responsibility for traffic accidents caused by AVs appeared in November 2000. The article cited this as one problem that needed to be resolved, but it did not discuss the issue in detail. The next such article appeared in 2003 and pointed out that, in the event that an accident occurred while the AVs were in operation, the manufacturer may have to assume responsibility, and as a result companies were not enthusiastic about pursuing development. Of the 51 articles that discuss the determination of responsibility for accidents, 20 limit themselves to merely pointing out the existence of the problem of determining responsibility, while seven suggest the possibility that manufacturers may be held responsible. In contrast, only a single article deals with the operator's responsibility, and a single article touches on the possibility that there will be no-one to be held responsible. In the discussion of the determination of responsibility for an accident, the need to develop legal systems has been pointed out (7 articles). There were also articles mentioning the existence of unease caused by the fact that determining responsibility is unclear, and pointing out that public opinion should be reflected in the creation of rules relating to this issue.

Problem: Development Funding

From 1994 to 2005, there were occasional articles about the national government securing a budget to support AV development as a part of ITS. Since 2014, however, these articles primarily pointed out that development expenditure by private companies had increased. Beginning in 2016, group company reorganizations and capital alliances were conducted, and articles noted efforts to reduce the associated increase in AV development expenditure through joint research.

The analysis of articles seems to show that neither the national government nor private sector companies can withdraw from AV development, due to the fact that companies must recover research and development expenses through profits over the course of 30 years. AVs are a symbol of technical development in a variety of industries, such as the information industry, aerial survey industry and so on, and that international competition is heating up. As of 2021, it is unclear when fully-fledged AV implementation will become a reality.

Diversification of Problems

As in the case of AV development objectives, the problems with AVs that have been pointed out have become diverse in recent years. One reason for this is likely the increase in industries involved in AV development and the increase in elemental technologies. The diversification of problems can also be thought of as the result

of active field trials being conducted on public roads, providing increased opportunities for people to experience AV systems. These systems are in full-fledged use in Sakaimachi, Ibaraki Prefecture, and driving safety-support technology is being incorporated into commercially-available vehicles. All of these developments have led people to feel that AVs are familiar to them, resulting in increased discussions about AVs.

By tracing the changes in AV development objectives and problems through the analysis of newspaper articles, it was possible to clarify the process by which AVs became symbolic of the sum of various technologies, as well as changes to shifting development objectives, concerns that means have become objectives, diversification of problems and so on. In the future, it is likely that situations that cannot be anticipated at this stage will become problems. In order to implement AVs in society, it will be essential to anticipate unforeseen situations and expect the unexpected, and to be prepared to deal with such situations in a forthright manner.

4.2 A Brief Analysis of Media Reporting on AVs in a German Newspaper

AV is associated in the German scientific, public and political discussion with often very different expectations and promises of solutions. In many cases, safety issues are in the foreground. Some see AV as the key enabler for a transition towards sustainable mobility, while others focus on the international competitiveness of the German automotive industry. Against this background, it is interesting to examine which expectations are placed in the foreground in media reporting. Within the framework of the CADIA project in Germany (for CADIA see the introduction), a small media analysis was carried out. The results are summarised below. The analysis concentrated on "Handelsblatt" ("Commerce paper"), a German daily business newspaper with a strong focus on economic and financial topics. The circulation is 127,280 copies, and a limited range of the reporting is accessible online. In 2020, Handelsblatt was the most cited business newspaper in Germany. Since Handelsblatt repeatedly deals with the economic potential of new technologies, a relatively high presence of the AV topic could be expected.

As search strings, the German versions of the following terms were used: "automated driving", "autonomous driving", "automated cars, autonomous cars".

The analysis focused on the number of articles (661 overall) as well as the expectations or promises related to AVs and/or future developments. In the scientific and public discourse on AVs, a variety of expectations is usually reported. For the analysis, we differentiated between the following expectations:

1. AVs as a means to ensure international competitiveness of German industry
2. AVs as means to improve safety in traffic
3. AVs as an enabler for a sustainable transition in the mobility sector
4. AVs enable individual mobility for disabled persons and children/teenagers

5. AVs enable an increase in the efficiency of the mobility system (optimization of traffic flows on roads and at intersections)
6. AVs as an enabler for travel time savings (reading, working etc. while travelling)
7. AVs only briefly mentioned without clear expectations or promises.

Results are plotted in Fig. 20. Until 2018, the amount of articles increased steadily. It can be assumed that the decline in 2020 is at least partly due to the dominance of COVID-19 in public discourse and a corresponding shift in the focus of media reporting.

Casual mentions in particular fell sharply in 2020 and 2021. The expectation "international competitiveness" was relevant in 45% of the articles. It dominates the sample very strongly, with approximately half of all articles primarily dedicated to this subject. Given the orientation of Handelsblatt, a focus on economic issues was to be expected. Nonetheless, the overall result is in line with the observations of Jelinski et al. (2021), who performed a standardized content analysis of five German media outlets between 1 May 2017 and 31 October 2018, and found a similar dominance of economic reporting. The topic of "safety", which was important in 88 articles, follows at a considerable distance. The other categories are rather rare, although the topic "sustainable mobility" was relevant in 23 articles in connection with AV.

Overall, it is evident that AV is strongly framed as an economic issue, which is primarily expected to lead to safety benefits. Other socially relevant aspects, such

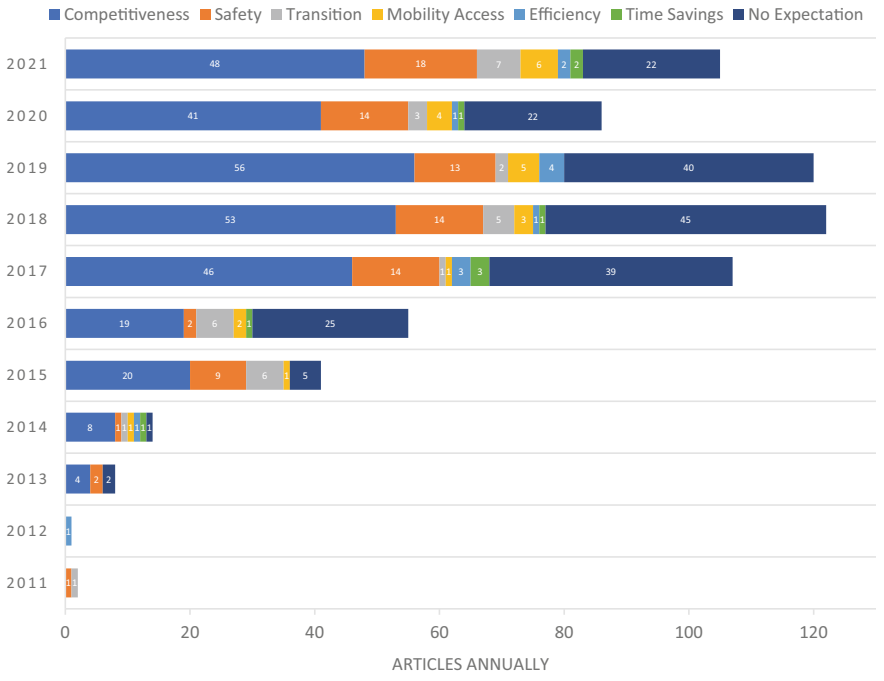

Fig. 20 Results of the media analysis of the German newspaper "Handelsblatt"

as sustainability, mobility enablement or the use or perception of travel times, are addressed only to a limited extent. The reporting therefore focuses primarily on AV as product and less on its social embedding.

4.3 Conclusions of Media Analysis

The media analyses carried out in Japan and Germany differ significantly as regards the general methodological approach, the selected publications, the time span covered and the way the articles were classified. Nevertheless, some interesting commonalities can be observed. There is a strong increase in the number of articles starting between 2013 and 2015. In Japan, this take-off phase starts somewhat earlier than in Germany. The strong emphasis on economic aspects can be demonstrated in both countries. Above all, the international competitiveness of the respective industries is clearly in the foreground. The more detailed analysis of the Japanese articles further shows that in Japan issues of regulation, legal settings and related questions of responsibility were mentioned quite frequently. In both cases, the direct traffic effects (with the exception of safety), as well as environmental impacts and social aspects of AVs, are clearly less in focus. The potential of AVs to trigger a transition of the mobility system with far-reaching changes for society, which has been widely discussed in the scientific community, at least in Germany, is hardly reflected in the media analyses conducted in the two countries.

5 Conclusion and Avenues for Further Research

This chapter first introduced various debates on social acceptance. We presented the broad definition of social acceptance of a technology, by illuminating different dimensions of acceptance—acceptance subjects and acceptance objects and the relationships between them, and suggested encompassing various classifications in each dimension. The various studies introduced following the conceptual discussions focused on different acceptance phenomena and the contributing elements that influence them. The results reveal various commonalities but also differences between Germany and Japan.

In all surveys that the authors conducted in both countries, they found the tendency that respondents in Japan offer less extreme answers and lie more towards the centre compared to the German respondents. A matter of future research will be whether this tendency will be observed in other surveys, regardless of the topic. We think that some of the differences in response behaviour can be attributed to different cultural settings. For example, the results of our explorative questionnaire survey in 2020 show that German respondents are relatively positive when it comes to reducing CO_2 emissions with AVs. The high importance of environmental issues in German society certainly plays a role here. To give another example from the same survey: When asked whether

road safety regulations should be relaxed to make AVs easier to implement, the respondents in Japan were surprisingly positive. This may be related to the fact that "deregulation" is generally framed quite positively in Japanese discourse. The larger-scale population survey in 2021 revealed interesting and sometimes surprising findings. Respondents in Japan are more optimistic about the impact of AVs on cost reduction of mobility services, whereas German respondents are more optimistic about impacts of AVs on stationary traffic and traffic flow. There are some highly interesting similarities with regard to the expected long-term effects in both countries. The statistical analysis reveals that most current expectations about the long-term effects of AVs may be shaped by one potential factor. Future research should identify this latent factor and compare it in both countries. Another interesting finding is that, in both countries, regulatory measures to improve safety are most welcomed, while measures that aim at relaxation of regulatory frameworks are most opposed. An intriguing difference can be seen in preference for a functional design of AD. Two-thirds of the German respondents would like to be able to intervene in AVs if this is perceived as necessary to avoid an accident. Interestingly, less than half of the respondents in Japan share this view. As regards the set of questions about wellbeing in different use cases, it is of considerable interest that the patterns of answers are quite similar in both countries, even though respondents in Japan tend more towards the middle of the options. What is striking is that in both countries, wellbeing in new mobility services is not only determined by the degree or concept of automation, but also by other design and service factors. It would be important to dig deeper into this finding in follow-up projects to get a better understanding of these "other" design and service factors.

The results of the survey conducted in 2017 where field trials have taken place in Japan suggest that participation in field trials can enhance social acceptance, as measured by the increase in trust in the technology and the administrative and business actors involved, the intention to use AD public transport, and the willingness to support society with public transport that uses AD. However, in particular in Japan, so-called NIMBY-effects might reduce the willingness of affected citizens to accept field trials. At the same time, it is striking that many more German respondents than those in Japan disagree with the idea of creating a "*society realizing an autonomous vehicles system.*" The news article analyses show that, in both countries, increasing (or sustaining) the international competitiveness of the national industry has been the central topic of AD in the media during recent years.

Without a doubt, AVs are a technology with very great potential for both countries in terms of transport developments, but also in terms of economic and social developments. It is therefore very important to understand how different technical and non-technical factors, including social acceptance, influence the development of AVs and where there is leeway for political influence. In order to achieve a "soft landing" for AVs in society, discussions that involve government, academia and the private sector will be essential, and comparisons with countries that have different societal and cultural backgrounds will also be important to contribute to the discussion. The results presented in this chapter show that a comparative perspective can provide important insights. It would now be very important to build on these findings

and to provide appropriate scientific comparative support for the further development of AVs in the two countries. There is much to suggest that AVs will develop dynamically over the next few years, and that this period will set the course for many future development directions. It is hoped that cooperation between Japan and Germany at both the governmental and research level in a variety of venues can be enhanced.

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