# Public opinions on Urban Air Mobility

## The significance of contributing to the common good

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### Main Research Questions

How are specific use cases for UAM evaluated by the public?

What are the most relevant expectations and concerns related to air taxis?

## 1. Introduction

With growing populations in metropolitan areas and increasing individual traffic, new, safe and efficient transport modes are being explored to meet rising social and environmental demands. An innovative possibility to tackle constraints of urban traffic is to employ the airspace above cities as transportation routes. In this vain, unmanned drones, so-called Unmanned Aerial Vehicles (UAV), which are autonomously controlled and capable of vertical take-off and landing, are being developed – a concept referred to as Urban Air Mobility (UAM). UAVs allow for a range of different use cases, including the transport of packages, medical goods, or passengers. Manufacturers such as Airbus, Lilium or Volocopter already have successfully carried out the first test flights with unmanned drones in Germany, underlining their ambitions to launch UAM operations in the near future. However, next to technological, legal and infrastructural barriers, one of the main challenges ahead of market introduction is the acceptance of UAM operations by potential users and the public.

Therefore, the goal of this research was to explore public acceptance of various use cases of Urban Air Mobility as well as the factors that influence the individuals' intention to use UAM services in the future. The study was carried out in the greater Ingolstadt area in Southern Germany. With the commercial aircraft manufacturer Airbus close by and the cross-cutting "Urban Air Mobility Initiative" led by the City of Ingolstadt, citizens in the Ingolstadt area have been frequently confronted with news about Urban Air Mobility in recent years.

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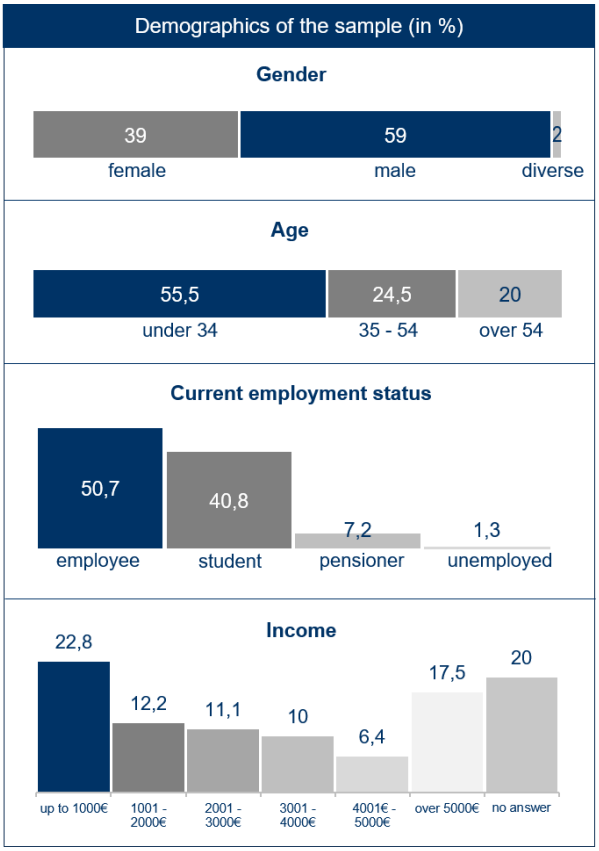
## 2. Research approach and sample

Within the framework of the research project GABi, which sought to investigate drivers and barriers of UAM adoption, data were collected in the timeframe of September to December 2019 across the Ingolstadt area. The questionnaire covered a wide range of topics: prior knowledge of and interest in UAM, the evaluation of different use cases, general attitudes towards the technology, individual usage intentions and acceptance factors as well as relevant demographic variables. Due to “air taxis” being at the center of public discourse in the focal region, a large part of the questionnaire focused on the use case of passenger transportation. The results provide a comprehensive overview of citizen’s opinions on UAM use cases in general and the case of air taxis in particular.

The sample consisted of 537 participants. Of these, 59% were male and 39% female (2% diverse). While the sample covered all age groups, younger participants up to the age of 34 made up the majority (53%). Overall, the sample was characterized by a high level of education with 56% of participants holding a university degree, and a high proportion of students (40%). Household incomes were largely distributed at the extreme ends of the spectrum. Regarding their personal level of knowledge on the subject of UAM, 47% of participants stated that they did not feel well informed. Only 5% of the participants indicated feeling very knowledgeable. At the same time, however, the majority of participants (58%) indicated actively following news and coverage on the topic of Urban Air Mobility. Thus, the majority of participants felt poorly informed, even though they were generally interested in the topic. This disparity may be an indication that media reports cover the wrong type of information or too little information to meet information needs of the public.



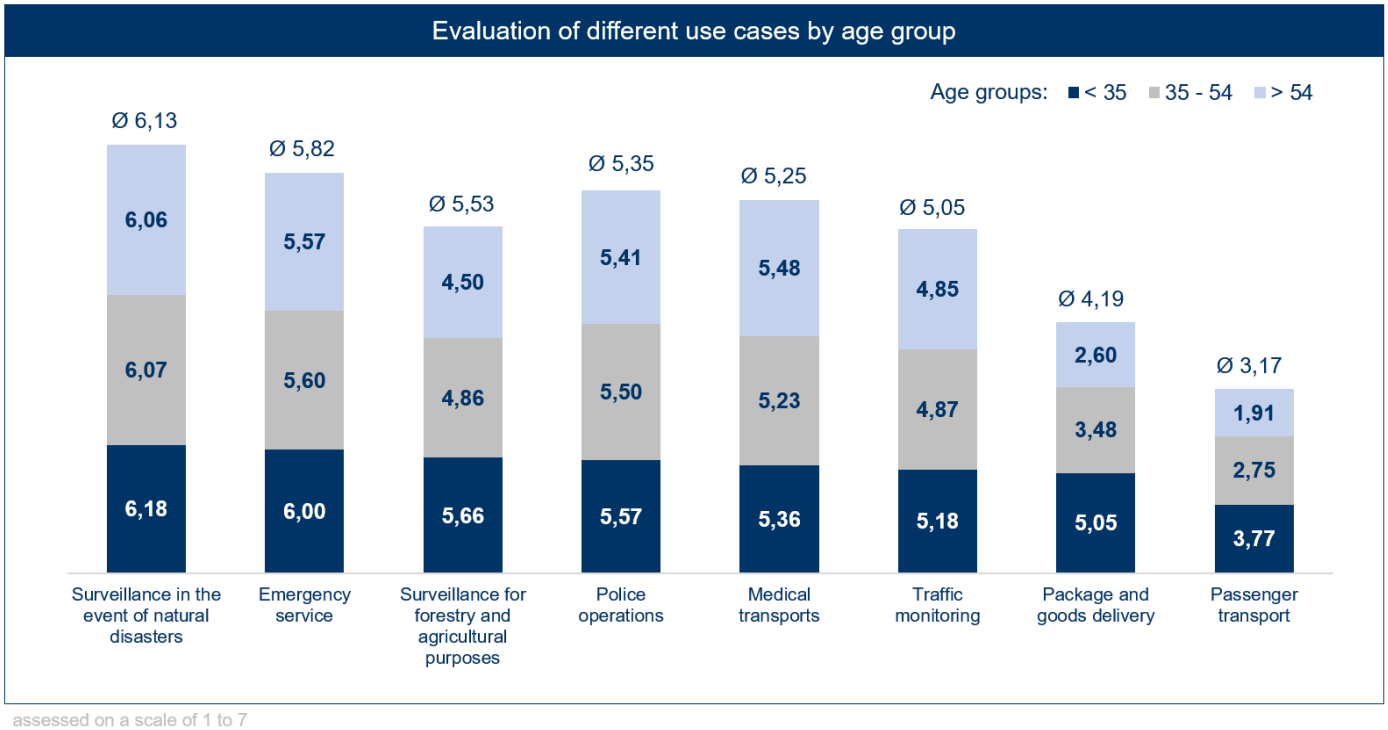

## 3. Results

### Overall perceived usefulness of UAM use cases

Participants evaluated different use cases of Urban Air Mobility ranging from aerial surveillance to passenger transportation by indicating the perceived usefulness of each use case on a scale from 1 to 7. The results clearly showed that use cases which serve the common good, such as aerial surveillance, emergency services or police operations, were rated as particularly useful. In contrast, use cases mostly serving the benefit of individuals, such as package delivery and passenger transportation were rated less favorably, as the average ratings in the figure below indicate. In particular, passenger transportation was rated with a value significantly below 4 (4 indicating a neutral stance) and therefore not perceived as useful.

A comparison between the different age groups revealed that participants in the age group < 35 considered all use cases as more useful than the older age groups. Overall, ratings of use cases decrease with an increase in age, the only exception being medical transports. This disparity becomes particularly apparent for the individual use cases (package delivery and passenger transportation) which achieved significantly more positive evaluations among the younger generation. It is noteworthy, however, that the use case of passenger transportation still received a rating below 4, even in the age bracket < 35, indicating a very critical stance towards air taxis throughout all demographic groups in our sample. The answers point out that the deployment of UAM services may benefit by following a systematic introduction starting with common good operations to, finally, the use of passenger transport services.

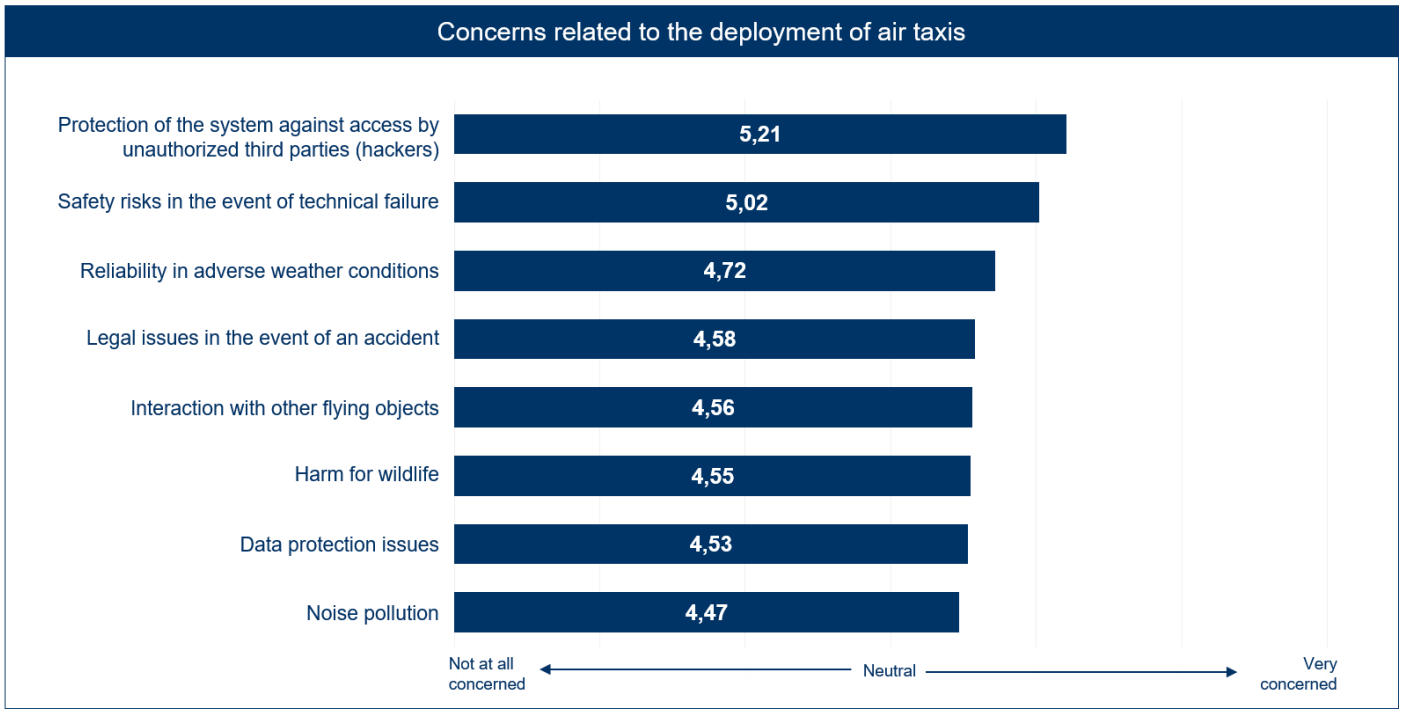
UAM operations serving the common good are rated more useful than operations serving the benefit of individuals.




## Evaluation of air taxis

As benefit perceptions shape overall attitudes and acceptance of new technologies, participants were asked to indicate whether they expected the most commonly cited benefits of air taxis to be fulfilled. Overall, the results indicate that participants were quite skeptical about the ability of air taxis to provide significant benefits compared to other means of transport. Apart from reduced travel time and the possibility to avoid traffic jams with an average rating of 4,75 and 4,23 respectively (on a scale of 1 to 7), all other possible benefits were rated as rather unlikely to be fulfilled. In other words, participants would expect air taxis to deliver on their promise of fast travel but do not anticipate any advantages in the areas of accessibility, comfort, safety, environmental friendliness or costs compared to other means of transport.

Participants' concerns regarding air taxis indicate possible barriers to future usage as well as public acceptance. As expected, the greatest concerns pertained to possible safety threats, including the fear of unauthorized third parties gaining access to the autonomous system and general safety risks due to technical failures. Other concerns were rated almost equally. There are two possible explanations for these results. On the one hand, they could indicate similarly pronounced concerns of participants regarding all aspects mentioned. On the other hand, the ratings could indicate difficulties of participants in evaluating these aspects in detail given the currently still limited knowledge about air taxis in general.

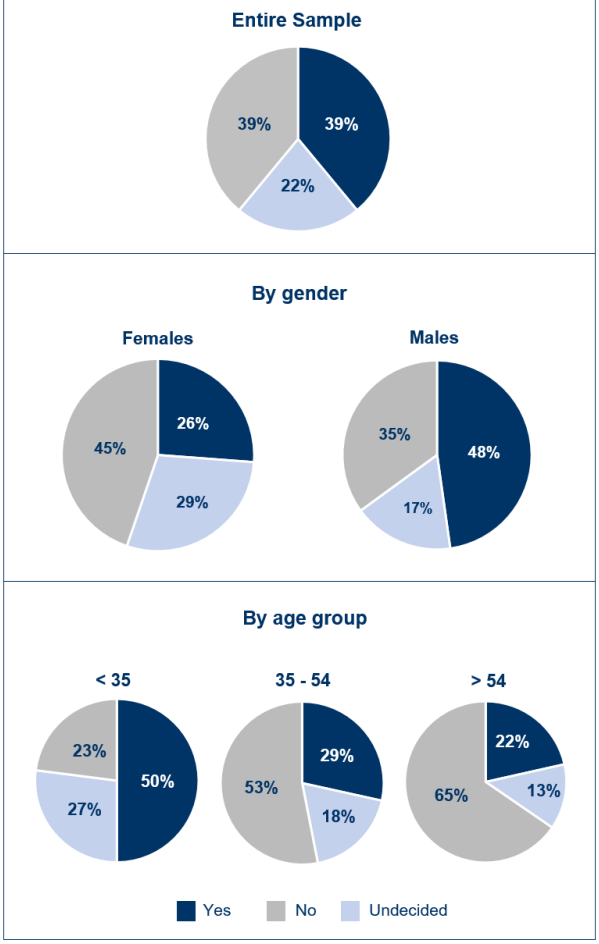


## Personal usage intentions

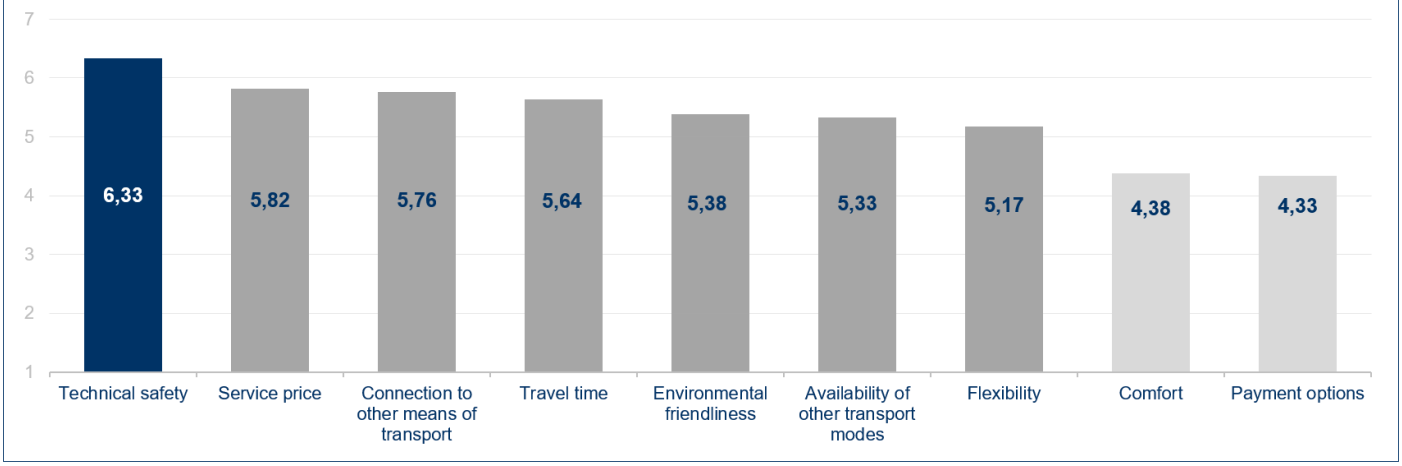
Regarding personal intentions to use air taxis in the future, the responses of the full sample were very balanced, with 39% indicating “yes” and the same number rejecting the idea, while the remaining 22% were indecisive. However, a closer analysis distinguishing different demographic groups reveals a different distribution: comparing usage intentions between males and females, it becomes clear that women in our sample were much more reluctant to embrace the technology than men, with 45% of females rejecting air taxis and 29% still indecisive (compared to 35% / 17% of men). Similarly, the analysis reveals great disparities between the different age groups, with half of the respondents aged younger than 35 indicating intentions to use air taxis in the future, compared to only 22% of participants older than 54 years. Of those who indicated intentions to use air taxis in the future, the clear majority (80,5%) would use them in cases of emergency, followed by 69,5% of participants indicating an interest in using them for business purposes. On the other hand, only 20% of participants indicated the intention to use air taxis for purely private occasions such as shopping.

With regard to the most important factors promoting or inhibiting the future usage of air taxis, the results once again pointed to safety concerns as being the most critical factor in potential users’ decision-making. Service pricing was rated as the second most important factor. In conjunction with the previously described expectation of participants that air taxis will be priced higher compared to existing means of transport, this result points to the need for service providers to put careful consideration into the pricing schemes of future mobility services. The connection to other means of transport for the journey to and from take-off and landing platforms as well as the short travel time were also considered very important. These results underscore the need for future service providers and municipalities to ensure proper integration of take-off and landing platforms into existing infrastructure and traffic systems. Comfort during flight, on the other hand, was rated least important of all aspects mentioned.

Willingness to fly with an air taxi




Importance of various aspects in the decision to use air taxis



The distribution of answers across five attitudinal categories reveals that citizens perceive Urban Air Mobility ambiguously.

## Results from open questions

The questionnaire ended with an open question in which the respondents were asked to freely express their opinion on the topic of Urban Air Mobility. Responses were assessed using qualitative content analysis, leading to five categories related to overall tendencies in opinions expressed in the comments.

The answers from the open questions reveal that citizens perceive urban air mobility ambiguously. Roughly 40% of the participants held a rather positive attitude towards UAM. Many participants agreed that the technology was forward-looking, but expressed that more education of the public is needed. Additionally, a large number of favorable comments assumed that the market launch of air taxi services would not take place within the near future. In contrast, more than half of the respondents expressed concerns and rather critical opinions about the usage of unmanned drones in general and air taxis in particular. Numerous participants expressed concerns about potential adverse effects of UAM, such as noise or environmental pollution. For this reason, many deemed the technology only appropriate to be used in exceptional cases, such as emergencies. Finally, roughly one quarter of the comments expressed a clearly dismissive attitude towards UAM. Many comments fully rejected the idea of autonomous drones as a useful addition to existing transport options and labeled UAM a daydream or “castle in the air”. Instead of investing in UAM applications, many participants advocated the endorsement of existing alternatives, for example by investing in the expansion of bicycle lanes.

### Open Comments

**Positive Attitude (16%)**

"Urban Air Mobility will lead the way in improving the mobility of the future and new business models will develop from it. I'm looking forward to it!"

**Positive with some reservations (25%)**

"I think Urban Air Mobility is very interesting and forward looking, however it needs more education and information on the subject. I also think it is still in the distant future."

**Undecided (7%)**

"Reminiscent of science fiction movies. Let’s wait and see what the future will bring."

**Critical Attitude (27%)**

"Aircrafts will continue to be more polluting than earthbound vehicles. Special operations may make sense, but it’s not a solution for mass transportation. Electric propulsion technology won't change that!"

**Full Rejection (25%)**

"The topic of UAM is just a huge hype at the moment with a completely uncertain outcome. Better work on improving public transport, making streets bike-friendly - Urban Air Mobility is the last thing we need."

## 4. Conclusion and implications

Overall, the study results show that use cases, which serve the common good, such as medical emergencies or aerial surveillance, are perceived as particularly useful. The majority of participants are currently still skeptical about the use of unmanned drones in urban areas for commercial purposes, especially in the case of delivery drones and air taxis, yet 40% of participants indicated the intention to use air taxis in the future. In general, opinions seemed strongly influenced by risk perceptions and safety concerns. Open comments underscored participants' impressions that potential risks of the technology, possible adverse effects of drone use in urban areas, as well as aspects of environmental friendliness have so far been largely absent from public discourse. Respondents expressed a need for more transparent communication regarding these issues and a clear desire for the implementation of UAVs in urban areas to be moderate and aligned with actual demands.


Accordingly, UAM stakeholders should seek to give potential users and the public more opportunities to learn about and familiarize with this new technology. Going beyond traditional communication measures, security concerns as well as technical questions could be addressed during road shows, product demonstrations, and test flights, thereby mitigating uncertainties in the run-up to a market launch. Such initiatives could foster awareness of the benefits and impacts of UAM and encourage the dialog between different stakeholders, to help decrease reservations and improve knowledge and acceptance of the technology. In addition, stakeholders should consider limiting the implementation of unmanned drones in urban areas to clearly defined exceptional cases, such as emergency medical transports, at first, while continuously evaluating acceptance among citizens throughout first deployments. Stakeholders should gradually move onto the implementation of further use cases such as passenger transport, while paying specific attention to aspects like the seamless integration of take-off and landing platforms into existing infrastructures in urban areas.

## 5. Limitations and outlook for further research

As previously described, the chosen distribution channels imply a strong regional focus of the study. Additionally, the high percentage of students may lead to a bias in results, as younger age groups are generally more open towards new technologies. As Urban Air Mobility is a new and innovative mode of transportation, which is yet to be fully developed and brought to market, research on the acceptance of UAM heavily relies on participants' imagination of the concept. It is essential for future research to survey participants after undertaking test flights to understand how the actual experience with air taxis shape perceptions and usage intentions. Vivid visualizations, such as mock-ups or virtual reality demonstrations can provide a basis for the investigation of public opinions while real flight experiences are still lacking.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Stadt Ingolstadt

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