Deliverable N.2.2

Analysis of Societal Impact

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This project has received funding by the European Union's Horizon Europe research and innovation programme HORIZON-CL5-2021-D6-01-13 under Grant Agreement no 101075332

Abstract:

This document provides a comprehensive overview of the activities and advancements within HAIKU Tasks 2.3 "Analysis of Societal Impact" and 2.2 "Engagement with end-users and stakeholders".

Section 1 delves into the initial analysis of societal acceptance concerning six Intelligent Assistants prototypes developed by HAIKU, with the objective of identifying potential societal acceptance concerns from the early stages of design. The analysis engaged Use Case Leadership Teams and users participating in the VAL1 phase for selected use cases.

A thorough examination of societal acceptance models, such as the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), Acceptance and Intention to Use AI model (AIDUA), Virtual Mobile Unmanned Aerial System Technology Acceptance and Use model (VMUTES), and the significance of trust in technology adoption, is conducted. Among these models, the VMUTES framework stands out for its specificity and comprehensive approach to user acceptance factors, particularly beneficial in the aviation domain.

The assessment of societal acceptance regarding AI-based systems is considered paramount from the initial design phases to address pertinent aspects that could influence solution success. The proposed framework and questionnaire garnered positive feedback from participants, offering invaluable insights for refining Intelligent Assistant designs. The application of the analysis framework is recommended across various stages of technology development, involving concept owners, developers, and end-users.

Section 2 reports the HAIKU end-users and stakeholders engagement activities performed during the first half of the project.

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Information Table

Deliverable Number	2.2
Deliverable Title	Analysis of Societal Impact
Version	1.0
Status	Final
Responsible Partner	DBL
Contributors	-
Reviewers	Barry Kirwan (ECTL) Brian Hilburn (CHPR) Simone Pozzi (DBL)
Contractual Date of Delivery	February 29th, 2024
Actual Date of Delivery	February 26th, 2024
Dissemination Level	Public

This project has received funding by the European Union's Horizon Europe research and innovation programme HORIZON-CL5-2021-D6-01-13 under Grant Agreement no 101075332

Document History

V.	Date	Status	Author	Description
0.1	Nov 13th, 2023	Draft	Giampaolo N. (DBL)	Outline
0.2	Nov 29th, 2023	Draft	Giampaolo N. (DBL)	Section 1 - Chapters 1 and 2 & Appendix A added
0.3	Dec 5th, 2023	Draft	Arrigoni V. (DBL)	Review of Section 1 - Chapters 1 and 2 & Appendix A with comments
0.4	Jan 26th, 2024	Draft	Giampaolo N. (DBL)	Section 1 - Chapter 3 added
0.5	Feb 2nd, 2024	Draft	Arrigoni V. (DBL)	Review of Section 1 - Chapter 3 with changes and comments + Conclusions added
0.6	Feb 19th, 2024	Draft	Kirwan B. (ECTL) Hilburn B. (CHPR) Pozzi S. (DBL)	Review with minor comments
0.7	Feb 23rd, 2024	Draft	Giampaolo N. (DBL) Arrigoni V. (DBL)	Comments addressed Section 2 added
1.0	Feb 26th, 2024	Final	Arrigoni V. (DBL)	Final quality check & Final version

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List of Acronyms

Acronym	Definition
AI	Artificial Intelligence
AIDUA	AI Device Use Acceptance model
ANACNA	Associazione Nazionale degli Assistenti e Controllori della Navigazione Aerea
AVs	Autonomous Vehicles
CERTH	Centre for Research and Technology Hellas
EASA	European Union Aviation Safety Agency
ECA	European Cockpit Association
ENAC	Ecole Nationale de l'Aviation Civile
ENAV	Ente Nazionale Assistenza al Volo
IA	Intelligent Assistant
IU	Intention to Use
LLA	London Luton Airport
NATS	National Air Traffic Services
PEOU	Perceived Ease of Use
PU	Perceived Usefulness
TAM	Technology Acceptance Model
TAP	Transportes Aéreos Portugueses
UAM	Unmanned Aerial Mobility
UAS	Unmanned Aerial Systems
UC	Use Case

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UTAUT	Unified Theory of Acceptance and Use of Technology
VMUTES	Virtual Mobile Unmanned Aerial System Technology Acceptance and Use

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Introduction

The main purpose of this document is to present the activities and progress of HAIKU Tasks 2.3 "*Analysis of Societal Impact*" (Section 1) and 2.2 "*Engagement with end-users and stakeholders*" (Section 2).

Section 1 shows the preliminary analysis of societal acceptance for the six Intelligent Assistants prototypes proposed and under development by HAIKU, aiming to identify and advise on possible societal acceptance concerns to be considered from early stages of design. The analysis involved all Use Case Leadership Teams and a set of users involved in VAL1 for selected use cases (1 and 4).
It is structured in 4 chapters:

- Chapter 1 provides an overview on various available models that could be used to assess the societal acceptance of new technologies and shows the models chosen for this assessment;
- Chapter 2 describes the methodology;
- Chapter 3 shows the results of this preliminary societal acceptance assessment for each of the six HAIKU use cases;
- Chapter 4 presents conclusions from the assessments.

Section 2 reports the HAIKU end-users and stakeholders engagement activities performed during the first half of the project.

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SECTION 1: Analysis of Societal Acceptance

In recent years, the rapid advancement of Machine Learning (ML) and Artificial Intelligence (AI) technologies has brought about a transformative era in which AI is increasingly integrated into expert decision-making processes. These developments have opened up new frontiers in fields such as automotive, manufacturing, healthcare, and aviation, potentially revolutionising the way these domains operate. However, the mere delivery of accurate algorithmic predictions, though crucial, has proven insufficient for effective human-AI collaboration (Cai et al., 2019). As AI technologies continue to proliferate across various sectors, the need to understand and enhance human-AI interaction has gained prominence in the realm of technological innovation.

A critical point of discussion is that the adoption of AI is not solely contingent upon the technology's functionality and reliability. While developers have been primarily focused on demonstrating the efficacy of AI, the intricate interplay of various factors that influence technology acceptance has often been overlooked (Sujan et al., 2020). Several studies have delved into psychological factors, drawing from established behavioural theories, to elucidate the dynamics of technology acceptance. These include (sometimes interrelated) factors such as attitude, perceived usefulness (PU), perceived ease of use (PEOU), perceived fit between human and technology strategies (Westin et al., 2013) and trust (Jing et al., 2020). The existing body of research suggests that the exploration of Human Factors (HF) tied to user demographics and cognitive aspects should be an integral part of the AI development process (Sujan et al., 2020). Furthermore, researchers emphasise the importance of considering human values when establishing successful interactions with AI systems, as the insufficient trust in AI systems remains a significant barrier to technology adoption (de Visser et al., 2020).

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1. Societal Acceptance Models and Framework

A comprehensive examination was conducted to gauge the societal acceptance of intelligent assistants (IA), assessing various models that elucidate the intricate dynamics influencing the adoption and integration of these assistants into society. For in-depth insights into the details of each model, additional information can be found in the dedicated appendix (Appendix A).

The different models analysed provide distinct insights into the complex dynamics that shape the adoption and integration of these assistants into various societal contexts.

In our exploration of societal acceptance of AI, we will delve into the **Virtual Mobile Unmanned Aerial System Technology Acceptance and Use model (VMUTES)** (Myers, 2019), a conceptual framework that has already been extensively studied in the domain of Unmanned Aerial Mobility (UAM). This model assesses exogenous variables such as Subjective Norms, Perceived Risk, Knowledge of Regulations, and Facilitating Conditions. Endogenous variables include Perceived Usefulness, Perceived Ease of Use, Attitude Toward Use, Behavioural Intention, and Actual Use. VMUTES provides a comprehensive framework for understanding the acceptance of Unmanned Aerial Systems.

Other models were analysed, including the **Technology Acceptance Model** (TAM), introduced by Fred Davis in 1985 and refined in 1987, serves as a foundational framework for comprehending technology adoption. It revolves around two pivotal components: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). PU evaluates the perceived benefits of a technology, while PEOU assesses the ease of using it. External variables, including social influences, play a role in shaping these perceptions. TAM has exerted significant influence, and its adaptability to specific contexts is acknowledged.

The **Unified Theory of Acceptance and Use of Technology** (UTAUT), developed by Venkatesh et al. in 2003, integrates various acceptance models, including TAM. UTAUT's key components encompass Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. Moderators, such as gender, age, and voluntariness of use, influence the impact of predictors. UTAUT's widespread use is attributed to its comprehensive nature, explaining a substantial portion of the variance in behavioural intentions.

The **Acceptance and Intention to Use AI model (AIDUA)** introduces a multi-stage framework focusing on AI devices in service encounters. Users undergo primary and secondary appraisals, considering factors such as user experience, human-like qualities, benefits, and costs. Emotional responses play a crucial role in user

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acceptance or objection. AIDUA recognizes that acceptance and objection are not mutually exclusive, allowing for a nuanced understanding of user attitudes.

Finally, the role of **trust** in technology acceptance emerges as a fundamental and subjective attitude crucial for the adoption of advanced technologies like AI. Trust serves as a driving force behind AI acceptance, with direct and indirect effects on users' behavioural intentions. Trust moderates relationships within technology acceptance models, influencing users' decisions when perceived usefulness is lower than expected. Trust is dynamic across industries and contexts, necessitating tailored strategies for technology adoption. It significantly shapes attitudes, intentions, and actual behaviour, establishing itself as a linchpin in technology acceptance.

The VMUTES model was chosen for this study as, when compared to the TAM and the AIDUA model, offers several distinct advantages that make it a valuable addition to the study of AI acceptance in the HAIKU project:

- It is tailored specifically for the domain of aviation. This domain-specific focus provides a more nuanced and relevant framework for understanding user acceptance in a context that is inherently distinct from generic technology adoption scenarios.
- It expands beyond the traditional TAM by incorporating elements from the Theory of Planned Behavior, allowing for a more comprehensive examination of factors influencing user behaviour. This integrated approach takes into account additional determinants such as subjective norms, facilitating conditions, perceived risk, and knowledge of regulations, providing a richer understanding of user acceptance.
- It introduces a multi-step process for user acceptance, involving primary appraisal, secondary appraisal, and outcome stages. This step-wise approach offers a more detailed and realistic representation of how users evaluate and decide to accept or object to technology, a departure from the binary acceptance-rejection paradigm in AIDUA.

Furthermore, we will complement our investigation by considering the pivotal role of trust in shaping user attitudes, intentions, and behaviour within the technology adoption process, offering a holistic perspective on user acceptance that transcends traditional models (Figure 1). By integrating trust into the analysis of the VMUTES model, we can enhance our understanding of how this crucial psychological factor influences user acceptance, bridging the gap left by TAM and AIDUA. Trust serves as a critical element in shaping user attitudes and intentions, playing a pivotal role in the adoption of advanced technologies.

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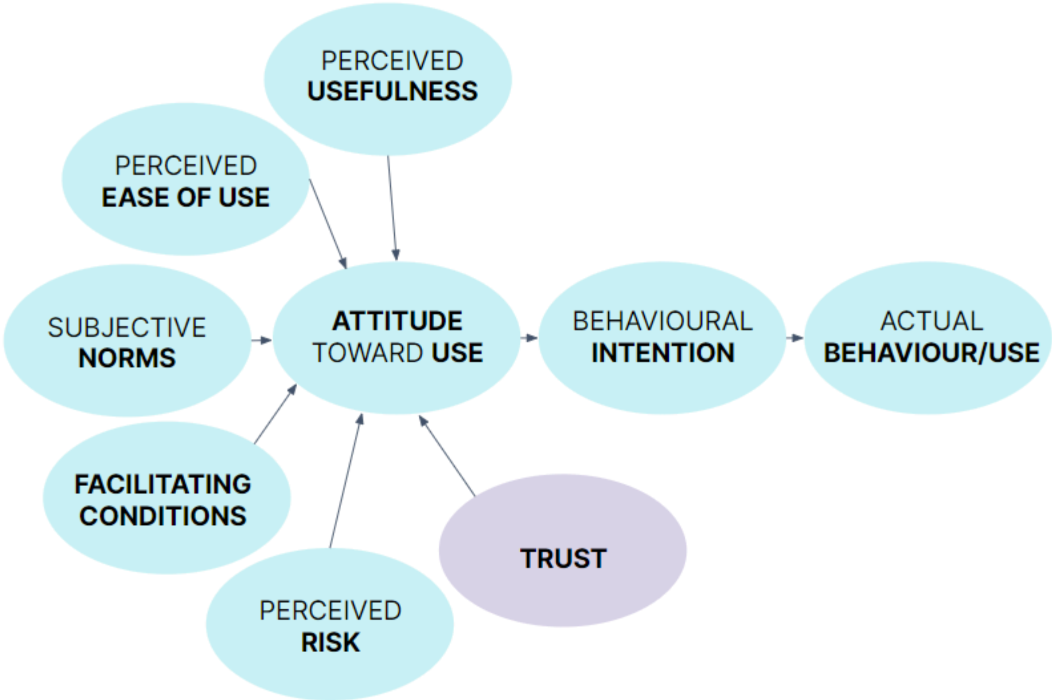

Figure 1. Societal Acceptance Model

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2. Methodology

To gauge participants' perceptions and attitudes, we utilised a structured questionnaire comprising 23 questions. Each question was evaluated on a 5-point Likert scale, spanning from 1 (Strongly Disagree) to 5 (Strongly Agree). Upon completing the questionnaire, the responses to individual questions were averaged to derive the final average for each respective dimension. Additionally, participants had the option to respond with a 0 in instances where a specific item was deemed irrelevant to their Use Case (UC). Notably, any response marked as 0 was excluded from the computation of dimension averages.

The questionnaire was crafted to address 8 dimensions concerning the utilisation of IAs. These dimensions are summarised and defined in Table 1.

Table 1. Societal Acceptance Assessed Dimensions

Dimension 1: **PERCEIVED USEFULNESS**	
Definition	Individuals' perceptions regarding how users view the technology as advantageous and valuable in their day-to-day activities.
Assessed factors	**Task Efficiency** *Q1: Using "IA" would enable me to accomplish "task name" more quickly.*
	Productivity Enhancement *Q2: Using "IA" would enhance my productivity.*
	Workload Balancing *Q3: "Using "IA" would support and optimise workload balancing.*
Dimension 2: **PERCEIVED EASE of USE**	
Definition	Individuals' perceptions regarding the ease or difficulty of utilising the IA, examines how straightforward and convenient it is to operate a technological device or system.
Assessed factors	**Reduced Mental Effort** *Q1: "Interacting with "IA" would reduce the mental effort required to accomplish the "task name.*
	Intuitiveness *Q2: The "IA" would be intuitive and easy to use.*
Dimension 3: **SUBJECTIVE NORMS**	

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Definition	The impact of social norms and others' opinions on individuals' perceptions of the usefulness of the IA and their attitude toward its use, measuring the influence of social norms and external opinions on individuals' perspectives regarding the utility of the IA, their attitude toward its use, and their behavioural intention.
Assessed factors	**Individual Values and Morality** *Q1: My individual values and beliefs morally support the introduction and use of the "IA."*
	Societal Approval *Q2: Society would be in favour of introducing "IA" into operation.*
	Perceived Societal Benefits *Q3: Society would perceive the introduction of "IA" into operation as safety and/or efficiency improvement.*
Dimension 4: **FACILITATING CONDITIONS**	
Definition	The perceived availability of resources, support, and conditions that ease the use of the IA, pertains to the support and resources accessible to users to effectively utilise the technology. This encompasses elements like technical support, training, and infrastructure.
Assessed factors	**Knowledge and Experience** *Q1: I have sufficient knowledge and experience to use "IA" effectively.*
	Training Requirement *Q2: I would be able to use "IA" without receiving specific training.*
	Guidance Need *Q3: I would not need guidance to consult in case I need help on understanding the "IA" behaviours.*
	Safety Assurance *Q4: I would feel able to keep operating safely in case of "IA" failures.*
Dimension 5: **PERCEIVED RISKS**	
Definition	The potential risks and negative consequences linked to using the IA, evaluates the possible drawbacks and adverse outcomes

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	associated with the utilisation of UA. This factor directly influences an individual's attitude toward the IA.
Assessed factors	**Threats and Risks** *Q1: Using "IA" would not pose new potential threats and risks to myself and/or society.*
	Safety Undermining *Q2: "IA" malfunctions may not undermine safety.*
	Skills Degradation *Q3: An extensive usage of "IA" may not lead towards skills degradation.*
	Cost Concerns *Q4: The costs associated with acquiring, operating, and maintaining "IA" may not be cause for concern.*
Dimension 6: **ATTITUDE TOWARD USE**	
Definition	The individuals' comprehensive attitude and emotional response to using the IA, is linked to the individuals' overall sentiment and emotional reaction when engaging with the IA.
Assessed factors	**Personal Desirability** *Q1: It is desirable to use "IA".*
	Safety Perception *Q2: Using "IA" would enhance safety.*
Dimension 7: **BEHAVIOURAL INTENTION**	
Definition	The individuals' intentions to use the Intelligent Assistant (IA) are influenced by their attitude, and include various elements that shape users' inclinations toward adopting and utilising IA. The associations involve users' overall attitudes toward the IA, incorporating their perceptions, sentiments, and emotional responses.
Assessed factors	**Preference in Complex Scenarios** *Q1: When engaging in complex scenarios, opting for "IA2 would be my preferred choice.*
	Recommendation to Colleagues

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	Q2: I would recommend using "IA" in complex scenarios to my colleagues.
Dimension 8: **TRUST**	
Definition	Trust enables individuals to make decisions that often involve vulnerability and reliance on a given technology or system, and is pivotal to users' belief that the IA will effectively and reliably help them achieve their desired goals.
Assessed factors	**Reliability in Task Assistance** *Q1: I trust that "IA" would reliably assist me in "task".*
	Accuracy and Reliability *Q2: I trust that the "IA" suggestions and/or actions would be accurate and reliable.*
	Confidence in Security and Privacy Measures *Q3: I have confidence in the security and privacy measures of "IA".*

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3. Results

Overview of the results

This analysis examines the early societal acceptance of IAs across six diverse use cases, drawing upon initial research findings. The overall reception towards these IAs was generally positive, characterised by perceived usefulness across various tasks and ease of use in their interfaces.

Across all use cases (Figure 2), scores measuring initial acceptance indicated favourable public perception. Usefulness emerged as a common thread, with participants acknowledging the assistants' potential to enhance efficiency, productivity, and safety within their respective domains. Interface intuitiveness and user-friendliness further contributed to positive experiences. Although trust variations existed, most participants expressed willingness to engage with the assistants, particularly in complex scenarios.

While similarities in positive reception and perceived benefits were observed, each use case presented unique challenges and concerns. For instance, the risk of skills degradation and overreliance, especially for junior ATCOs, surfaced in Use Case 4 (tower controllers), while data privacy worries were prominent in Use Case 5 (airport safety). Furthermore, trust variations manifested, with participants' level of experience with AI technology influencing their confidence in the assistants. Ultimately, the societal acceptance of these intelligent assistants will hinge on factors such as implementation strategies, public perception management, and effective mitigation of use case-specific concerns. The next sections will delve into the specific results of each UC.

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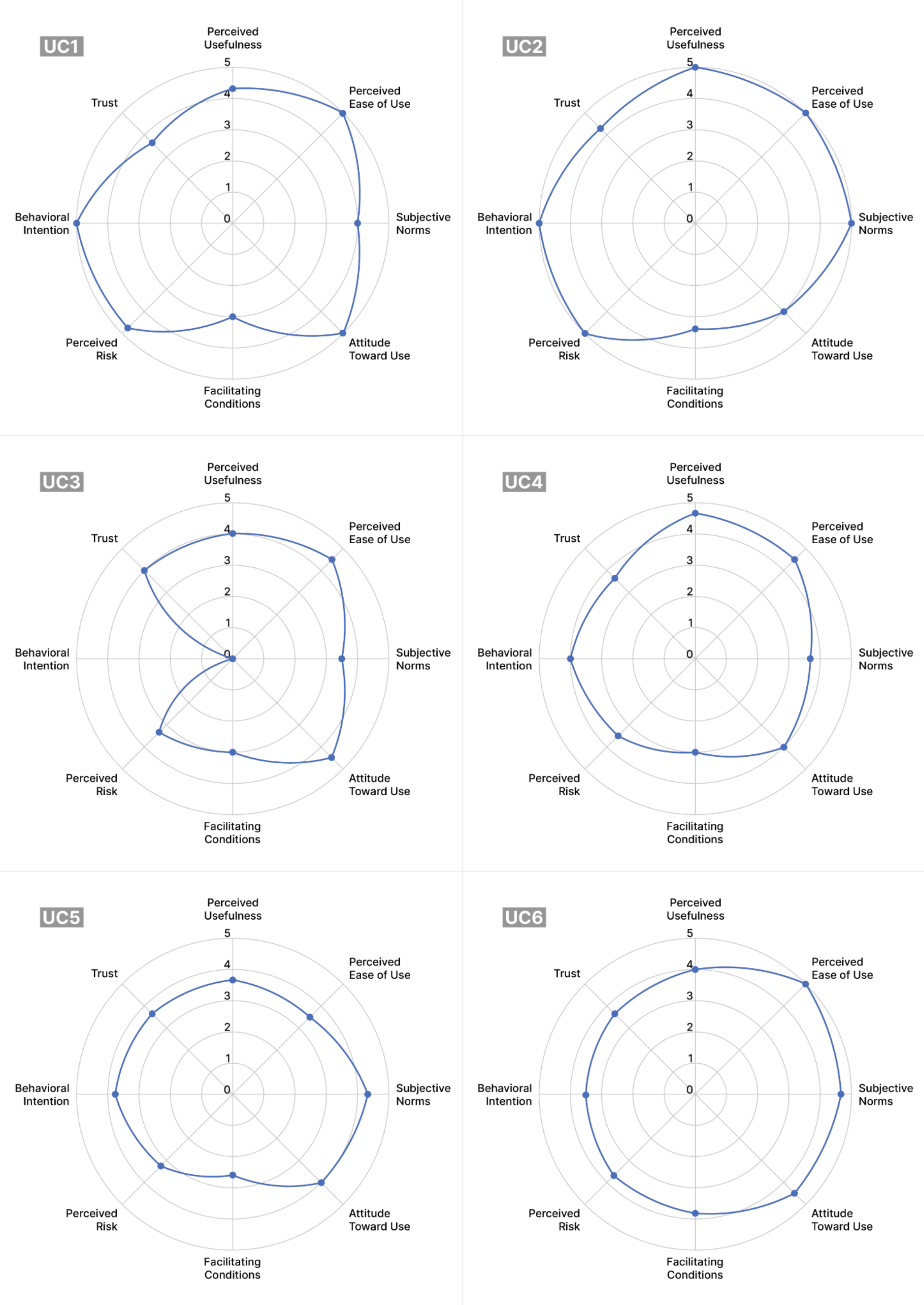

Figure 2. Comparison of the 6 UCs.

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Use Case 1: Intelligent Assistant in the cockpit to assist in 'startle response' adverse events

The results of the study on the societal acceptance of the Flight Operational Companion for Unexpected Situations (FOCUS) was analysed together with the Use Case 1 Leadership team and 1 of the Pilot involved in Validation 1. The results are summarised in Figure 2 and Figure 3 and further detailed below.

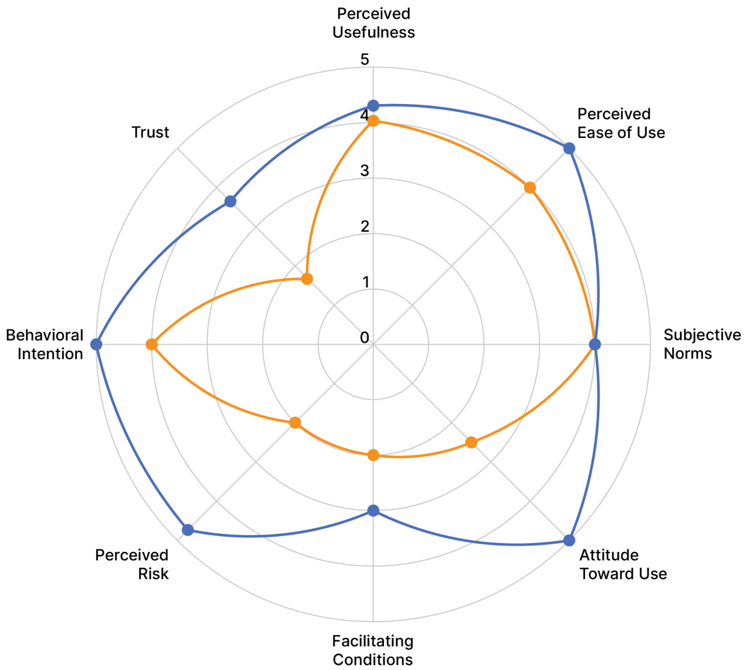

Figure 3. Spider-chart UC1 leaders (Blue) and User (Orange)

The **perceived usefulness** of FOCUS received good ratings (UC1L score: 4.3; Pilot score: 4). It is recognised for its high usefulness in case of startle effects, especially in making the pilot aware of the fact that s/he is startled. An indirect impact on workload optimization is identified, acknowledging that FOCUS could definitely help the pilot in understanding what is the relevant information to consider reducing his/her workload. However, the pilot highlighted that FOCUS could also have a negative impact on workload if the pilot does not understand why the assistant draws attention to some aspects or if it draws attention to aspects the pilot already knows.

This leads to discrepancies in the evaluation of the **perceived ease of use** of FOCUS (UC1L score: 5; Pilot score: 4) where the pilot remarked on the risk of FOCUS to interrupt, confuse and disrupt the cognitive process. This aspect is suggested to be further studied (HAIKU WP4 and 5) and tested (WP6) to avoid negative impact on pilot workload and situational awareness and ensure accuracy of both architecture and explainability requirements. A general positive feedback on usability was collected, acknowledging FOCUS intuitiveness and user-friendliness.

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Subjective norms received good ratings (UC1L score: 4; Pilot score: 4). It is expected that society would favour integrating FOCUS into operations, especially for safety improvements. However, individual values and beliefs of pilots may not fully support FOCUS's introduction. Nevertheless, the pilot highlighted the potential benefit of FOCUS in training as it could help in learning and understand what is startle and what is surprise.

Significant discrepancies emerged in the **attitude toward use** dimension (UC1L score: 5; Pilot score: 2.5). It is agreed that FOCUS would be an important partner to team-up with in case of startle effect, in both two-pilots and single pilot configuration. However, the pilot highlighted that FOCUS may lead to the feeling of "being watched" and this is a key aspect that may undermine desirability. It is therefore suggested to consider this aspect in the assistant design, defining requirements for data recording and protection that take into consideration and target this aspect.

Facilitating conditions are acknowledged to be the dimension where a set of targeted interventions to ensure a successful integration of FOCUS is deemed necessary (UC1L score: 3; Pilot score: 2). Both UC1L and the pilot agreed on the need for a dedicated training, with the pilot remarking that, despite FOCUS being intuitive and user friendly, a solid training on the assistants, its capabilities and limitations should be provided, ensuring also a relevant practice in a simulated environment to allow the pilot to learn to team-up with it and clearly understand when it works properly and when it does not. Furthermore, a manual explaining the system functionality should be provided for offline consultation.

Significant discrepancies emerged also in the **perceived risks** dimension (UC1L score: 4.75; Pilot score: 2). While the UC1L disagreed that using FOCUS would pose new threats or risks to the flight crew and society, the pilot remarked that in case of FOCUS malfunction (e.g. if it draws attention to irrelevant information) this could lead to riskier situations. Furthermore, FOCUS should be included in the minimum equipment list to avoid a situation where the pilot, trained on managing the startle effect in partnership with FOCUS, will not have it available.

Participants showed a **high behavioural intention** to use FOCUS (UC1L score: 5; Pilot score: 4), particularly in complex scenarios.

Trust emerged to be a delicate dimension (UC1L score: 3.6; Pilot score: 1.6) due some aspects already mentioned above, including system robustness and accuracy, and data privacy (especially concerning physiological measures).

In conclusion, it is agreed that FOCUS is an assistant that is needed and could definitely help pilots in case of surprise and startle effect. The startle detection and the emotion

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regulation functions are considered highly useful and could also be used for training purposes. However, there are some concerns mostly relating to the situational awareness function, as the FOCUS capability to understand the pilot mental picture and follow his/her mental processes without interrupting and confusing must be robust and accurate. This aspect is suggested to be further studied (HAIKU WP4 and 5) and targeted within VAL2 (WP6).

Use Case 2: Intelligent Assistant in the cockpit to assist in route planning/replanning

The results of the study on the societal acceptance of the Enhanced BIdirectional COMmunication for cockpit operations (COMBI) was analysed together with the Use Case 2 Leader. The results are summarised in Figure 4 and further detailed below.

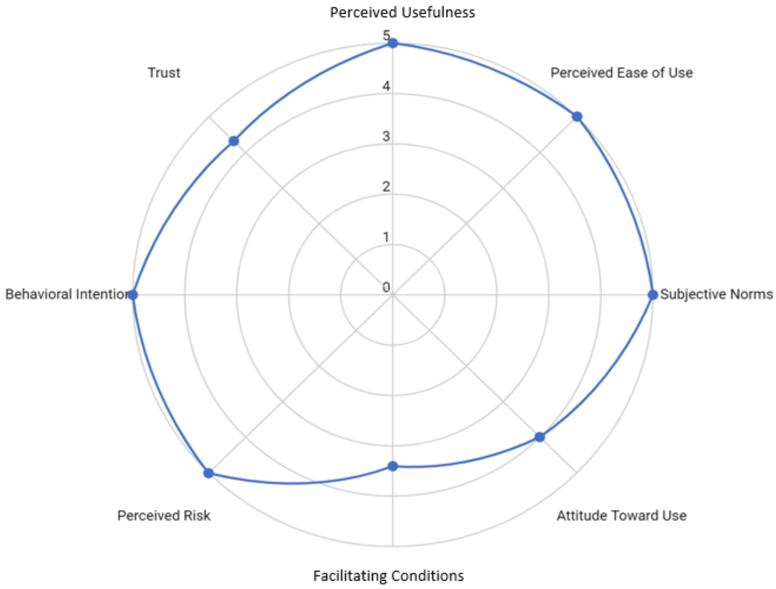

Figure 4. Spider-Chart UC2 leaders

The assessment of IA, based on COMBI, indicates overwhelmingly positive perceptions across various dimensions. The **perceived usefulness** of the IA received good ratings (score 5) acknowledging its potential to support pilots in planning and re-planning routes more quickly, enhancing overall productivity and supporting workload balancing. In terms of **perceived ease of use (score: 5),** interacting with IA based on COMBI is seen as reducing pilots' mental effort and being intuitive and easy to use (both rated 5). The real objective of mission management based on intention is to stay intuitive, as mentioned in participant comments.

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Subjective norms (score: 5)reveal that both individual values and societal beliefs strongly support the introduction and use of IA, with expectations of safety and efficiency improvements. The system considers the point of view of the pilot and society is expected to be in favour of introducing COMBI into operations. Additionally, participants expect that society would perceive the introduction of COMBI into operations as a safety and/or efficiency improvement.

Attitudes toward use are expected to be positive (score 4). However, the statement regarding IA for safety enhancement is considered not fully applicable to this UC as the system focuses on the improvement of operational intentions and not safety, although taking safety as a primary parameter.
Facilitating conditions are generally favourable (score: 3.4), with the acknowledgment that pilots need sufficient training prior to using the IA . Participants express confidence that after training, pilots would not need guidance, given the system's intuitiveness. There is also a strong belief that pilots could operate safely even in the case of IA based on COMBI failures, as the system does not directly influence safety parameters.

Perceived risks (score: 5) associated with the IA are minimal, with participants expressing confidence that its usage does not pose new threats. Malfunctions are perceived to impact parameters other than safety, such as airline profitability and passenger comfort. Extensive usage of IA based on COMBI is not anticipated to lead to skills degradation due to the system's explainability and support for pilots' decision-making skills. Explainability of the solutions allows pilots to keep their skills during decision-making, as mentioned in participant comments. Costs associated with acquiring, operating, and maintaining IA based on COMBI are not considered concerning.

Behavioural **intentions** (score: 5) and airline profitability, passenger comfort (score: 4.3) in the IA are high, with participants indicating that in complex scenarios, it would be the preferred choice for pilots, and they would recommend its use to colleagues. Trust in the IA's reliability, accuracy, and security measures is generally strong, although confidence in security and privacy receives a slightly lower score. Trust is supported by explainability, and the pilot has the final decision-making.

In conclusion, the study reflects a positive reception to the IA, emphasising its potential to enhance operational efficiency and pilots’ decision-making. Training and continued support are identified as critical factors for successful implementation, while trust in the system's reliability and security measures remains high. It is suggested to extend the assessment to the pilots involved in the system design and validation to have a broader view on perceived benefits and possible acceptance concerns so far not identified.

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Use Case 3: Digital Intelligent Assistant for Urban Air Mobility coordinator to assist in traffic management

The results of the study on the societal acceptance of the Digital assistant for UAM Coordinator (DUC) was analysed together with the Use Case 3 Leadership Team. The results are summarised in Figure 5 and further detailed below.

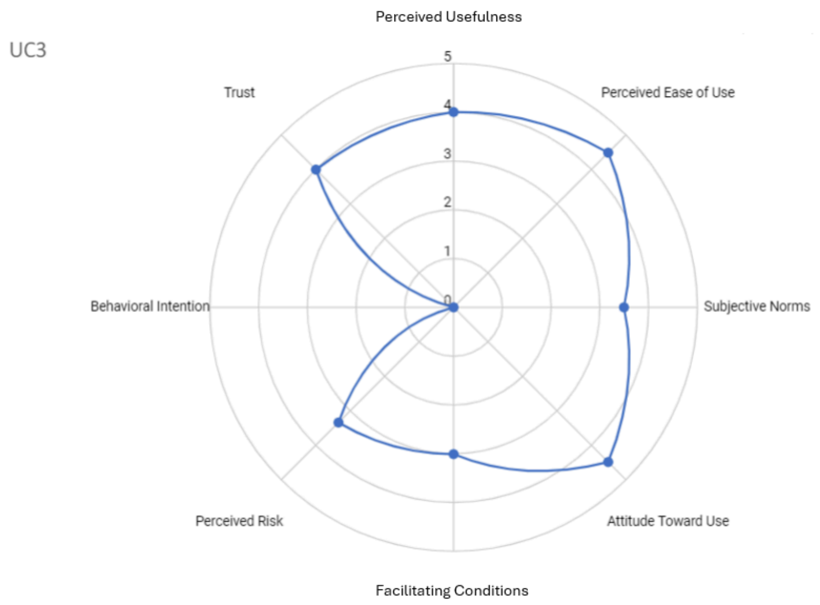

Figure 5. Spider-Chart UC3 leaders

Participants generally acknowledged the **usefulness** (score: 4) of the DUC in UAM operations, especially in view of the expected fast evolution and growth of this traffic (HAIKU Deliverable 2.1). DUC would allow the management of high traffic, performing complex calculations that exceed human capacity, and thus enable quick coordination. However, the perceived usefulness was contingent on the participants' trust in the system.

In terms of workload balancing, the participants expressed a more cautious view, assigning a rating of 3. They noted that the workload could be high regardless, and the perceived optimization would depend on the integration of adaptive functions, which are envisaged to be tested. If successfully implemented, this could potentially elevate the rating to 4.

The **perceived ease of use** for the DUC was rated favourably (score: 4.5), acknowledging its capability to reduce mental effort together with its intuitiveness and

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ease of use. However, participants emphasised the need for re-evaluation after the validation phase (VAL1).

Opinions on **subjective norms** varied. Participants highlighted the need to define the UAM Coordinator's role as part of HAIKU WP8 activities. Society's favorability towards introducing the DUC received a neutral score as it depends firstly on the acceptance of the UAM operational concept itself and, secondly on the more general acceptance of AI. The perception of the DUC contributing to safety and efficiency improvement received a rating of 4, especially in scenarios involving drones flying close to airports.

Participants expressed a strong positive **attitude toward using** the DUC in UAM operations (score: 4.5) as this would be crucial to handle the foreseen amount of traffic. However, concerns about safety were noted, highlighting the fact that this would lead to new types of risks.

Facilitating conditions are acknowledged to be the dimension where a set of targeted interventions to ensure a successful deployment of DUC is deemed necessary (score: 3). Substantial training would be fundamental to provide the UAM Coordinator with the necessary knowledge and skills to use DUC effectively, accompanied by an operator handbook consultable offline. Guidance and a checklist to use in case of system failures would be essential for safe operation, together with emergency procedures.

Perceived risks associated with the DUC were moderate (score: 3.3). While participants acknowledged that using DUC might pose new potential threats and risks, they expressed confidence that well-designed backup plans and system considerations could mitigate malfunctions, resulting in a rating of 4. Participants expressed uncertainty regarding the extensive usage of DUC leading to skill degradation. The associated costs were seen as a necessary investment to achieve high safety.

Behavioural intention is a dimension not applicable in Use Case 3 as opting for the DUC would be the UAM Coordinators' default choice.

Trust in the DUC received positive ratings (score: 4), for reliably assisting in coordinating and monitoring UAM operations and for the accuracy and reliability of its suggestions and actions. Participants highlighted the importance of periodic reanalysis by UAM Coordinators to ensure everything is functioning correctly. Confidence in the security and privacy measures of the DUC was mentioned without a numerical score, emphasising the need for another authority to oversee these aspects.

In summary, the DUC is considered a potential key asset for enabling UAM. To have a comprehensive societal acceptance analysis this study should be extended to the broader UAM operational concept which is however out of scope of HAIKU. Focusing on the UC3 and the DUC, HAIKU targets to further explore the following key aspects:

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- Evaluation of the ease of use during VAL1 and 2 (WP5 and 6);
- Definition of the UAM Coordinator role (WP8) and contribution to the design of the possible training path (WP8).

Use Case 4: Intelligent Assistant for tower (and remote tower) controllers to assist in routine and repetitive tasks for aircraft on approach

The societal acceptance of the Intelligent Sequence Assistant (ISA) was analysed in detail by involving both the Use Case 4 Leader and the 8 Air Traffic Controllers involved in Validation 1. A comparative analysis between the responses of UC4 leaders and the controllers involved in the experiment was carried out resulting in general acknowledgement of the potential benefits of integrating ISA into tower control operations. The results are summarised in Figure 6 and Figure 7 and further detailed below.

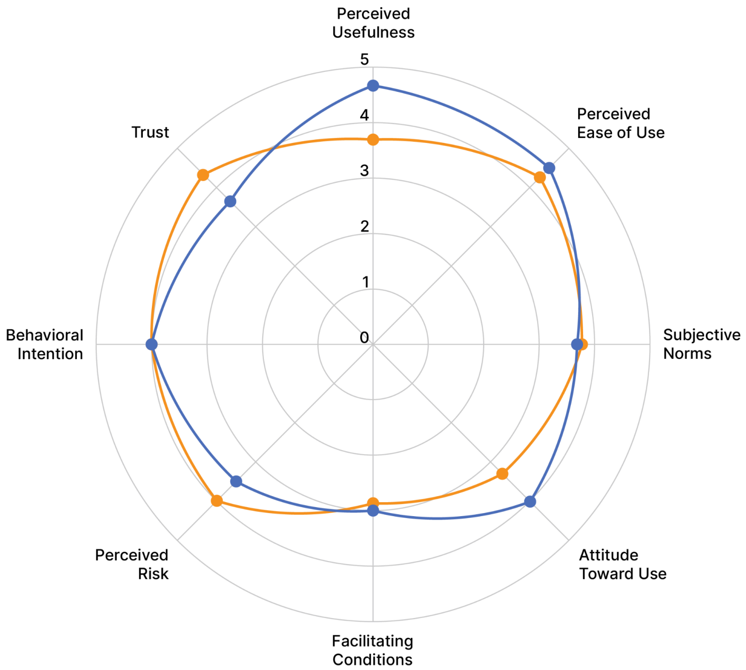

Figure 6. Spider-Chart UC4 leaders (Blue) and Users (Orange)

The **perceived usefulness** of ISA received good ratings, confirming the widespread recognition of the ISA's ability to enhance efficiency by expediting sequencing tasks and improving overall productivity. However, the perceived usefulness total score shows discrepancies between the UC4 Leader (score: 4.7) and the ATCOs (average score: 3.68) points of view. Indeed, ATCOs acknowledge the potential benefits of partnering with ISA mostly in peak traffic situations and not in low traffic ones where ISA support is considered redundant. Furthermore, ATCOs expressed concerns

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regarding potential overreliance and delegation issues, particularly in non-standard scenarios.

In terms of **perceived ease of use**, all participants expressed positive views (UC4L score: 4.5; ATCOs average score: 4.25), indicating that ISA would reduce mental effort, especially in tight operations. The HMI prototype received positive feedback, resulting to be potentially intuitive and easy to use. However, feedback and suggestions to improve the HMI were provided and are captured in HAIKU Deliverable 6.2[1]. Overall, a generally high level of agreement on the ease of incorporating ISA into existing operations among controllers is recorded.

Noticeable divergences in individual perspectives concern the **subjective norms** dimension (UC4L score: 3.6; ATCOs average score: 3.78). The UC4 Leader reported concerns about the alignment of individual values and beliefs with the introduction of ISA, highlighting potential ATCO reluctance associated with its possible impact on workforce reduction. Some ATCOs share this point of view and also raise concerns about job security and societal perceptions, while others express confidence in societal acceptance and moral alignment with ISA. Overall, it seems that there is a shared belief that both the ATCO community and society at large would favour the system's implementation, perceiving it as a safety and efficiency improvement. However, this seems to be strongly related to the more general acceptance of AI in common life.

The **attitude toward use** of ISA was generally positive (UC4L score: 4; ATCOs average score: 3.3), with participants expressing a desire to use the system and acknowledging its safety benefits. However, a minority of ATCOs, particularly from an older generation, exhibited reluctance particularly in complex scenarios where controllers may be reluctant to fully rely on ISA advice.

Facilitating conditions are acknowledged to be the dimension where a set of targeted interventions to ensure a successful integration of ISA is deemed necessary (UC4L score: 3; ATCOs average score: 2.86). Overall, ATCOs knowledge and expertise is considered sufficient to use ISA effectively and operate safely in case of ISA failures. However, the need for specific training on ISA and guidance to support the understanding of its behaviours is highlighted together with the importance of developing contingency planning and fallback procedures.

Participants' ratings on **perceived risk** vary, highlighting a moderate level of concern among controllers (UC4L score: 3.5; ATCOs average score: 3.97) mostly related to the potential risks derived from malfunctions, cyber-attacks and skills degradation. This acknowledges the need of deep diving on safety and security risks as done in HAIKU WP7 and defining training solutions capable of preventing skills degradation, as done in

[1] D6.2 First validation report (VAL1) and demonstrator (DEM1)

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HAIKU WP8. The costs associated with acquiring, operating, and maintaining ISA were not considered a cause for concern.

Behavioural intention was generally positive (UC4L score: 4; ATCOs average score: 4). Participants generally express positive intentions to use and recommend ISA, especially in complex scenarios and for inexperienced controllers. This suggests a recognition of the potential benefits of ISA, particularly in alleviating human workload during peak traffic periods and supporting the training of inexperienced controllers.

Trust in ISA was generally high (UC4L score: 4; ATCOs average score: 4.32) as participants trust the overall aviation system that ensures reliability, accuracy and safety of new tools before introducing them into operations.

In conclusion, the findings suggest an overall positive reception of ISA among tower ATCOs. It is generally acknowledged that there are potential benefits of partnering with ISA specifically in peak traffic and tight situations, where its advice would alleviate human mental effort. Trust in ISA seems not to be an issue as there is high confidence in the whole aviation system and the required steps to be performed before introducing new assistants into operations. However, some concerns were raised related to:

- The well-known reluctance associated with possible impact on workforce reduction;
- The skill degradation risks and overreliance on ISA in non-standard operations, especially for junior ATCOs. This aspects will be further analysed in HAIKU WP8;
- The risk derived from potential cyber-attacks, which is further investigated in HAIKU WP7.

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Use Case 5: Intelligent Assistant in the airport to assist safety in data analysis

The results of the study on the societal acceptance of the Airport Safety Watch (ASW) was analysed together with the Use Case 5 Leadership Team. The results are summarised in Figure 8 and further detailed below.

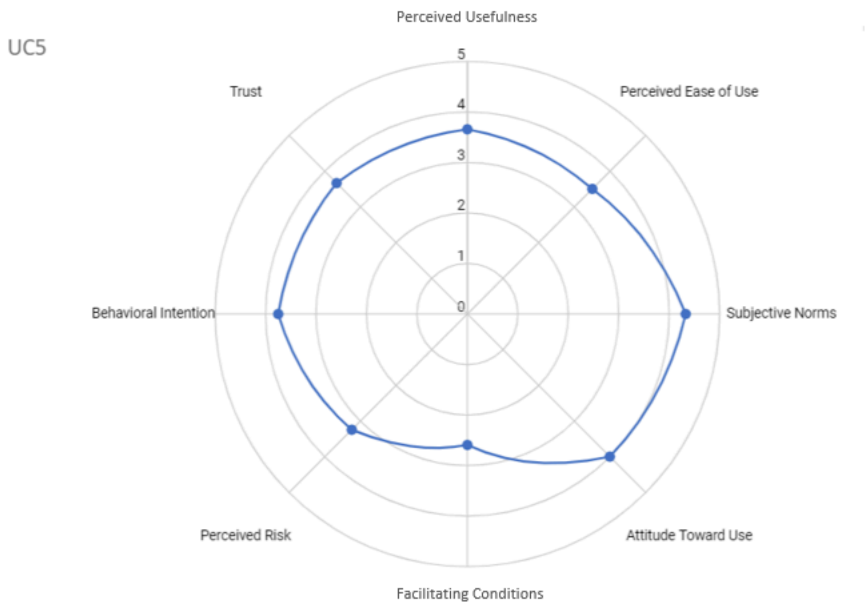

Figure 7. Spider-Chart UC5 leaders

The **perceived usefulness** of ASW received good ratings (score: 3.6), acknowledging that its main goal is to enable airport safety personnel to identify and better understand safety risks and hazards, providing new possible solutions to tackle both existing and evolving problems. However, it was noted that, to date, ASW managed to find a valuable solution for only one out of three identified issues. ASW technical developments are progressing to improve ASW capability and intelligence, thus this dimension should be re-evaluated at a later stage.

Concerning **perceived ease of use**, the participants expressed positive sentiments about ASW reducing mental effort in understanding safety risks and hazards (score: 4) as it helps the LLA Stack partners to explore the data in new ways. ASW intuitiveness and ease of use will be evaluated at later stages as the Human-Machine Interface (HMI) was not yet available.

Subjective norms received a positive rating (score: 4.3), denoting a strong support and alignment of individual values with the introduction and use of ASW. However, the study

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highlighted a dependence on the societal mindset toward AI at the time of implementation, suggesting the need for targeted awareness strategies to address potential organisational hesitations. The scores for societal favour and perception of ASF as a safety and efficiency improvement were 4, indicating conditional support based on societal acceptance.

Overall positive **attitudes toward ASF usage** were observed (score: 4). However, these positive attitudes were contingent on the evolution of ASF over time, emphasising the necessity for continuous improvements and updates to maintain positive perceptions.

Facilitating conditions are acknowledged to be the dimension where a set of targeted interventions may be required (score: 2.6). Concerns were raised about the knowledge and experience required for effective ASW utilisation, particularly in the domain of data science. Participants held diverse opinions on the need for specific training, and some underscored the necessity of guidance to understand ASW behaviours, indicating a need for tailored educational initiatives. High confidence in maintaining safety even in case of ASW failures was acknowledged.

Perceived risks were considered moderate (score: 3.3), prompting participants to advocate for a HAZOP study to address potential threats and risks associated with ASW. Notably, there was an acknowledgment that ASW malfunctions may not necessarily undermine airport safety, and extensive usage should not lead to skills degradation. The perceived costs associated with ASW, not from a financial perspective but from data sharing concerns, scored a 3, particularly relevant in VAL2.

Behavioural **intention** (score: 3.8) showed a preference for opting for ASW in complex scenarios, especially when traditional techniques proved ineffective in addressing stubborn incident patterns. However, recommendations to other airport safety teams were reserved pending further assessment in the upcoming VAL2 phase, highlighting the importance of thorough evaluations in subsequent stages.

Trust in ASW was moderate (score: 3.7), with participants adopting a wait-and-see approach, contingent on future performance and results. While trust in the accuracy and reliability of ASW suggestions scored relatively high with a score of 4, confidence in the security and privacy measures was tied to ASW being considered an add-on to existing systems. The integrated comments underscored the importance of a holistic reassessment in VAL2, particularly in terms of security and privacy measures.

In conclusion, the study suggests an overall positive initial reception of ASW among airport safety personnel, with promising feedback on perceived usefulness and positive attitudes. The integrated comments provide valuable insights into specific areas requiring attention, such as interface intuitiveness, societal mindset considerations, and comprehensive assessments in subsequent phases. These insights, along with the

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scores, will be instrumental in refining ASW, addressing concerns, and ensuring a successful integration into airport safety management operations during the upcoming VAL2 phase.

Use Case 6: Intelligent Assistant in the airport to monitor risk factor conditions associated with indoor spread of infectious diseases

The results of the study on the societal acceptance of COVAID: Covid Aid (COVAID) was analysed together with the Use Case 2 Leader. The results are summarised in Figure 9 and further detailed below.

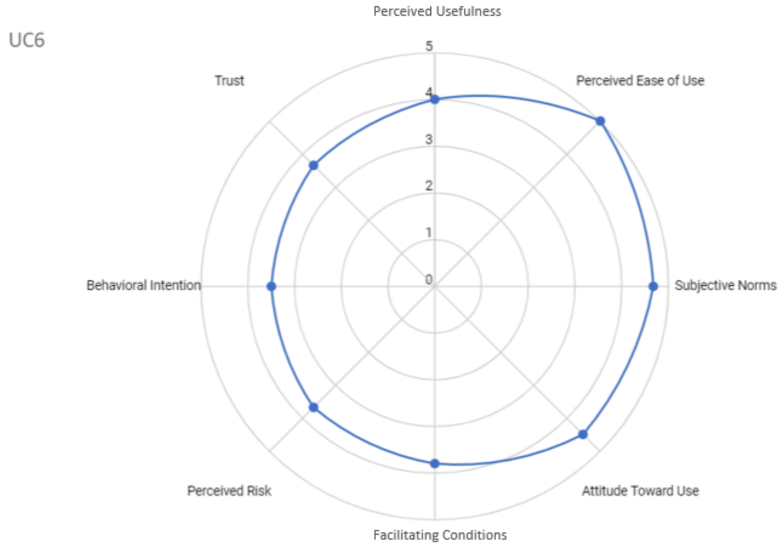

Figure 8. Spider-Chart UC6 leaders

The evaluation of COVAID reveals promising insights into its potential integration into airport operations, with scores reflecting the single participant's perspective. The UC6 Leader strongly believes that using COVAID would significantly contribute to the primary goal of preventing the spread of diseases within airport premises. However, there are reservations about its potential impact on airports' productivity (3), indicating uncertainty and emphasising the need for further investigation.

Regarding facilitating conditions, the participant expressed confidence in the ease of use for passengers (5), expecting the application to be intuitive and straightforward. There is a positive perception that passengers would have sufficient knowledge and experience to use COVAID effectively (5). However, concerns arise about potential mental stress for passengers (3), emphasising the importance of a careful design to ensure a smooth user experience.

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Subjective norms surrounding COVAID are generally positive, with the participant indicating that individual values and beliefs (4) align with the moral support for disease prevention. Moreover, society, especially after quarantine periods, is expected to be in favour of introducing COVAID (5), perceiving it as a safety and efficiency improvement.

The assessment of **perceived risk** suggests that while COVAID may not pose new threats to passengers and society (4), the participant acknowledges the need for a detailed evaluation of potential malfunctions (2). The concern is that malfunctions could lead to unintended consequences, such as overcrowded places. However, the associated costs of acquiring, operating, and maintaining COVAID are not seen as a cause for concern (5).

Behavioural intention and **attitude toward use** in COVAID appear contingent on factors such as awareness, promotion, and the perceived reliability of the application. The participant suggests that passengers' preference for COVAID in complex scenarios (3) would depend on the level of trust in AI. Recommendations to family and friends (5) are expected, provided users witness the effectiveness of COVAID in practice.

Trust in COVAID's reliability, accuracy, and security measures vary. The participant suggests that trust depends on the level of usage (4), personal preferences, and potential integration with various elements of the journey. While expressing confidence in the security and privacy measures of COVAID (3), the participant noted that the extent of personal information collection may impact overall confidence, particularly if the app becomes connected to various points in the traveller's journey.

In conclusion, the evaluation of COVAID demonstrates a provisional positive reception, particularly in terms of perceived usefulness and subjective norms. The application is perceived as highly useful (4), with the participant acknowledging its potential to effectively contribute to disease prevention in airports. The exceptional ease of use (5) for passengers is a noteworthy strength, likely contributing to positive subjective norms (4.67), as both individual values and societal perspectives align with the moral support for COVAID's introduction. Attitude toward use (4.5) reflects a favourable disposition, emphasising the anticipated benefits COVAID could bring to airport safety. While facilitating conditions (3.8) received positive feedback, the participant expressed the need for careful consideration to minimise potential mental stress for passengers. The perceived risk (3.67) highlights the participant's awareness of potential malfunctions, emphasising the importance of a nuanced evaluation. Behavioural intention (3.5) and trust (3.67) underscore the conditional nature of COVAID's acceptance, contingent on factors like awareness, personal experience, and the application's perceived reliability. Overall, COVAID shows promise, but careful attention to user experience and addressing potential concerns is crucial for its successful implementation in airport settings.

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Conclusions

The assessment of societal acceptance of AI-based systems is a key task to be performed from early stages of design as it may bring up relevant aspects that could enable or inhibit the success of the proposed solutions.
The proposed framework of analysis and related questionnaire were highly appreciated by all participants who considered it comprehensive and full of relevant points of reflection. Relevant insights emerged from this study and will be taken into account to refine the design of the proposed assistants.

The assessment approach is suggested in the following stages:

- At a conceptual stage (TRL1-2);
- At a prototype low level of maturity stage (TRL 3-4, corresponding to VAL1 activities in HAIKU);
- At a prototype medium level of maturity stage (TRL 5-6, corresponding to VAL2 activities in HAIKU for some use cases).

In all stages, it is suggested to involve both concept owners, technology developers and end-users.

Focusing on the results, the analysis of the introduction of AI systems into operations leads to the following considerations:

- Aviation stakeholders appear to **value the potential of AI,** acknowledging it as a promising way to improve safety and productivity and an interesting partner to work with. Indeed, an average positive score is recorded in the dimensions #1 Perceived usefulness #2, Subjective norms #3, Attitude towards use and #7 Behavioural intention.
- The **design/redesign of the human role**, of the **human-AI interaction** and teaming, of the **required skill-set** and related **targeted training,** seem the aspects mostly impacted, where the lowest scores were recorded (dimension #5 Facilitation conditions). HAIKU is covering this dimension in WP8 and it is suggested to pay particular attention to it, especially where the AI-based as IA represents a full-fledged new member of the team.
- Another dimension that should be carefully considered is #6 Perceived risk to identify **potential new risks** that could emerge once introducing new AI-based solutions, especially if combined with the introduction of new operational concepts such as UAM and single pilot operations. This dimension in HAIKU is further analysed in WP7.
- The **societal acceptance** of AI solutions in aviation, in this study covered by dimension #3 Subjective norms, seems to be strongly linked with the general societal perceptions and acceptance of AI. Focusing on the end-users, the

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acceptance is also strongly driven by **trust** that firstly derives from the system reliability and robustness and secondly from the quality of training provided to end-users before using it in real operations.

This preliminary study will be refined in the second half of the HAIKU project, aiming to involve all users involved in the validation activities. This will allow a broader view on perceived benefits and possible additional acceptance concerns so far not identified.

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SECTION 2: Report on end-users and stakeholders engagement activities

In the first half of the project, a variety of end-users and stakeholders have been involved in the project. An overview is provided in Table 2.

Table 2. Stakeholders engagement - Overview

AVIATION SEGMENT	ORGANISATIONS	N. OF PEOPLE (with gender details)		
		TOT	F	M
AIRLINE & AIRSIDE EXPERTS	Corsair Easyjet ECA Embraer ENAC EVA Airways HOP (Air France) ITA Airways Lufthansa Norwegian Airline Ryanair TAP THALES *Other major airlines (not disclosable)*	**30**	2	28
ATM	ANACNA ENAV EUROCONTROL LFV NATS SESAR Skyguide Skyway	**23**	6	17
UTM	Deep Blue Drone Radar Embraer EUROCONTROL Euro-USC Eve Air Mobility JEDA LFV	**12**	1	11
AIRPORT	Dublin Airport	**8**	-	8

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AVIATION SEGMENT	ORGANISATIONS	N. OF PEOPLE (with gender details)		
		TOT	F	M
	Bologna Airport Egnatia Aviation LGKM LLA Schiphol airport			
REGULATOR	EASA UK CAAi	**5**	2	3
RESEARCH/ CONSULTING	CERTH INNAXIS THALES TU Munich	**5**	1	3
PASSENGERS	-	**7**	5	2

More details on the activities in which the end-users and stakeholders have been involved are shown in In Table 3.

Table 3. Stakeholders engagement - Activities

WP	TASK & ACTIVITIES (high level)	N. OF PEOPLE
WP2	T2.1 - Human-centred AI principles | Interview	4
	T2.2 - 2030 Future landscapes | Interview	11
	T2.3 - Analysis of societal acceptance (UC1 and UC4) | Interview/Questionnaire	9
WP3	Task 3.4 – Intelligent Assistants concepts development	14
WP4	UCs requirements and concepts definition	21
WP6	UCs co-development and VAL1 activities	22
WP7	T7.3 - HAZOP (UC4)	3
	Interchange Meeting with EASA	4
WP8	T8.3 - Future workforce | Workshop	22
	T8.4 - Future skills | Workshop	2

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WP	TASK & ACTIVITIES (high level)	N. OF PEOPLE
WP9	HAIKU 1st Dissemination Event | Involvement as speaker	6

HAIKU aims at expanding his network of end-users and stakeholders in the second half of the project, also targeting a better balance from a gender perspective.

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APPENDIX A

TAM

The Technology Acceptance Model (TAM) is a widely recognized framework that explains how individuals' attitudes and perceptions influence their intention to use technology and, subsequently, their actual technology usage. Originally proposed by Fred Davis in 1985 and further refined in 1989, the TAM was developed as an adaptation of the Theory of Reasoned Action by Fishbein et al. (1975).

The TAM posits that external variables, such as media and social references, play a role in shaping individuals' perceptions of a technology's usefulness and ease of use. These perceptions, in turn, influence their intentions to use the technology, ultimately leading to the adoption of the technology and actual system usage. Delving into the key components of the TAM:

Perceived Usefulness (PU): PU refers to the extent to which a user perceives a technology as beneficial and useful in their everyday life. In other words, it assesses whether individuals believe that using the technology will enhance their job performance or daily activities. PU is considered a critical driver of an individual's intention to use a new technology. When users believe that a technology can provide substantial benefits, they are more likely to have a positive intention to adopt and use it.

Perceived Ease of Use (PEOU): PEOU represents a user's perception of how easy and convenient it is to use a technological device or system. This factor assesses the user's judgement of the simplicity and user-friendliness of the technology. PEOU is theorised to have a weaker influence on technology acceptance than PU because it is primarily relevant to the technical aspects of a device. Over time, as users become more familiar with technology, the ease of use may become less critical in influencing their intention to adopt technology. However, it's worth noting that some studies have challenged the significance of PEOU as a predictor of behavioural intention in certain contexts, suggesting that its importance may diminish when a technology is frequently used and users become more accustomed to it.

External Variables: The TAM recognizes that external variables, such as social influences and media exposure, can shape an individual's perceptions of PU and PEOU. These external factors can impact how users perceive a technology's usefulness and ease of use, subsequently affecting their behavioural intentions.

The TAM serves as a foundational framework for understanding technology adoption and acceptance. It has been influential in guiding research and practical applications in various domains. It is important to note that while the TAM provides valuable insights

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into technology acceptance, it may not account for all contextual factors and may require adaptation for specific situations.

UTAUT

The Unified Theory of Acceptance and Use of Technology (UTAUT) is a comprehensive model developed by Venkatesh et al. in 2003. It is based on the integration of various acceptance models, including the TAM, and it seeks to provide a unified framework for understanding individuals' acceptance and use of technology. UTAUT identifies key determinants of behavioural intentions and actual technology usage, taking into account various individual and contextual factors. Here is an overview of the key components of UTAUT:

- *Performance Expectancy*: Performance Expectancy in UTAUT is similar to the concept of Perceived Usefulness (PU) in TAM. It assesses the degree to which an individual believes that using the technology will lead to improvements in their job performance or overall gains. In other words, it focuses on the perceived utility and benefits of the technology for the user.
- *Effort Expectancy:* Effort Expectancy is akin to the concept of Perceived Ease of Use (PEOU) in TAM. It measures the perceived ease associated with using the technology. Users' perceptions of how easy or difficult it is to interact with the technology play a crucial role in their acceptance and intention to use it.
- *Social Influence:* Social Influence is a central factor in UTAUT, representing the extent to which individuals perceive that influential people in their social network (significant others) believe they should use the new system. This factor highlights the impact of social norms, peer pressure, and recommendations from others on individuals' technology acceptance.
- *Facilitating Conditions*: Facilitating Conditions refer to the support and resources available to users for using the technology effectively. This includes factors such as technical support, training, and infrastructure. Having the necessary conditions in place can significantly affect users' intentions and actual usage of the technology.
- *Moderators:* UTAUT recognizes that the effects of the predictors (Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions) on behavioural intentions and use behaviour can be influenced by certain moderating factors. These moderators include gender, age, voluntariness of use (whether the use of technology is mandatory or voluntary), and prior experience with similar technologies. These individual characteristics and contextual factors can enhance or diminish the impact of the predictors.

UTAUT has been widely used in research and practical applications to understand technology acceptance and usage across different cultures and contexts. It is known for its ability to explain a significant portion of the variance in behavioural intentions, typically accounting for approximately 60-70% of the variance. This makes UTAUT a

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valuable tool for organisations and researchers seeking to predict and facilitate technology adoption among users.

AIDUA

In the AIDUA model, the process begins with the primary appraisal stage. Here, users evaluate the importance of using AI devices, taking into account several crucial factors. Users consider the pleasure and enjoyment they anticipate from using the AI device. A positive user experience can enhance willingness to accept the technology. The extent to which the AI device exhibits human-like qualities, such as appearance or behaviour, is a key factor. Users may be more inclined to accept devices that replicate human characteristics.

Following the primary appraisal, users progress to the secondary appraisal stage. Here, they weigh the benefits and costs associated with AI device usage, including the AI device's ability to meet their needs and expectations. Positive assessments of performance expectancy can enhance acceptance. Users assess the perceived ease or difficulty of using the AI device. Perceived convenience can positively influence acceptance.

Throughout these appraisal stages, users develop emotions toward the AI device. These emotions can encompass a wide range, from positive feelings like excitement or trust to negative emotions like apprehension or scepticism. Emotions play a significant role in shaping user acceptance or objection to the technology.

The outcome stage is where users make their final decisions regarding the AI device, resulting in two potential outcomes. Users are willing to use the AI device for service encounters, reflecting a positive readiness to engage with the technology. Objection occurs when users are unwilling to use the AI device, instead preferring human service. This reflects a reluctance to adopt the technology.

A unique aspect of AIDUA is its recognition that acceptance and objection are not mutually exclusive. Users can exhibit mixed attitudes and behaviours toward AI technology. For example, a user may object to using an AI device for ethical reasons while still accepting and using other digital services provided by the same company. This nuanced understanding of user attitudes allows for a more comprehensive analysis of user behaviour.

AIDUA offers a detailed and multi-step framework for comprehending user acceptance and objection to AI technology, with a specific focus on AI devices in service encounters. This model acknowledges the intricate decision stages and emotional responses that influence user behaviour and provides valuable insights for researchers

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and managers seeking to develop strategies for AI device investment and adoption in real-world scenarios.

VMUTES

The VMUTES (Virtual Mobile Unmanned Aerial System Technology Acceptance and Use) model is a comprehensive framework for understanding and predicting the acceptance and use of Unmanned Aerial Systems (UAS). This model integrates elements from the Technology Acceptance Model (TAM) and the Theory of Planned Behavior while incorporating new factors. Here is a breakdown of the key factors within the VMUTES model:

Exogenous Variables:

Subjective Norms: This factor measures the influence of social norms and the opinions of others on individuals' perceptions of the usefulness of UAS, their attitude toward its use, and their behavioural intention.
Perceived Risk: It assesses the potential risks and negative consequences associated with using UA. This factor directly impacts an individual's attitude.
Knowledge of Regulations: This factor evaluates an individual's understanding and awareness of the regulations and rules governing the use of UAS. It directly influences perceived usefulness.
Facilitating Conditions: It gauges the perceived availability of resources, support, and conditions that make it easier to use UAS. This factor has a direct influence on perceived ease of use, attitude, and behavioural intention.

Endogenous Variables:

Perceived Usefulness: This variable explores individuals' perceptions of how UAS can improve their tasks or goals. It directly influences attitude.
Perceived Ease of Use: It assesses individuals' perceptions of the ease or difficulty of using UAS. This variable also affects perceived usefulness and attitude.
Attitude Toward Use: This factor measures individuals' overall attitude and emotional response toward using UAS. It is influenced by the above factors.
Behavioural Intention Toward Using UAS: Behavioural intention assesses individuals' intentions to use UAS. It is influenced by attitude.
Actual Use: Actual use measures individuals' real-world usage of UAS. It is influenced by behavioural intention.

The VMUTES model provides a comprehensive framework to understand the complex interplay of these factors and their relationships in predicting the acceptance and use of UAS. The model's structure allows researchers and practitioners to gain valuable insights into user behaviour and guide strategies for UAS adoption.

This project has received funding by the European Union's Horizon Europe research and innovation programme HORIZON-CL5-2021-D6-01-13 under Grant Agreement no 101075332

The Role of Trust

Trust is a fundamental and subjective attitude that significantly influences the acceptance and adoption of technology, including advanced technologies like AI. It allows individuals to make decisions that often involve vulnerability and reliance on a given technology or system. This trust in technology is central to users' belief that the device or system will effectively and reliably help them achieve their desired goals.

Researchers and experts have recognized the paramount importance of trust in technology acceptance, leading to its incorporation into technology acceptance models. For instance, the extension of the TAM has revealed that trust plays a pivotal role in predicting users' behavioural intentions. In some cases, trust even emerges as the strongest predictor, overshadowing the influence of PU on users' behavioural intentions.

Notably, trust extends to AI and the technology providers behind these innovations. It is a driving force behind AI acceptance, a domain where trust has been found to exhibit both direct and indirect effects on users' behavioural intentions and overall technology acceptance. Trust is a key factor in shaping users' intentions to adopt AI technology, such as AI-based healthcare technologies and Autonomous Vehicles (AVs).

Trust emerges as a fundamental factor that significantly shapes users' intentions to adopt AI technology. Moreover, trust doesn't merely operate in isolation; it also has moderating effects on various paths within technology acceptance models. For example, trust can moderate the relationship between PU and the intention to use (IU) for AI-based healthcare technologies. This means that even if the devices are not as useful as initially expected, improved trust in AI can still lead to technology adoption.

It's essential to recognize that the impact of trust and attitudes varies across different industries and contexts. While these factors may be of significant importance in one domain, their effects can differ in another. This underscores the need to tailor research and strategies to specific industries and user demographics. Both trust in AI and attitudes toward technology providers emerge as substantial predictors of AI acceptance. Researchers are increasingly encouraged to incorporate these variables into traditional technology acceptance models to gain a more comprehensive understanding of user acceptance and behaviour across various technological domains.

Trust is a linchpin in the realm of technology acceptance, shaping users' attitudes, intentions, and actual behaviour. It exerts a significant impact on AI acceptance and the adoption of advanced technologies. Understanding the multifaceted role of trust in technology acceptance is crucial for developing effective strategies for technology

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adoption and use, considering the varying influences of age, gender, and industry context.

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