A Holistic Approach to Sustainable, Digital **EU** Agriculture, Forestry, Livestock and Rural Development based on Reconfigurable Aerial Enablers and Edge Artificial Intelligence-on-Demand Systems

CHAMELEON D.6.1 Pilot campaign plan open call on boarding and evaluation methodology

Work package	WP6: CHAMELEON Applicability and piloting
Task	Task 6.1: Pilot campaign plan open call on boarding and evaluation methodology
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Revision and history chart

Version	Date	Main author	Summary of changes
0.1	20/03/2023	Alberto López Casillas	Draft outline
0.2	23/03/2023	Alberto López Casillas	Changes provided by contributors
0.3	04/04/2023	Alberto López Casillas	Inclusion of contributions of bundle developers for Pilot Case Uses.
1.0	03/05/2023	Alberto López Casillas	Proposal for partners meeting contributions
1.1	10/07/2023	Alberto López Casillas	Pre-final document for review
1.2	19/07/2023	Laura Piedelobo	Pre-final document for review
1.2	20/07/2023	LAMMC	Pre-final document for review
1.3	21/07/2023	Alberto López Casillas	Final Document
1.4	11/08/2023	Georg Aumayr	Compilation of final document with strategy elements of WP6

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1 Abbreviation list

Abbrevation	**Full Text**
TAM	Technology Acceptance Model
STS	Socio-technical system
ICT	Information and communication technology
UAV	Unmaned Aireal Vehicle
VLOS	Visual Line of Sight
UC	Use Case
SUS	System Usability Scale
USE scale	Ease of Use and Ease of Learning Scale
TC Scale	Technology Acceptance and Technology Competence Scale
TRL	Technology readiness level

2 GENERAL GOAL

GENERAL GOAL OF THE TASK

The task goal is the definition of high-level strategy, planning and methodology for the Demos proposed on the CHAMELEON Demos.

There has been a selection and agreement on the bundles to be included on the Demo campaign, according to WP4 and expectations for the project.

It has been defined the framework to plan pilot campaign and defined the guidelines to provide the needs for the Pilot realization.

The high-level strategy for Demos consecution is based on the split of Use Cases into activities for being conducted according to its own time and considerations under the general framework of the Use Cases.

For this purpose, the action flow is based on the bundles collected in deliverable 2.1. per pilot case. Each bundle will be considered as an activity with tasks and subtasks to be conducted, definition of features of the tasks, identification of stakeholders involved on the consecution of the tasks and evaluation.

The information collected per bundle has been transformed in a Gantt diagram with a document to evaluate the advance on its development, in order to define a planning framework for evaluating the advances on the development of Use Cases according to a general methodology based on the analysis of each activity.

3 PILOT PLAN ACTIVITIES

Task 6.1 is dedicated to set up a strategy for the pilot execution and evaluation of CHAMELEON. Therefor it is necessary to be aware of the pilot specialties and aims, as they are dealing with different issues. The general AIM OF THE PILOTS is to evaluate the perceived usefulness of the CHAMELEON bundles and to identify the improvement potential. By this, the pilots work in iterative cycles. The term "pilot" is dedicated to the execution of a close to real life testing scenario for the dedicated bundle and the accompanying evaluation. The results of each pilot will feed the developers and will be tested in the next iteration. In total, there are 3 iterations envisaged: 1. Primary set up and requirements check 2. Testing of first improvement 3. Final Evaluation of the project developments.

In table 1, an overview of the pilot sites is given with the responsible entities and the main contacts for the pilots with a status at the 30.07.2023.

Pilot site	Responsible Entity	Main Contact	1. Iteration planned	2. Iteration planned	3. Iteration planned
Greece	MAICh	Chariton Kalaitzidis chariton@maich.gr	14.04.2024 - 10.07.2024	14.10.2024 - 10.11.2024	14.04.2025 - 10.07.2025
Spain	AVILA	Alberto Lopez - alopez@diputacionavila.es	01.03.2024 - 14.04.2024	01.08.2024 - 30.09.2024	01.03.2025 - 14.04.2025
Austria Forest	JOAFG	Geogr.aumayr@johanniter.at	01.10.2023-01.12.2023	01.01.2024-01.03.2024	01.01.2025-01.03.2025
Austria Vineyard	JOAFG	Clemens.liehr@johanniter.at	10.09.2023-15.12.2023	10.10.2024-15.02.2025	10.05.2025-15.07.2025

Table 1 Pilot overview

3.1 Overview of Pilots and Specialties

Each pilot has its own bundles and aims as well as challenges. In each country, the areas are differing a lot and the environmental requirements are different. With CHAMELEON T6.1 an overall strategy has to be found to make a common framework for 3 very different pilots.

3.1.1 Greece

Expectations

The Greek pilot is predominantly about the topic of monitoring of livestock.

Following features are the main core of interest:

- Remote Scanning: Monitor the herd from an optimal distance, ensuring minimal stress while providing clear imaging.
- Movement Modeling: Track irregularities in herd movement, identifying potential health issues through behavioural analysis.
- Thermal Health Monitoring: Use of Thermal Cameras to ascertain health status by measuring body temperature and detecting posture anomalies.
- Alert System: Includes an alert mechanism for the herd owner, signaling health issues or straying individuals, using data from the movement model and thermal readings.
- Position Monitoring: Features an automated mapping system for swift, accurate location determination, particularly valuable in emergency situations.

Working Environment

The pilot operates in a small valley (at the highest heights of the mountainous Sfakia region) that operates as the main base camp for most herders (including the GR Pilot case herd owner). This area is notable for its isolated and difficult terrain, as well as its typical shrub-filled vegetation, which is common on the island. The valley is surrounded by steep and empty mountain slopes, featuring ancient trails known only to the local goatherders. The region often experiences changing wind patterns.

User of Chameleon

The local goatherds and shepherds in the pilot area will utilize the CHAMELEON system. They generally possess roughly a high school education and exhibit the typical traits and behavior found among the rural, mountainous populations of Crete. It is important to present technical and complex information in a simple and easily understandable manner for them. Also, the provided system needs to be easy-to-operate and some instructions may be provided in Greek.

Complications expected

- Variable wind conditions, which the drone must be able to handle and adjust to, due to the steep rises in elevation in parts of the Pilot Area.
- Range & autonomy: Since the extend of the pilot region from the center of the valley reaches upwards to 2000 meters, different parameters for distance, elevation and weather conditions need to be considered.
- Flying Altitude: If too high (>80m), identification becomes hard. If too low (<30m), animals get scared of the noise. Ideal altitude 50-60m.

At least in the Pilot Area, there doesn't seem to be much need for monitoring flora at high-altitude grazing areas or fertilization for seasonal animal feeding (partly because of the hard lines drawn between the grazing ground borders among the pastural populations of the mountains). Some interest was expressed for its application on fertilizing the wintering pastures.

3.1.2 Spain

Expectations

The CHAMELEON system must be able to feature the following:

- Identification of wildfire high risk areas. Allow the identification of wildfire high risk areas associated to the vegetation state. Introduction of risk factors like vegetation continuity and fuel models.
- Identification of wildfire high risk areas. Allow the identification of the zones within the urban-forest interface in order to prioritize the actions to be conducted on those areas in terms of wildfire prevention and self-protection. It would be interesting to offer information for firefighters (evacuation paths, extinction means, best places to act…) to improve the actions in emergencies.
- Identification of wildfire starting points. Accelerate the identification of wildfire starting points to improve the chances of controlling it. Include first estimations of wildfire evolution from the starting point, to offer information for extinction.
- Remote Scanning: Monitor the herd from an optimal distance, ensuring minimal stress while providing clear imaging.
- Movement Modeling: Track irregularities in herd movement, identifying potential health issues through behavioral analysis. Identify weird movements that could mean wild animals attacks, to protect herd.
- Thermal Health Monitoring: Use of Thermal Cameras to ascertain health status by measuring body temperature and detecting posture anomalies.
- Alert System: Includes an alert mechanism for the herd owner, signaling health issues or straying individuals, using data from the movement model and thermal readings.

- Position Monitoring: Features an automated mapping system for swift, accurate location determination, particularly valuable in emergency situations.
- Analysis of crop development. Monitor the crop development to identify potential deviations in the expected results to improve the management.
- Identification of water stress. Anticipate potential damages due to droughts in crops, to improve the management decision process.
- Identify soil catalogue. Identify particularities in soil in small lands to improve management decision process. Identification of particularities of soil that can be remarkable for crops.

Working environment

For Forest cases, the environments are two. On one hand, forest in mountain areas where continuity of vegetation is real and there are some problems for access in some places. On the other hand, the urban-forest inter-phase is located close to urban areas so the environment is adequate for technical requirements.

User of Chameleon

The forest Pilot cases have two main target groups of users. On one hand, the responsible of prevention and extinction of wildfires, who usually have enough technical training to use results and products. On the other hand, municipalities responsible who probably will not have the technical capabilities to use technical and complex information.

The Livestock pilot case system would be used by farmers and shepherds, who will probably not have the technical capabilities to use technical and complex information.

The vineyard pilot case system would have two main users. On one hand the technicians in charge of providing management services for farmers. This group has enough technical capabilities to use it properly. On the other hand, the farmers, that could use it to obtain information for improving the management. This group has probably not enough technical capabilities to use technical and complex information

Complications expected

- Size of the field where herd lives. Cows are on the field, in freedom, so it is difficult to identify paths for them. It can be used those moments where cattle are managed for sanitary reasons, because there is a concentration on closed areas.
- Licenses and permissions to flight drones.
- Interruption of wildfire extinction activities is not possible.

3.1.3 Austria

Expectations

Forest

- Crop and vegetation monitoring. To receive local funding, it is necessary to count trees and species on a regular base.
- Damage monitoring. After a heavy weather situation, the forest has to be checked for debris and damages to trees that could cause danger to people living the area.
- Healthstatus and pest detection. To ensure a healthy forest, it is necessary to have an early detection system to identify pests in the forest and to act against them at an early stage. CHAMELEON is expected to help in this.
- Monitoring of humidity of soil and plants for assessing risk of fire. It is expected that CHAMELEON provides help in this area to support prevention measurements e.g. prohibition of smoking in the forest during drought.

Vineyard

- Damage monitoring. After heavy storms and hail, the vineyard has to be checked for damage.
- Due to droughts and heatwaves but also after heavy rain falls or longer periods of moist weather conditions, the humidity level of the soil and plants has to be checked to identify needed artificial watering.

Working Environment

Forest

For the forest, the area is steep and at the bottom f the valley, a natural river is flowing to the next settlement. During the last 30 years more and more people moved to the valley from the nearby City of Linz, the regional capital. The area has no flight restrictions and is narrowly planted. In the 70s and 80s and 90s the forest was a pure needle wood forest. This has changed since 2000.

Vineyard

The Vineyard is a professional vineyard of a local winemaker. It is at a hill side and completely private property. Nearby are no special flight zones. Drones can work without permissions.

Users of Chameleon

Forest

Users of the CHAMELEON System are going to be local people that normally have job for their living and are working as part-time farmers and Forestiers. They have different education backgrounds. For the envisaged area, the main forester is a stone mason, freshly married and his family is supporting him in the forestation. The forest is within this family for centuries.

Vineyard

Users of the CHAMELEON system are absolvents from the University of Agriculture and Forestry of Vienna and hold an Engineering Diploma for Agriculture. They are working for some generations already in this area as vinters and have expanded to an international market in the latest years. They are very well known for the quality and special taste of their sorts and species. They have already experience with data collection of their soil and a system installed.

Complications expected

Due to the hill structure, it could happen that there need to be several serial flights to cover the area as VLOS flight is mandatory.

3.2 Planning procedures and meetings

For the pilot planning, overall structures for each pilot have been described and documented as UML and process model.

All pilots follow the same procedure over time within their specialities. The methodology is the unifying element, not the content.

Each pilot will provide initial use cases and a design for the envisaged experiments. Within the first pilot action, under worst condition, a table top exercise for planning the next steps will be done. Therefore, mock ups and wireframes need to be provided by the technical partners together with the envisaged operation specifications.

The 2nd pilot action will then focus on a hands on aspect of the bundles and the perceived usefulness within the pilot setting.

The 3rd and final pilot action is the test of the full scale prototype of CHAMELEON under real life conditions.

Whereas the time between the 1st and the 2nd pilot action is dedicated to development, the time between 2nd and 3rd pilot is for refining the CHAMELEON prototype.

To keep an overview and everyone on the same page, regular meetings (1st Wednesday every month) are organised by JOAFG to bring up current issues of WP6 and the pilot planning. This call is dedicated to problem solving and pilot coordination.

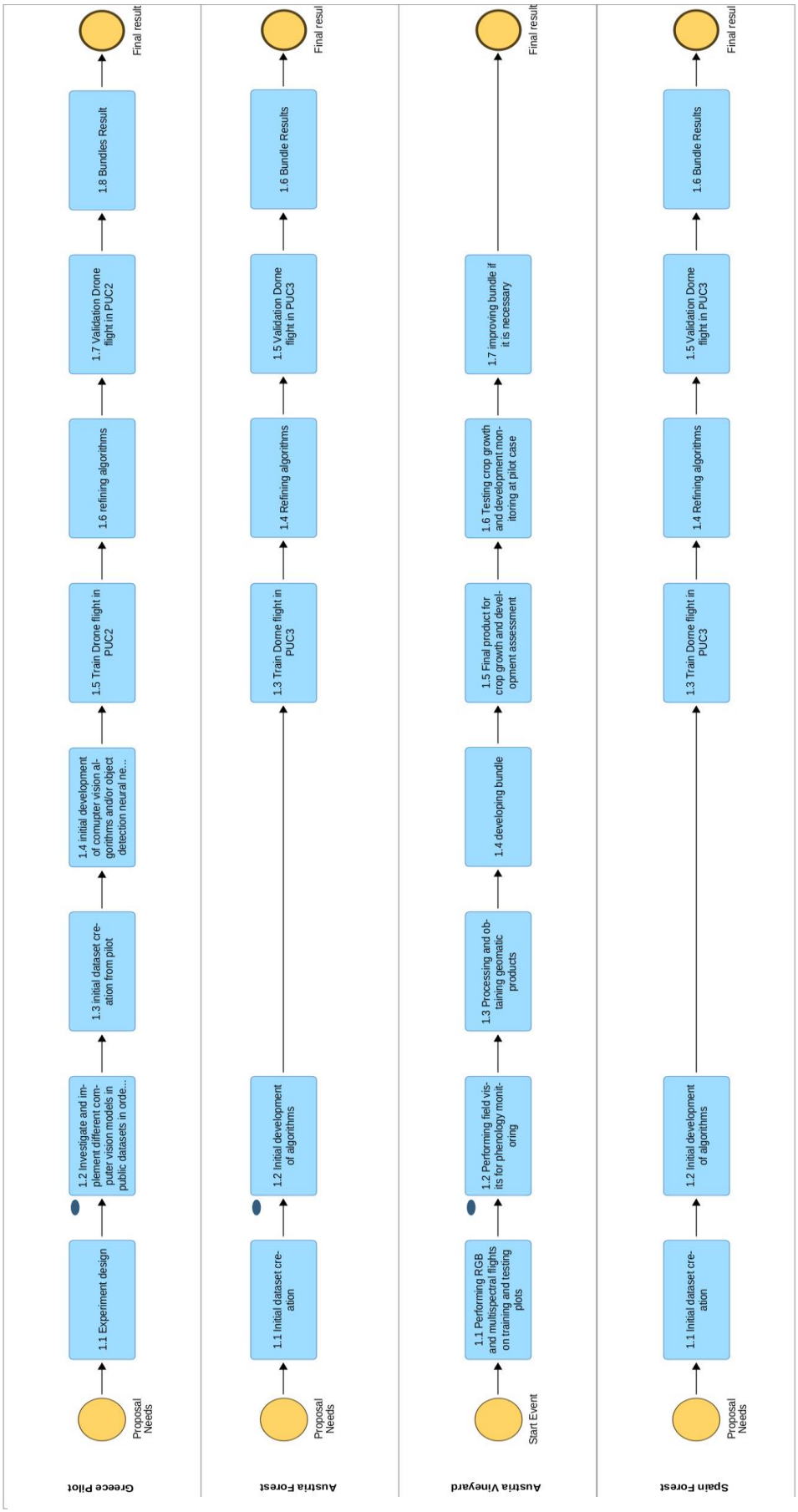

Figure 1 Pilot Overview Process steps

3.3 Timeframe for pilot actions

As each of the pilots has a different field of action, the execution as to follow the needs. It is a challenge to move the needed devices and system components to each pilot site and to have them done within a dedicated timeframe, that is partly overlapping. Following the prerequisites of each pilot a GANTT Chart is possible to solve the logistics as well as the availability of demonstrators of the hardware components. With a first draft of a GANTT chart that is following the windows of opportunity at the pilot sites, a detailed planning should be possible for the pilot sites as well as for the development roadmaps.

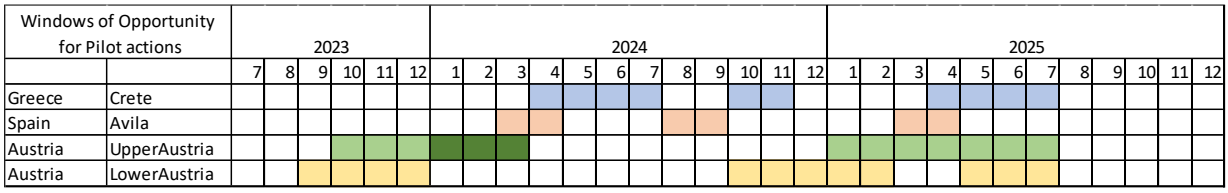

Figure 2 GANTT Windows of Opportunity for Pilots

Figure 2 shows the overview of the different pilot sites with their windows of opportunity to test with the CHAMELEON system with their use cases.

3.4 Pilot strategy

3.4.1 Resources to be committed to each pilot

Role model for pilots

To ensure that all pilots are running the same structure, predefined roles have been defined.

For each pilot site, all roles are defined in the document “Pilot Role model and contacts.xlsx” on the shared space of the CHAMELEON project. Table 2 explains the type of roles, that are in principle developed from a crisis response staff.

Type		Description
CHAMELEON pilot leader	EXCON	This is the main contact person for the pilot in a region. The responsibility for the pilot is with this person. Tasks are organisation (through team), escalation point for questions, descision maker for pilot
CHAMELEON pilot support S6 (tech)	Technical partner	S6 is taking care about the technical situation onsite of the pilot and the check of all technologies for the pilot, if they are working properly. Additionally, this position is responsible for the communication streams between pilot elements (S1-S6 , team onsite etc.) This position has to be covered with technicians that can onsite repair, manage and set up all technical infrastructure that is needed and is for other technical solution provider the main contact for the pilot
CHAMELEON pilot support (eval)	Evaluation team	The evaluation support is the main contact for all evaluation questions for the aim of the pilot. This position is responsible to provide questionnaires, execute

		interviews and document the pilot. They report to S3
CHAMELEON pilot support S3 (execution org.)	EXCON	The execution/operation position is monitoring the pilot if all procedures are running and when a new action within the pilot has to be triggered. S3 is responsible for the pilot management during the execution, coordination with other teams, permissions collection, warning and alerts and reports to the pilot leader. All procedures for the pilot execution are coordinated at this position.
CHAMELEON pilot DRONE PILOTS		The drone pilots will steer the drones according to the mission briefing by the pilot leader. They are responsible for the technical readiness of the drone and the sensors on the drone and the data connectivity from drone to the target system. The drone pilots will not operate as a single person but as a unit onsite. Drone pilots are subordinate to the pilot leader.
CHAMELEON pilot support S1 (staff org.)	EXCON	S1 is taking care of staff/personnel necessary for the pilot execution. All participants register at S1. This position has the contact information of all participants. It is responsible that all needed people are with the pilot and are available at the right time at the right place.

CHAMELEON pilot support S2 (current situ ion org.)	EXCON	S2 is collecting all information about the current situation at the pilot area. This position will work and a map of all units at the field, potential damages and problems, areas of action and visualisation of units and troops in the field. This position reports to the pilot leader. With this position, the pilot diary is running and documentation of the pilot procedures have to be done
CHAMELEON pilot support S4 (logistics, allowances)	EXCON	S4 can organize support units (power supply, fuel etc.), takes care about drinks and food for the pilot, Supply material for maintenance, safety and security at the pilot site, support in accomodation.
CHAMELEON pilot support S5 (Disseminaion, press)	EXCON	S5 is the dissemination cell. At this position, all material for dissemination is collected. Directly from there, social media as well as press contacts are organized. If there is interest from media to be onsite at the pilot, S5 is coordinating this action. This position reports to pilot leader and S2/S3/S4

Table 2 Pilot Roles

Materials

For the CHAMELEON pilot, several materials are necessary to secure the execution of the pilots.

Personell (S1)

For execution of the pilots, an organisations and preparation team is necessary, that will also handle the pilot onsite. For each pilot, the necessary roles are defined and need to be staffed. Furthermore, the operative element, the user, needs to be briefed and supported. This can be

done by the pilot leader. Next to the defined roles, in detail, technical partners will have to participate at the pilot sites to cover necessary actions from system side and prepare everything to run smoothly during the execution phase. Each pilot is estimated to be handled by at least 6 people and representatives of the users.

IT Equipment and Software (S6)

The IT Equipment needs to be defined by the technical partners. Also all power supplies, connectivity (wifi, LTE/5G, LAN) and environmental robustness needs to be known and available. A full equipment list needs to be provided for each bundle of CHAMELEON to ensure the function during the pilot actions. All of this equipment needs to be checked onsite before the pilot actions start.

Same goes for the software. Everything needs to be pre-checked onsite for full functionality. Especially for the perceived usefulness, all waiting times, data transfer times etc. need to be known and part of the user briefing to ensure that the CHAMELEON in its functionality is tested and not latencies of bad connections.

Logistics (S4)

As the pilot sites are not in well habituated areas, logistics are a core action of the pilot actions. Next to the idea of running costs of the systems, it is mandatory that all necessary supplies are available onsite to make the CHAMELEON system running. For the team, there must be sufficient supplies and transportation capacity. For damages and system failures, there need to be backups in reasonable reach. For all mobile elements, mobility needs to be secured. All allowances need to be pre-checked and available at the pilot action day(s). Pilot logistics starts from the nearest airport to the pilot site. For providing necessary material to the target airport, the relevant partner of CHAMELEON is responsible.

Drone Pilot register

Each pilot site needs to run a drone pilot register to ensure that all people who are handling a drone are allowed by national and EU law to do so. Therefor the drone training according to EASA guidelines for drone pilots needs to be certified and available. Also, each drone needs to be registered and has to have a proper insurance. Within the drone pilot register, the all this information is collected.

Parnter	Name	Surname	Pilot Registration ID	Acting under Droneprovider Reg. Nr.	Trained on	Pilot for AT	Pilot for GR	Pilot for ES

					drone (Type)			
JOAFG	Georg	Aumayr	XXXXXXX	XXXXXX	DJI MAVIC 3	Yes	Yes	Yes
JOAFG	Birgit	Schilcher	YYYYYYY	XXXXXX	DJI MAVIC 3	Yes	No	No

Table 3 Drone pilot register Example filled in

The document is available at the CHAMELEON shared space as “Drone Pilot Register.xlsx”

Contact details for pilot regions

Greece:

Chariton Kalaitzidis chariton@maich.gr

Spain:

Alberto Lopez - alopez@diputacionavila.es

Austria:

Georg Aumayr Georg.aumayr@johanniter.at

Clemens Liehr Clemens.liehr@johanniter.at

3.5 LIST OF PILOT use cases

The pilots, the cases and the Business Use Case of the Pilot Use to be developed in Chameleon, according to the conceptualisation and use cases definition of Deliverable 2.1 are in table 1. The CHAMELEON solution will be demonstrated and validated under three relevant pilots: i) Vienna-Austria, ii) Crete-Greece, and iii) Avila-Spain. The pilot use cases in Austria identified by stakeholders are Forest and Vineyard, Greece – Livestock and Pasture, Spain – Forest, Livestock, and Vineyard. Each pilot use cases have a few business use cases.

Table 1: Pilot, pilot cases and Business Use Case

Pilot	Pilot use cases	Business Use Case
Vienna – Austria	Forest	Crop and vegetation monitoring Extreme weather event and drought Health and pests Wildfire
	Vineyard	Crop and vegetation monitoring Extreme weather event and drought Health and pests
Crete - Greece	Livestock	Monitoring livestock
	Pasture	Crop and vegetation monitoring
Avila - Spain	Forest	Crop and vegetation monitoring Health and pests Wildfire
	Livestock	Monitoring livestock
	Vineyard	Crop and vegetation monitoring Extreme weather event and drought Health and pests Soil

The Business Use Cases have a relation with the bundles of each pilot case. These bundles are actions to be conducted on each Pilot with a specific purpose and indicator. The list of bundles, related to each Business Use Case is in table 2. The Austria pilot covers five bundles, Greece – has two bundles, and Spain – has five bundles.

Table 2: Pilot, pilot cases and Business Use Case

Pilot use cases	Business Use Case	Bundle
Vienna – Austria Forest	Crop and vegetation monitoring	Vegetation monitoring and census: tree census, species, treetop colour
	Extreme weather event and drought	Large woody debris on rivers
	Health and pests	Health status of vegetation (mainly bark beetle), game browsing, ground cover and fungal growth
	Wildfire	Monitoring humidity of soil and plants for assessing risk of fire

Vienna – Austria Vineyard	Crop and vegetation monitoring	Crop growth and development monitoring
	Extreme weather event and drought	Vineyard water stress due to drought
Crete – Greece Livestock	Monitoring livestock	Livestock management (herd) and monitoring (individual animal) Animals' health
Crete – Greece Pasture	Crop and vegetation monitoring	Monitoring flora at high-altitude grazing areas for seasonal animal feeding
Ávila – Spain Forest	Crop and vegetation monitoring	Continuity of vegetation
	Wildfire	Characterization of urban-forest interface. Access for firefighters, evacuation and biomass Hot spot identification at the beginning of wildfire
Ávila – Spain Livestock	Monitoring livestock	Collecting information about health status and stress (wild animals) Lameness detection in cows
Ávila - Spain Vineyard	Crop and vegetation monitoring	Crop growth and development monitoring
	Extreme weather event and drought	Vineyard water stress due to drought
	Soil	Soil zonification

After prioritizing the Agriculture, Livestock and Forestry bundles, some of the important bundles were selected and prepared to submit for the Open calls, which are planned during the implementation stage CHAMELEON project. The list of selected bundles for Open calls provided in Table 3.

Pilot use cases	Business Use Case	Bundle
Vienna – Austria Forest	Extreme weather event and drought	Woody debris on forest slopes
		Load of snow on the trees (depth)
Crete – Greece Pasture	Crop and vegetation monitoring	Application of fertilizers in inaccessible grazing areas of high altitude
Ávila – Spain Livestock	Monitoring livestock	Monitoring livestock/ individual animal/ virtual fences

Third parties officially will be able to participate and submit applications in Open Calls, based on their expertise and experience.

3.6 Bundles for pilot

3.6.1 Austrian Pilot

Austria (USAL)	Forest	Crop and vegetation monitoring	Vegetation monitoring and census: tree census, species, treetop colour
Austria (USAL)	Forest	Extrem weather event and drought	Large woody debris on rivers
Austria (LAMMC)	Forest	Health and pests	Health status of vegetation (mainly bark beetle),game browising, ground cover,and and fungal growth
Austria (USAL)	Forest	Wildfire	Monitoring humidity of soil and plants for assessing risk of fire
Austria (UCLM)	Vineyard	Crop and vegetation monitoring	monitoring (Vineyard damage evaluation due to heavy wind storms; Vineyard damage evaluation due to
Austria (UCLM)	Vineyard	Extrem weather event and drought	Vineyard water stress due to drought.

3.6.2 Greek Pilot

Greece (AIDEAS)	Livestock	Monitoring livestock	Livestock management (herd) and monitoring (individual animal)
Greece (AIDEAS)	Livestock	Monitoring livestock	Animals health
Greece (UCLM)	Pasture	Crop and vegetation monitoring	Monitoring flora at high-altitude grazing areas for seasonal animal feeding

3.6.3 Spanish Pilot

Spain (USAL)	Forest	Crop and vegetation monitoring	Continuity of vegetation
Spain (USAL)	Forest	Wildfire	Characterization of urban-forest interface. Access for firefighters, evacuation, and biomass
Spain (USAL)	Forest	Wildfire	Hot spot identification at the beginning of wildfire
Spain (USAL)	Livestock	Monitoring livestock	Collecting information about health status and stress (wild animals)
Spain (AIDEAS)	Livestock	Monitoring livestock	Lameness detection in Cows
Spain (UCLM)	Vineyard	Crop and vegetation monitoring	Crop growth and development monitoring.
Spain (UCLM)	Vineyard	Extrem weather event and drought	Vineyard water stress due to drought.
Spain (UCLM)	Vineyard	Soil	Soil zonification

3.7 PILOT PLAN ACTIVITIES and development roadmap

The pilot plan contains different bundles as actions to be conducted on each Pilot. Bundles have been split into tasks and subtasks to plan the development of the activities.

Each bundle of the Pilot Case has its own a number and title (e.g.: 1. Vegetation monitoring and census) and each task / subtask has a chronological code for each bundle (e.g: 1.1 Identification of location; 1.2 Vegetation data collection). The distribution of tasks, provided in a Gantt diagram, will allow responsible following the advances of each bundles' associated work.

1.1.1 AUSTRIA PILOT CASES

1.1.1.1 FOREST

BUNDLE	1. Vegetation monitoring and census: tree census, tree traits (coordinates, tree height and crown diamater), forest type, treetop colour and shape																														
	2022						2023												2024												
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1.1 Initial dataset creation	Dataset USAL_Forest, HRL Forest CLMS																													
1.2 Initial development of algorithms, using existing dataset																														
1.3 (Train) Drone flight in PUC3																														
1.4 Refining algorithms																														
1.5 (Validation) Drone flight in PUC3																														
1.6 Bundle results																														

BUNDLE	3. Large debris on slops on rivers																														
	2022						2023												2024												
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
3.1 Initial development of computer vision algorithms and/or object detection neural networks, using existing dataset	Dataset USAL_Jucar_River																													
3.2 (Train) Drone flight in PUC3																														
3.3 Refining algorithms																														
3.4 (Validation) Drone flight in PUC3																														
3.5 Bundle results																														

BUNDLE	6. Health status of vegetation, game browing, ground cover and fungal growth																														
	2022						2023												2024												
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
6.1 Initial dataset creation	Dataset LAMMC_Forest, Dubrava Forest HS																													
6.2 Initial development of algorithms, using existing dataset																														
6.3 (Train) Drone flight in PUC3																														
6.4 Refining algorithms																														
6.5 (Validation) Drone flight in PUC3																														
6.6 Bundle results																														

BUNDLE	7. Monitoring humidity of soil and plants for assessing risk of fire																												
	2022						2023												2024										
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
7.1 Initial dataset creation	Dataset USAL_Tietar_Valley, HRL Forest CLMS, Corine Land Cover CLMS, HRL Water & Wetness CLMS																													
7.2 Initial development of algorithms, using existing dataset																														
7.3 (Train) Drone flight in PUC3																														
7.4 Refining algorithms																														
7.5 (Validation) Drone flight in PUC3																														
7.6 Bundle results																														

1.1.1.2 VINEYARD

BUNDLE	1. Crop growth and development monitoring																												
	2022						2023												2024										
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1.1. Performing RGB and multiespectral flights on training and testing plots	Dataset generated during project life in Albacete province																												
1.2. Performing field visits for phenology monitoring																														
1.3. Processing and obtaining geomatic products																														
1.4. Developing bundle.																														
1.5. Final product for crop growth and development assessment																														
1.6. Testing crop growth and development monitoring at pilot case																														
1.7. Improving bundle if it is necessary																														

BUNDLE	3. Vineyard water stress due to drought																												
	2022						2023												2024										
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
3.1. Performing RGB, multiespectral, and thermal flights on training and testing plots	Dataset generated during project life in Albacete province																												
3.2. Performing field measurements of stomatal conductance																														
3.3. Processing and obtaining geomatic products																														
3.4 Developing bundle																														
3.5 Final product for water stress assessment																														
3.6 Testing water stress at pilot case																														
3.7 Improving bundle if it is necessary																														

1.1.2 GREECE PILOT CASES

1.1.2.1 LIVESTOCK

BUNDLE	1. Livestock management (herd) and monitoring (individual animal)

	2022						2023												2024											
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1.1 Experiment design - Investigate existing datasets																														
1.2 Investigate and implement different computer vision models in public datasets in order to define the dataset requirement.																														
1.3 Initial dataset creation from Pilot.																														
1.4 Initial development of computer vision algorithms and/or object detection neural networks, using existing dataset																														
1.5 (Train) Drone flight in PUC2																														
1.6 Refining algorithms																														
1.7 (Validation) Drone flight in PUC2																														
1.8 Bundle results																														

BUNDLE	2. Animals health

	2022						2023												2024											
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
2.1 Experiment design - Investigate existing datasets																														
2.2 Investigate and implement different computer vision models in public datasets in order to define the dataset requirement.																														
2.3 Initial dataset creation from Pilot.																														
2.4 Initial development of computer vision algorithms and/or object detection neural networks, using existing dataset																														
2.5 (Train) Drone flight in PUC2 / or Stable camera.																														
2.6 Refining algorithms																														
2.7 (Validation) Drone flight in PUC2 / or Stable camera																														
2.8 Bundle results																														

1.1.2.2 PASTURE

BUNDLE	3. Monitoring flora at high-altitude grazing areas for seasonal animal feeding

	2022						2023												2024											
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
3.1 Pilot case images of high altitude pasture providing																														
3.2 Devolping bundle																														
3.3 Flora surveillance at pilot case																														
3.4 Improving bundle if it is necessary																														

1.1.3 SPANISH PILOT CASES

1.1.3.1 FOREST

BUNDLE	1. Continuity of vegetation

	2022						2023												2024											
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1.1 Initial dataset creation																														
1.2 Initial development of algorithms, using existing dataset																														
1.3 (Train) Drone flight in PUC1																														
1.4 Refining algorithms																														
1.5 (Validation) Drone flight in PUC1																														
1.6 Bundle results																														

BUNDLE	3. Characterization of urban-forest interface. Access for firefighters, evacuation, and biomass

	2022						2023												2024											
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
3.1 Initial dataset creation																														
3.2 Initial development of algorithms, using existing dataset																														
3.3 (Train) Drone flight in PUC1																														
3.4 Refining algorithms																														
3.5 (Validation) Drone flight in PUC1																														
3.6 Bundle results																														

BUNDLE	4. Hot spot identification at the beginning of wildfire

	2022						2023												2024											
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
4.1 Initial dataset creation																														
4.2 Initial development of algorithms, using existing dataset																														
4.3 (Train) Drone flight in PUC1																														
4.4 Refining algorithms																														
4.5 (Validation) Drone flight in PUC1																														
4.6 Bundle results																														

1.1.3.2 LIVESTOCK

BUNDLE	1. Collecting parameters related to the health and stress of livestock

	2022						2023												2024											
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1.1 First livestock collar prototype																														
1.2 Initial tests with collar																														
1.3 Final livestock collar prototype																														
1.4 (Train) Data collection																														
1.5 Algorithm creation																														
1.6 (Validation) Data collection																														
1.7 Bundle results																														

BUNDLE	2. Lameness detection in cows																												
	2022						2023												2024										
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
2.1 Experiment design & Investigate existing datasets																														
2.2 Investigate and implement different computer vision models in public datasets in order to define the dataset requirement.																														
2.3 Initial dataset creation from Pilot.																														
2.4 Initial development of computer vision algorithms and/or object detection neural networks, using existing dataset																														
2.5 (Train) Drone flight in PUC1																														
2.6 Refining algorithms																														
2.7 (Validation) Drone flight in PUC1																														
2.8 Bundle results																														

1.1.3.3 VINEYARD

BUNDLE	1. Crop growth and development monitoring.																													
	2022						2023												2024											
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1.1. Performing RGB and multiespectral flights on training and testing plots	Dataset generated during project life in Albacete province																													
1.2. Performing field visits for phenology monitoring																														
1.3. Processing and obtaining geomatic products																														
1.4. Developing bundle.																														
1.5. Final product for crop growth and development assessment																														
1.6. Testing crop growth and development monitoring at pilot case																														
1.7. Improving bundle if it is necessary																														

BUNDLE	2. Vineyard water stress due to drought.																												
	2022						2023												2024										
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
2.1. Performing RGB, multiespectral, and thermal flights on training and testing plots	Dataset generated during project life in Albacete province																												
2.2. Performing field measurements of stomatal conductance																													
2.3. Processing and obtaining geomatic products																													
2.4 Developing bundle																													
2.5 Final product for water stress assessment																													
2.6 Testing water stress at pilot case																													
2.7 Improving bundle if it is necessary																													

BUNDLE	4. Soil zonification																												
	2022						2023												2024										
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
TASK/SUBTASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
4.1 Historical satellite images analasying at pilot case plot	Dataset generated during project life in Albacete province. Use of available information of UCLM																												
4.2 Crop vigour zonification																													
4.3 Plot zonification																													
4.4 Performing soil samples at pilot case																													

The pilot plan of different bundles consists different action steps of the workflow in order to follow implementation tasks/subtasks. Action steps of the workflow are divided into three groups according to the specification of execution:

- Tasks, which will be developed in the office (Grey colour in Gantt Diagram)
- Tasks, which will be developed on the ground (Green colour in Gantt Diagram)
- Mixed tasks, which will be developed both on the ground and in the office (Soft Grreen colour in Gantt Diagram)

4 EVALUATION METHODOLOGY

All pilots will follow a similar evaluation methodology. To unify the results of each pilot and make them comparable, a standard for the evaluation has to be put into place. To ensure the intercoder reliability, questionnaires and observers will be trained for the job at each pilot action and will have a briefing from technical as well as operational side to understand what is going on. Especially for the observations, this is necessary to extract relevant data. The focus of the evaluation will be on the users and the relevance of the system to their needs and jobs.

4.1 Background for methodology

For the outcome of CHAMELEON, it is of interest to know if the system delivers an added value to the users. Also, the development needs to be supported by users to provide the necessary context for developments as well as to have a reality check against the assumptions from tertiary stakeholders to the main observation subject. This means the perspective of academics and coder have to stand against the judgement of practitioners. With the feedback of practitioners, the development can proceed to the next step and adjust features of the system.

To evaluate if the users are satisfied with the development and find a use for the new technology over different places and use cases, a standardized questionnaire can support to normalize the feedback and provide a response to the consortium. This response has to be supported with context. At one level of response the consortium gets the feedback that the technology is acceptable and useful with a comparable score for each pilot action. At another level, contextual feedback will provide the information to the developer for each pilot action what needs to be improved, developed or dismissed.

In theory, there are some approaches to systematize the collection of such responses and to classify the relevant information. As state of the art, the technology acceptance model has formed over the years a decent approach with theoretical foundation and elaborated models and discussions in the scientific community. With the TAM3 (Venkatesh & Bala, 2008) a universal and appropriate model for CHAMELEON is already existing as seen in Figure 3.

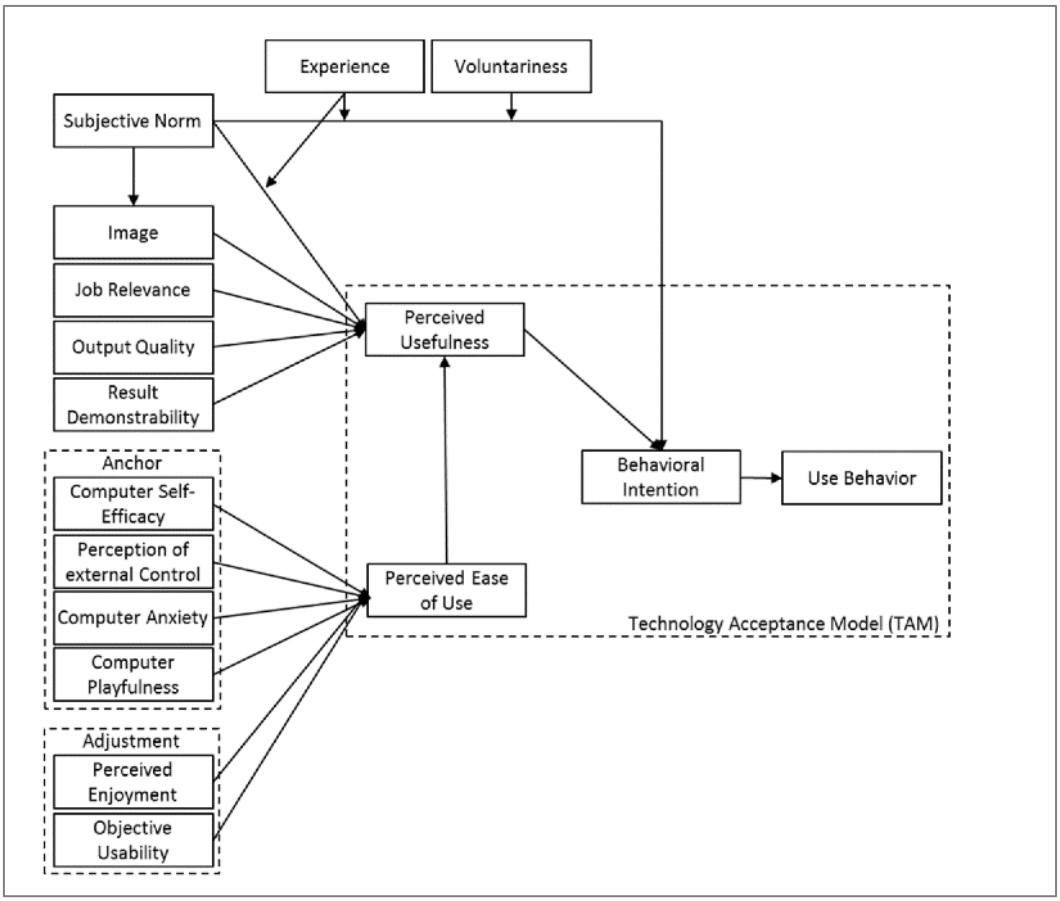

Figure 3 TAM3 Model

The TAM3 is more elaborated in the subjective norms and combines the experiences and the voluntariness into the behavioural intention. By this, intervening factors are declared and can be taken into account. Three measurements lead to the approximation of system usage: Perceived usefulness, perceived ease of use and the behavioural intention. The perceived usefulness describes the a very personal motivated impression of the system to the user on operational means. The perceived ease of use is providing a psychological and social background to the system usage that is affecting motivation. The behavioural intention is resulting from the perceived usefulness and the attitude toward using the system. (Alharbi & Drew, 2014)

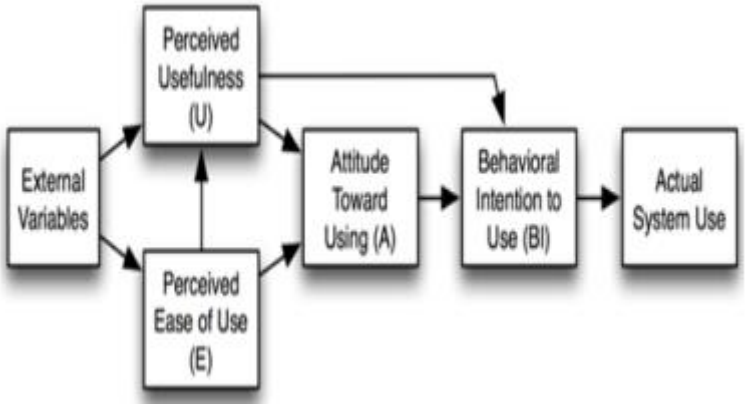

Figure 4 TAM1 steps

Additional to the TAM approach, the idea of socio-technical systems (STS) is necessary to provide more context to the feedback. By Socio-technical systems, it is meant to widen the scope of development from the principle manufacturing process to the work process of the user, the social interactions in the field of work and the interrelations between the social and the technical component.(Clancey, 1992) The integration of technology into the habitus of the users – not just the legislative processes or working routines, but also into the social meaning and personal values of jobs and tasks – provides a potentially higher acceptance of technology. Following the ease of use from TAM, this means, the final actual system use is higher in probability. Which could be considered a success for CHAMELEON. For the evaluation, CHAMELEON will therefore focus on this holistic perspective of the system usage: Technical – Operational – Societal/psychological

Within the methodological discussion, there are standardized questionnaires available that allow also a comparison between different projects and developments from other projects and with a scientific background. This will be taken into account (e.g. SUS, USE scale, TC scale)

Next to standardized questionnaires, there are different assessment methodologies for gathering data that provide – in relation to the available TRL - an approved approach. As baseline for the assessments, CHAMELEON will follow the guideline “The art and joy of user integration in AAL projects” (AAL, 2015)

4.2 Evaluation branches

4.2.1 Technical

The technical evaluation will consist of a pre- check for each pilot action if all functionalities are according to the requirements. KPIs are defined by an operationalisation of the use case. For each use case, a defined KPI will have to be met. Within the pre- check of the functionalities, the technical readiness for the plot action is checked. This result will influence the methodological aspect of data collection for the pilot action.

4.2.2 Operational (T6.3)

The operational aspects will be checked during the pilot action. Tasks will be defined for each pilot with a scale how much of the task could be accomplished with the CHAMELEON system. KPIs will mark the milestones of tasks.

Within Task 6.3 the operational tasks will be collected and systematically designed as PROCESS MODELS with indicators, when which process step is met. This will then be the foundation for the pilot action evaluation.

4.2.3 Societal/psychological (T6.4)

Following the subjective norm, as seen in Figure 3, for each pilot action, a questionnaire for the states and traits will be handed over to the users. This should provide a base for the interpretation of the data collected after the pilot action. Also, the process models will help in a SOCIAL NETWORK ANALYSIS of the interaction of different working groups/Stakeholder/users with the technology and show up where more training needs to be done to allow a seamless integration of a CHAMELEON system into daily routines. Within Task 6.4 all necessary questionnaires and interview guides will be put together and executed during the pilot actions.

4.3 Evaluation "Development Monitoring"

During the development of the Pilot Case there will be bi-monthly meetings to evaluate the advance of the bundles advances according to Gantt Diagram proposal. The evaluation will be based on a document containing information about the advances of the pilot according to the tasks and subtasks on which the Pilot Case has been split. This document will be completed on a monthly basis and discussed during the bi-monthly meetings.

The model of the document for monthly evaluation is in Annex 1.

This model will be prepared for bundle developers for each bi-monthly meeting in order to evaluate the advances on the workplan and foreseen certain activities to solve potential deviations and delays.

5 References

Alharbi, S., & Drew, S. (2014). Using the Technology Acceptance Model in Understanding Academics' Behavioural Intention to Use Learning Management Systems. *International Journal of Advanced Computer Science and Applications*, *5*(1). https://doi.org/10.14569/IJACSA.2014.050120

Clancey, W. (1992). *Guidon-Manage revisited: A socio-technical systems approach. 4*. https://doi.org/10.1007/3-540-55606-0_3

Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision Sciences*, *39*(2), 273–315. https://doi.org/10.1111/j.1540-5915.2008.00192.x

6 Annex 1. Advance evaluation

Pilot case						
Bundle						
Task		State [1]	Achieved on time [2]	Shared [3]	Feedback [4]	Considerations [5]

Date of completion:	

Considerations to overcome deviations and delays

Operator's need	
Systems operating	
Conflicts	

Individual test needed?	
Partners involved	
Feedback	

(1) Not initiated yet / Initiated / Advanced / Finished
(2) Not finished yet / Yes
(3) List the actors who have taken part on the action and the information shared with them
(4) List the actors who have feedbacked and their contributions
(5) Any consideration

A Holistic Approach to Sustainable, Digital EU Agriculture, Forestry, Livestock and Rural Development based on Reconfigurable Aerial Enablers and Edge Artificial Intelligence-on-Demand Systems

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