D2.1
DELIVERABLE

CI's needs
for indoor filming using RPAS

AiRT

CI's NEEDS

FOR INDOOR FILMING USING RPAS

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With contributions from Clearhead, Pozyx and the 20 participants in the focus groups who are experts in 13 sectors of creative industries

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1. EXECUTIVE SUMMARY

This document describes the creative industries' needs for aerial indoor filming and photography using RPAS, commonly also known as drones. To do so, three sessions in different countries, England, Belgium and Spain using the Participatory Action Research (PAR) technique, commonly applied for the analysis of focus groups were held. The PAR tool, that consist on collecting information through a semi-structured group interview process, is led by a moderator that can intervene from a low to a higher level, depending on the dynamics of the discussion. This methodology is very useful to gather information on a specific topic. Informants (experts) were chosen strategically from 13 different sectors to guarantee that all the Creative Industry's (CI) needs are detected, including experienced drone pilots working in different CI sectors (40% of the informants). Then, information was codified and analysed using the qualitative analysis software QDA Miner by Provalis Research, which is especially designed to analyse interviews and focus group transcriptions. Following ethnographic rules, the names of participants were encoded so they remain anonymous. Results and conclusions are presented in this document, deliverable D2.1, and also in the deliverable D2.2 "Ethical, Security and Safety issues concerning RPAS use in confined spaces".

2. INTRODUCTION

Drones are used for outdoors activities, although there is a wide range of industries that could benefit from its use indoors. Since existing RPAS lack of a precise, robust and affordable indoor positioning system as well as advanced safety features, the control of any RPAS in indoor environments is particularly difficult and unsafe. It is therefore that RPAS cannot be yet employed professionally in indoors environments. The goal of this new product (AiRT-RPAS) which is able to obtain professional filming and photographic material for the CI in order to increase their competitiveness within the European market.

The AIRT project aims to create a new product that fulfils the needs of the creative industries by the definition and improvement of indoor RPAS. This deliverable presents the process of identifying the needs of CIs and the required RPAS features. The structure of the report is as follows

a) methodology

b) the identification of the key informants

c) the elaboration of the gathered information during the work sessions

d) the analysis of the extracted results

Other issues related to privacy, security and safety have also been analysed and are presented in the deliverable D2.2 Ethical/ security and safety issues concerning RPAS use in confined spaces.

3. METHODOLOGY PAR TECHNIQUE

In order to obtain information directly from the consumer and identify the features that a new product must accomplish, the focus group technique is the most suitable research methodology. Although It is a qualitative method with open questions to participants, in the analysing process the information was transformed into quantitative data to facilitate useful data to the RPAS manufacturing company AeroTools. For a smooth execution of the group dynamics discussions are normally led by at least one expert, that follows a semi-structured interview. In our case, two experts were leading every focus group, one being an expert in the field of Management and the other one in creative industries holding a drone pilot licence. Invited experts for the PAR activities came from different creative industries sectors such as heritage, museums, design, advertisement, etc. Moreover, the different types of companies that conform the creative industries were considered in the selection of participants. Three different work sessions were organized, one in each of the partner's country (England, Spain and Belgium), to ensure coverage of the European creative industries' needs. (See figures 1-3).

The UPV team led the different sessions while Clearhead jointly with the partner of each country (UPV in Spain; Pozyx in Belgium), was in charge of the selection of the informants attending those previously defined criteria.

Figure 1- Luton (England) focus group n° 1.

Figure 2. Valencia (Spain) Focus group n° 2.

Figure 3. Ghent (Belgium) focus group n° 3.

3.1 Regarding the participants

In every group parity of genders among all six key informants (experts) was aimed and invited experts should all be in a decision-making position or CEOs, while belonging to Europeans SMEs.

At the beginning, the participants have been informed of the overall procedure and goal of the focus groups session. Furthermore, an agreement form which allows the consortium to work with the obtained material for AiRT project purposes was signed. Also, every participant was informed that the intellectual property (IPR) of the sessions belongs to the project team. These agreements were signed by the informants following data protection regulation of each country. The description of the informants can be seen in table 1.

As can be seen in this table, all relevant sectors were covered. Out of the 20 participants, ten were from the Advertising sector (encoded as participants 3,4,5,7,9,11,13,17,19 and 20), four from the Architecture and design (encoded as participants 4,6, 13 and 14), two from the Fashion industry (participants 18 and 20), and 10 participants belonged to the movie industry (encoded as participants 1,2,5,7,10,12,15,16,18 and 19). Participants encoded as 9 and 14 were classified in Antiques and Museums sectors, while participants 1,5, and 20 came from the Music sector. There were ten participants in the Photography sector, some of them also classified in the sector of Advertising and Movies (participants 2,4,5,7,10,12,13,15,16 and 19). Participants 1,15 and 18 in TV sector were also related to the Movie industry sector. Two of the informants came from Arts and Crafts sector (participants 8 and 13), and one of them was also related to Museums and the second to TV and Advertising. Participant 6 was related with the Architecture industry and with the Design sector. The Photography sector was the most numerous (see figure 4) which includes 21% of the total, followed by Movie and Advertising (19%), as those are also the most directly related to the industries that are currently leading the use of drones.

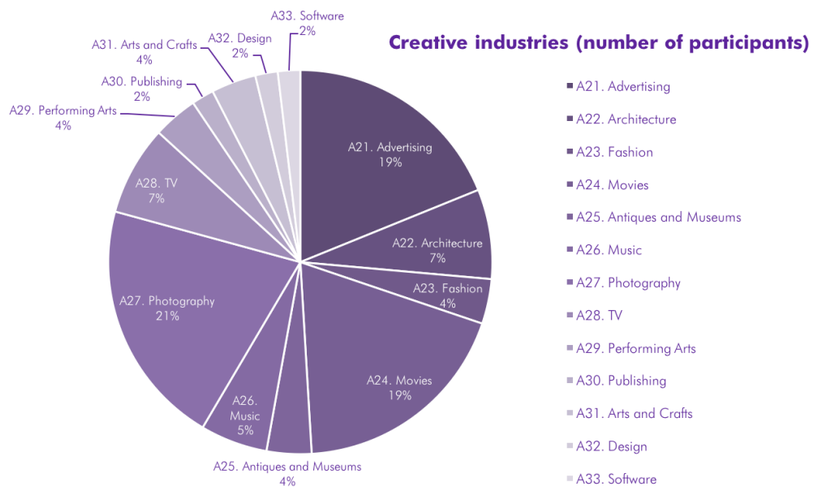

Figure 4. Groups of informants by type of creative industry in percent.

ID	A21. Advertising	A22. Architecture	A23. Fashion	A24. Movies	A25. Antiques/Museums	A26. Music	A27. Photography	A28. TV	A29. Performing Arts	A30. Publishing	A31. Arts and Crafts	A32. Design	A33.Software
Part1				X		X		X	X	X			
Part2				X			X		X				
Part3	X							X			X		
Part4	X	X					X						
Part5	X			X		X	X						
Part6		X										X	
Part7	X			X			X						
Part8					X						X		
Part9	X												
Part10				X			X						
Part11	X												
Part12				X			X						X
Part13	X	X					X						
Part14		X			X								
Part15				X			X	X					
Part16				X			X						
Part17	X						X						
Part18			X	X				X					
Part19	X			X									
Part20	X		X			X	X						

Table 1. Distribution of focus-groups participants regarding their area of expertise.

On the other hand, Software, Design, and Publishing were the less represented creative industry (2% of the total informants) whereas Arts and Crafts, Performing Arts, Fashion, and Antiques and Museums made up equal representation of 4%.

3.2 Identification of the appropriate place

As the session was recorded, with both, video and sound systems, the adequate level of light and sonority was needed. Clearhead was in charge of selecting the appropriate places, with the help of the partners in each country, as well as of recording and photo shooting the sessions. A total number of 809 photos were taken and 310 minutes of filming was recorded.

The first meeting took place in Luton, The Bear Club 24a Guildford Street Mill Yard Luton LU1 2NR, on the February 3rd, led by Prof. Maria de Miguel (UPV, expert in Management) and Prof. Angela Carabal (UPV, CI expert and drone pilot). The second session took place in Valencia, at the Polytechnic University of Valencia, on February, 9th, and was led by Prof. Virginia Santamarina (UPV, CI expert and drone pilot) and Blanca de Miguel (UPV, expert in Management). Finally, the last one took place in Ghent, Belgium, February 13th, at Pozyx headquarters, Vrijdagmarkt 10/201, 9000 Ghent, and was led by Prof. María del Val Segarra (UPV, expert in Management) and Xavier Mas (UPV, CI expert and drone pilot).

3.3 Identification of the appropriate place

The sessions followed a guide to keep the conversations in the most interesting topics to identify the needs of the sector. Information was processed according to the ethical rules of the focus groups fieldwork, that is: the information provided cannot be attributed to a specific participating informant (guaranteed anonymity).

The informants are a representative sample of potential clients, carefully selected, in order to cover most of the possible features of the new AiRT product (RPAS), especially those not so obvious characteristics like safety and footage quality.

In this context, a focus group can offer insights consistent with those shared by the broader target market. Focus group moderators are trained to ask participants in a special way to get honest and insightful responses, avoiding suggestive or manipulating questions.

The sessions in Luton (UK) and Ghent (Belgium) were held in English, while the focus group session in Valencia (Spain) was held in Spanish, as desired by the participants. The recorded material was transcribed and analysed using the above mentioned software package, QDA Miner, for qualitative analysis in order to classify the information and select the most relevant data.

Informants did not know the questions they were going to be asked in advance, although a brief explanation of the project and the intended objective of the meeting was presented.

Even though it was not mandatory that all the participants had used drones before, at least 1-3 participants per group with previous experience in the use of drones were selected to get better insights of real needs, since those are aware of the current difficulties and a may give useful information of future/desired features which should be included in the new product.

Before the session, catering was offered in order to create a comfortable and friendly environment.

3.4 Focus group results

Analysis of results from focus groups was obtained by using a Qualitative Content Analysis method. Qualitative data were obtained through the analysis of interviews to participants in focus groups, which were recorded and transcribed. The software QDA Miner (Provalis Research) was used to undertake the analysis and all the information in the transcriptions was codified. Codes are organized in relation to the predefined questions, trying to guide the focus group participants' answers to these questions. Additional codes were defined to cover information that was also considered to be important and, moreover, strategies for the commercialisation phase. Results from this codification are presented below, and have been organised into seven groups:

- ☐ The previous use of drones by participants
- ☐ The potential benefits and requirements they identified for indoor use of drones
- ☐ The importance of an indoor positioning system
- ☐ The elements to be included in the drone camera
- ☐ The impact of vibration, noise and wind in operating drones indoor
- ☐ The importance of safety, ethical and security issues
- ☐ Other important aspects to be considered in relation to the user's total experience

3.5 Identification of the appropriate place

This subsection includes the analysis of questions related to whether they used drones before, the experience while they were using them, reasons for not using drones and features which should be added based on their experience. Results are presented in Figure 5 and Tables 2-4.

Figure 5 indicates that 40% of the participants of the three focus groups had used drones before and 40% of the total were drone operators (RPAS pilot licensed). The remaining participants (20%) indicated that they would like to try the use of drones. Consequently, none of the participants refuses to fly/operate drones. When they were asked about their motives for using drones, two of them indicated that they had operated drones in an indoor environment, one application was in an advertisement campaign for a company while the second one was in an empty theatre. The rest of answers indicated the use of drones in filming and photography.

Participants were also asked about causes why they did not use drones before, and table 2 illustrates results.

Those answer added information to the analysis, as they showed most of their concerns were related to integrity and good conditions of the equipment, while others were sceptical about the new possibilities that drones can offer. They also distinguished between the different applications that are intended for drones and for regular cameras. The increasing number of new entrants in the industry, that can lead to a lack of professionalism in the drone pilot's activity, generates some unsteadiness that may prevent consumers to use the drones for their filming or photos sessions. Some others have not yet been aware of the possibilities and appear to be averse to change.

Participants were asked about their experience when they used drones (In case you used drones before, how was your experience?). Results and the codification are showed in table 3.

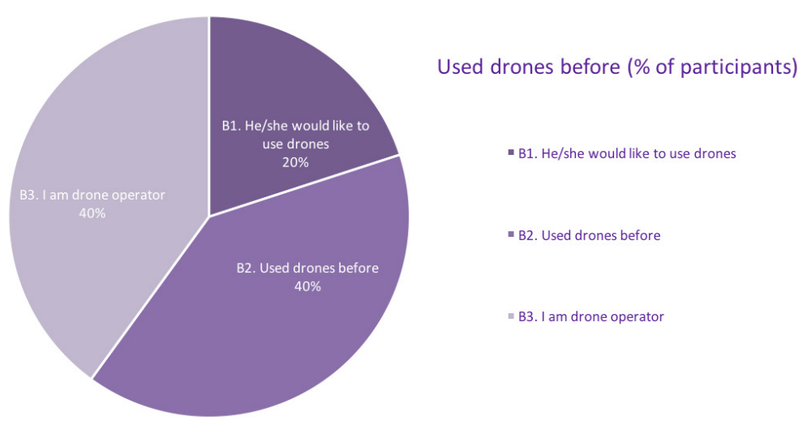

Figure 5. Previous use of drone by informants in percent.

Table 2. Table summarising why they did not use drones before or not very often

Code	Counts
BC1. I do not trust in amateurs with little knowledge who try to make me believe that they are drone operators (bravado)	2
BC2. Insurance side of risks (equipment broken, people hurt)	1
BC3. Uncertainty about having anything usable afterwards	1
BC4. They do not add anything to the narrative or to the story	1
BC5. There are applications for cameras on ground and others for drones	1
BC6. Solution needed for inside and outside buildings	1
BC7. Why change what you traditionally would do?	1

Table 3. Encoded responses regarding informants' experience

Code	Counts
BB1. Indoor flying is difficult when trying to avoid obstacles like machines	1
BB2. We struggled with coordinates	1
BB3. Trade-off between thinking in drone not crashing against objects and creativity	1
BB4. Experienced problems with DJI (4th generation)	3
BB5. Ultrasound is not reliable	3
BB6. Crashing if something is reflecting	1
BB7. Trade-off between bigger (better) camera for cinema (weight) and drone size	6
BB8. Drone flew away and never returned	2
BB9. Regulation limited our work	3

When analysing those answers, the quality of the camera appears to be the main concern as professional filming cameras are of heavy weight. Although they may value the advantages of using drones, so far quality reduction of the filmed material is too high.

Another important concern is reliability, since some of the participants experienced previously crashes when using drones for indoor filming, failures of the ultrasound technology or their creativity was restricted

since operator needs to concentrate on flight. Here again integrity of the equipment appears to be worrying.

> "...what I would think of the market currently is that there isn't a drone that handles indoor very well at all. I don't think there is. As a pilot you don't want to be controlled too much by it. Like, it's quite nice to just take off and fly it. And I fly quite regularly outside without GPS and all that kind of stuff, and I'm quite comfortable with it. But, when you're indoors then you don't want that thing because you're relying on something that you don't trust."

Restrictive regulations in the majority of countries for outdoor filming using drones could be also seen as a big opportunity for the drone operators to change work environment and concentrate on using drones for aerial indoor filming since indoor spaces fall not under the aeronautical regulations.

Another interesting issue that arises is related with the current biggest drone seller (DJI), which is offering a high number of reference devices intended for different purposes. Several informants have used the latest product from this company but the development of the technology seems not to be ready yet, as problems of reliability and interference caused by wind and light prevent users to go one step further in the use of drones.

Table 4. Desired features to be added to an indoor drone sing why they did not use drones before or not very often

Code	Counts
C1. Autonomous flight like an autonomous car	2
C2. Two inches nearer	1
C3. Possibility to fly very close to objects for filming, and in the case of contact RPAS should rectify and move backwards	1
C4. Reliability	1
C5. Ability to record and repeat a flight (repeating the shot would be the best, like with a slider)	6
C6. The drone should fly on its own and operator should only control (concentrate on) the camera	1
C7. Small-sized drone	1
C8. Something which scans the environment before flying	1
C9. Possibility of filming upwards	1
C10. Duration of battery (12 minutes like "Inspire" drone)	1
C11. Sensors for positioning	1
C12. Lighting system (for example, with LEDs)	2

The next question was about which features they would like to add, based on their experience. The answer from the informants were encoded and can be seen in table 4.

When analysing those answers it can clearly be seen, that the possibility to record and repeat flights would be highly appreciated by users.

> "So you could do a shot and it would always... normally you work with two people so if one... if the pilot that flies the drone, and the camera man that does the creative shot and you work together... if you can do something flying indoors without... and you're sure that you cannot bump into something so you can push it. It records the flight path and you can do it for, let's say, ten takes exactly the same. That's very interesting and... but you still must have the control when you start the shot. "

Other features desired by more than one informant was the option to illuminate the drone (to add a lighting system) and the option to make the flight automatic. Different definitions were said to the same concept, flying close to objects without crashing (sometime they suggested to add a tentacle system to avoid crashes, other suggested the possibility to just smoothly crash into the filming object and then going backwards).

The concept of filming upwards, was suggested too in order to capture images from above and to increase creative possibilities of the drone. The possibility to separate drone navigation from camera control, to increase battery life and the overall size of the RPAS were issues the participants from the Creative Industry thought may be considered. Moreover, a reliable positioning system, that may use sensors like ultrasound technology should be present in an indoor drone.

3.6 Identification of potential benefits and requirements for indoor drone use

The next group of questions were intended to identify the potential benefits when using indoor drones for filming and the requirements they suggest a product like this should have (see tables 5 and 6).

When the participants were asked "Which could be the potential benefits?" the informants had as clear idea that filming with drone is faster compared to traditional aerial filing since, e.g., the installation of a filming crane can be avoided. All mentioned, that here time is the critical factor. They considered the multiple possibilities of taking different shots of the same scenario without installing and removing a crane (or assembly and disassembly of a scaffold). Also the invisibility of a drone compared to a classical filming structure was mentioned the expected reduction of costs while employing drones for filming. The possibility of adapting the drone to the scenario and not the other way round was also considered as a benefit as this reduces time and is more convenient (see all responses in table 5).

In table 6, it can be seen, that key elements to guarantee success of the new product could be clearly identified. Safety and size are the main concerns, followed by flight autonomy. So, in order to be successful, the indoor drone must accomplish three precepts: a) it must be as small as possible, b) it has to be safe (for the operator, for the people in the environment and for the drone itself) and batteries must allow as much autonomy as possible. There are also other common ideas as reliability, flexibility and resistance that should also be taken into account.

And with respect to other requirements:

a) to reach a considerable high (to be able to get at the top of big buildings)

b) to be flexible and allow to interchange different cameras

c) to be stable in the air

d) to be easy to use (friendly interface)

e) to be reliable

f) to immediate transfer live images to other instruments (as cell phones or computers)

g) and to have self-updating software included have been mentioned by the participants.

Price arises in the conversation at this point for the first time, as a participant highlight the importance of the drone to be "affordable".

Table 5. Benefits from the use of an indoor drone sing why they did not use drones before or not very often

Code	Counts
EA1.Film set-up time in contrast to a filming crane/ scaffold	4
EA2. The possibility to go to a client's office or building and half an hour later you can show him a movie	1
EA3. If a client asks for an animation video, a video instead of an email could be send.	1
EA4. A drone can be invisible	1
EA5. No need to move all the equipment for every shot	1
EA6. No need to move all the object in the house, for example	1
EA7. Lower costs	1

Table 6. Elements for the drone to be successful

Code	Counts
K1. The battery is not the most important point	1
K2. In very big buildings to be able to go to the top	1
K3. Customizable, to use lots of extra things (like DJI does)	1
K4. Lighter battery	2
K5. Customizable will increase complexity and difficulties	1
K6. Easy to use and very easy to modify	1
K7. Modifiable battery size (adapt to flight)	1
K8. Safe	5
K9. As easy to use as possible	2
K10. "Uncrashable"	2
K11. Reliable	1
K12. Something like the Inspire 2 from DJI	1
K13. Small-sized (as small as possible)	5
K14. Live streaming to your smartphone	1
K15. Small sensors like in the iPhone	1
K16. Great film quality	1
K17. Possibility of flight recording	2
K18. Great flight autonomy	4
K19. Batteries easy and quickly to adapt	1
K20. Something like a calibration pad to hold the drone in position	2
K21. Sensor to help during landing	1
K22. Your stick is your pilot	2
K23. Great flexibility for the user	2
K24. Updating apps	1
K25. The drone must meet specifications demanded for the specific film set	1
K26. Affordable	1
K27. A drone that does not hit the wall	2
K28. To register space in 3D (indoor map) and to draw a reference grid	1
K29. Sensor in the camera needs to be flexible	2

3.7 Identification of indoor drone's potential use for CIs

Concerning the uses an indoor drone would provide, participants were explicitly asked "Which uses would provide you a drone for indoor recording?" and their codified answers included the items as shown in table 7.

It was interesting to notice after the analysis and coding of the three PAR group sessions that many participants mentioned Indoor Photogrammetry and mapping in 3D. Safety was the third most mentioned potential use of indoor drones, and Photography and gathering data for restoration or maintenance of artworks, paintings or historic buildings seems also to be an obvious and highly appreciate use of the indoor drone.

Additional services specially for high and inaccessible buildings as cleaning, maintenance or communication were mentioned, albeit the explanation and of the benefits were not very clear so far.

Table 7. Potential uses for an indoor drone

Code	Counts
G1. Drone flies from a desk to others in the office in a Skype call with a client	1
G10. Geo-location of emblematic buildings	1
G2. Mapping in 3D	4
G3. Photogrammetry indoor	6
G4. Following big groups of people dancing within confined spaces	1
G5. Companies that use 3D maps to retouch design of cars	1
G6. Photography and video	2
G7. Obtain valuable data in heritage and artwork conservation	1
G8. Capturing movements indoor	1
G9. Heritage	1
GC1. Safety industry	3
GC2. Drone with scanner that can fly through a warehouse	1
GC3. Real Estate	1
GC4. A lot of YouTubers use drones now	1
GC5. Cleaning	1
GC6. Maintenance in high buildings	1

3.8 Indoor positioning system

Participants were asked about the importance of an especially designed positioning system in an indoor drone, and 7 of them answered that it is very important because, regarding their experience, existing systems designed for outdoor environments do not properly function indoors.

3.9 Indoor positioning system

Participants were also asked "Which features should the camera provide for a professional work?", with the goal to talk about how the ideal camera should be and what is demanded by the CIs. Although most of the informants agreed that depending on the type of work (professional TV filming, movies, commercial videos, photos or videos, among others), the requirements for the camera may change, although the demand will depend on the budget.

Participants also identified as very important the possibility to interchange lenses and that the camera could record in an 360º angle, as well as the option to put the camera on top of the drone and to standardize the fitting system, so the same drone can carry on different cameras depending on the needs (see table 8).

Other characteristics of the camera that they considered they would add quality were the possibility to record in Raw and Log formats, the ability to compress data, and include time-lapse movements to drone.

3.10 Control of camera elements and movements during navigation

The users were asked two questions directly related to the control of the camera during the flight (Which elements from the camera do you need to control during the flight? And Which movements from the camera do you need to control during the flight? The encoded answers are displayed in tables 9 and 10.

Here, very interesting insights appeared, besides the common aspects to control as light, colour, or zoom. Again, the 360º filming possibility but moving independently from the drone and the option to make shots to the upper part were considered.

Table 8. Important elements for the drone camera

Code	Counts
M1. Able to fly a 5-10 kg camera.	1
M2. Resolution	1
M3. The compression of image/ video data	1
M4. A small compact camera	1
M5. Capability to record in Raw or Log formats	1
M6. Small-sized	1
M7. Interchangeable lenses	10
M8. Interchangeable camera (like in DJI)	3
M9. Camera capable to record 360°	4
M10. Time-lapse in Camera movement	1
M11. Option for mounting the camera on top or below	3
M12. UHD 4K recording	3
M13. Have a support to add an additional camera	3
M14. Not a drone with camera but a support to adjust any camera	1
M15. Able to avoid abrupt camera movements	1

Table 9. Elements of the camera to be controlled during flight

Code	Counts
N1. Roll	1
N2. Roll but only when you do a creative shot	1
N3. Flexibility to adjust colour, zoom, everything	3

Table. 10. Movements of the camera to be controlled during flight

Code	Counts
O1. The pan and the tilt	1
O2. Turn around 360° with the camera alone and not the drone	6
O3. Smooth motion of the camera (It has to be moved like nobody touches that camera)	2
O4. The three axes	1
O5. To shot upwards	2
O6. All the movements	3

Users also discussed about the type of system that should handle the camera and several points of view arose as can be seen in table 11, being the most interesting feature the option to see in real time the image in an auxiliary device.

Table. 11. How handling of RPAs and camera should be?

Code	Counts
S1. View of camera not blocked by the landing gear	1
S2. See the image in a screen while drone is filming	3

3.11 Vibration, noise and wind

As the project team had previously identified noise as a main barrier for the use of indoor drones, when the users were specifically asked about the most common problems as noise, wind or vibration, opinions were solid as codified answers reflect (see table 12).

Noise turned out to be the main disadvantage for the use of indoor drones, as vibration seemed to be a problem easier to control with the improvement of the gimbals as technology is already developed and accessible. On one hand, the participants in the sessions were struggling with the idea of reducing the size of the drone and therefore reduce the wind generated from the propellers, but, on the other hand, the quality of the camera is a must for them, assuming that good cameras are heavy and not small.

> "...what you were saying about the air making noise, when you're indoors then you forget about it and you can't record sound. You just can't."

Wind also turned out to be a problem when using indoor drones as the wind of the propulsion system may destabilized the artistic environment setup (actor and actresses' hair, clothes even plants or documents would be affected by the drone movement).

Table 12. Vibration, noise and wind as important issues

Code	Counts
P. Vibration a key element?	
P1. Vibration is important in a good motion	1
P2. DJI and others have a solution with good gimbals	1
P3. Stabilising via gimbals is already the solution	1
Q. Noise a key element?	
Q1. Noise is an important issue	9
Q2. Noise does not allow to use sound	2
Q3. Noise does not allow the use in a studio environment	3
Q4. Trade off between propellers size (wind) and noise	4
Q5. You want to hear a nice voice and not a buzz drone flying	1
Q3. Noise does not allow the use in a studio environment	3
Q4. Trade off between propellers size (wind) and noise	4
Q5. You want to hear a nice voice and not a buzz drone flying	1

3.12 Safety, ethical and security issues

The users were also asked about safety, ethical and security issues with two different questions that were jointly encoded in table 13 (Which safety measures, for prevention of accidents, are critical and need to be considered while working close to an RPAS? and Which ethical and security issues as protection from unauthorised access by third-parties, are critical and need to be considered while working with an RPAS?).

Regarding the safety measures, sensors were identified as a key part of the prevention whereas other comments also were remarkable like providing the drone with protectors or airbags.

When talking about ethical concerns, there were two aspects to consider, first of all, those related with privacy issues that will depend on regulation and should be solved with a deep understanding of law and with non-disclosure or image permission agreements and finally the possibility of hacking a Wi-Fi controlled drone, that should be considered as technology improves.

Table 13. Safety, ethical and security issues

Code	Counts
T. Safety measures to be considered?	
T1. Safety for goods	2
T10. Qualified drone pilots have been trained more on safety than on how to fly	1
T11. Integrated safety system	1
T12. Collision avoidance	1
T2. Something like an airbag to reduce impacts	1
T3. Safety for the camera	1
T4. Fly indoors when people are not present	1
T5. Use controllers in the entire place	1
T6. Use FPV cameras	1
T7. Sensors	7
T8. Propeller protector	2
T8. The pilot has the distance in a monitor	1
U. Ethical and security issues to be considered?	
U1. Privacy issues	6
U2. Problems when connection between drone and remote control knock out (i.e. Wi-Fi booster)	2
U3. Hijacking of drones	3

3.13 Thinking in the user's total experience

The potential clients were asked a question intended to obtain general information regarding the user's total experience of buying and using this kind of product, which would include the post-sale service (What would you expect from your supplier? See table 14)

Most of the clients would prefer to buy it online but would highly appreciate the option to try it in advance. Although this drone would be intended for drone pilots, who are supposed to be experts, to be better aware of all the features and real options that the drone can offer, it would be much better to try it first. Some of the participants mentioned the option to offer space for trying drones in every trade fair and technical exhibitions.

Another idea consisted in establishing a kind of leasing contract (as car dealers do), which would allow users to be always using the latest technology and drones available.

> "What would be also interesting ... you pay each month, you pay fee. But every time they have updates and you still having the best thing and every month is changing so if you would have a drone and you pay like ok, first time you pay thousand euros and you have the basics and then each month when something changes we will send you another piece and you like that ..."

What clearly appeared is that continuous training is a must for pilots and should be included when buying a drone.

The technical support and spare parts is also a market niche still uncovered that provokes certain rejection when making a significant outlay when buying a drone.

> "...they can repair straight away but they would maybe send another one meanwhile, so this is, they are really working on that to have you no more reasons to go to a local reseller because the biggest reasons would be if something happens, but if they offer very affordable programs that you get a new one straight away so you don't have to wait for even a few days and meanwhile you can send the other one back they can keep it or for a month you don't care..."

3.14 The price

Finally, when asked about the illustrative price they are willing to pay for an indoor drone, opinions were totally different as it can be seen in table 15, but it seems a price of 10.000 € would divide the market into two groups of users.

Table 14. Thinking in the user's total experience

Code	Counts
W. Where would you buy an indoor drone specially designed for CIs?	
W1. Online	5
W2. In a store because it is a expensive tech	1
X. As you buy would you like training?	
X1. Training before buying	2
X2. Training would be a plus	5
X3. Option for learning to fly	1
X4. YouTube videos of 5 minutes each or some random software, without putting money into it	2
X5. YouTube videos to say what people have achieved with that	2
X6. Videos for instructional use	1
Y. What would you expect from your supplier?	
Y1. A space where to try it and test it (even though you do not want to buy it but you pay to prove it)	9
Y10. Support (directly from the manufacturer or the distributor)	6
Y11. Good service when something does not work (DJI has bad service)	2
Y2. Trade fairs or expositions where you can book an appointment before buying	1
Y3. A space where they advise how to improve	1
Y4. Contact through chat, Facebook, LinkedIn	1
Y5. Support in questions nobody wants to wait for (maybe with help from other customers)	5
Y6. Fast delivery	1
Y7. Good technicians	1
Y8. Send another one meanwhile (if drone experience failure)	1
Y9.Something like a leasing (you pay a monthly fee and option to change for new model)	2

Table 15. How much would they pay for an indoor drone?

Code	Counts
V. Price for a drone?	
V1. 2,000-2,500€	1
V2. Same as DJI drone	1
V3. Same as the MAGNET drone	1
V4. Same as premium PHANTOM 3 drone	1
V5. 1,500€	1
V6. 4,000€	1
VA. Drones demanded for filming in CIs	
VA1. Freefly ALTA drone (about $17,000)	1
VA2. from £10,000 to £20,000	1
VA3. £36,000 (Falcon) and another camera can be added	1
VB. What price you would pay for an indoor drone specially designed for CIs?	
VB1. 10,000 pounds for platforms that serves as TV	1
VB2. >10,000€	1

4. CO-OCCURRENCES OF CODES

In previous sections the codes were analysed individually. In this section, the focus will be on the analysis of relationships among codes. In this case, only those codes which indicate all the features and characteristics that participants in focus groups explained are selected. The Social Network Analysis (SNA) method and software Ucinet has been used to obtain the groups of codes which tend to appear jointly, and subsequently these groups are called "cliques" in the SNA method. To obtain these groups, the following steps have been applied:

a) Select the codes to be included. In this case all the codes which referred to what needs to be taken into account, and that might be added to the indoor drone, has been included. These codes are C, F, J, K, L, M, N, O, S, T and U:

i) Codes C: Features to add

ii) Codes F: Requirements for indoor

iii) Codes J: Design routes and shootings in advance

iv) Codes K: Key elements for drones to be successful

v) Codes L: Indoor positioning system is a key element

vi) Codes M: Features for the drone camera for professional work

vii) Codes N: Elements of the camera to control during flight

viii) Codes O: Movements of the camera to control during flight

ix) Codes S: Handling of RPAS and camera

x) Codes T: Safety measures to be considered

xi) Codes U: Ethical and security issues to be considered

b) Elaborate a co-occurrence matrix, which is a 1-mode matrix where rows and columns are the same codes selected in a)

c) Import the co-occurrence matrix in Ucinet to calculate centrality measures and cliques, and also transform the matrix in a file with net format.

d) import the file with *.net format to VOSviewer to represent the network of codes (Figure 6) and obtain clusters of codes.

Through Ucinet software a centrality measures and cliques was obtained. The former represents the main codes and the cliques detected codes directly connected to others creating subnetworks of three and more codes. Degree centrality indicates which codes have the largest number of connections with other codes and thus highlighting the most important codes. Table 16 presents the codes with higher centrality, whereas Tables 17 to 20 include the four cliques obtained in the analysis. Concerning the most important codes, Table 16 indicates that both current users of drones and potential customers said that the indoor drone must include interchangeable lenses and camera. They also indicate that this camera will assure 360° movement, and if the drone will be as small as possible it will allow increasing the time it will be in the air. Users want that the drone incorporates a different positioning system from those typically employed outdoors. The drone should be able to detect and avoid obstacles and include the option to design routes and shootings in advance, in order to make operation easy and facilitate its use by more customers. They also give value to the capacity of record and repeat flights, since this would facilitate the link of shots done in different moments. Finally, they think that aspects related to safely and privacy are essential.

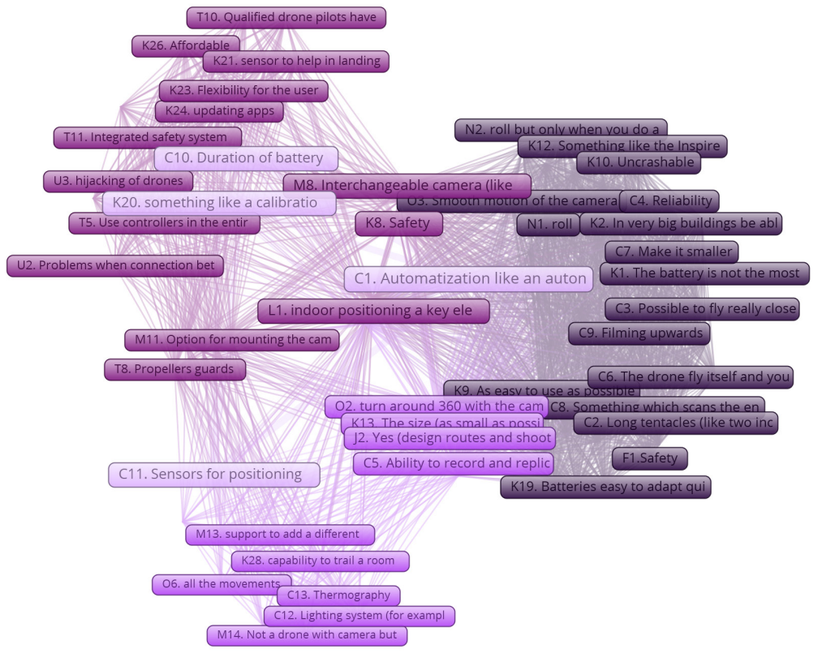

Figure 6. Network of codes indicating features and other characteristics for an indoor drone.

The four cliques obtained give information about what codes appeared in the analysis with those detected in the centrality measure as the most important. Each clique or group includes a number of codes which appeared in the total network like small components generating connections. Information from cliques could be used to define groups of customers depending on which features and characteristics they consider necessary. For example, clique 1 would include users with high specifications in relation to what should include the drone. Clique 2 would concentrate users who are more concerned about features in the camera, while in clique 3 refers to users which are more interested in safety issues. Lastly, clique 4 would include a user who consider not only features in the camera but also elements and movements.

Table 16. Main codes in relation to the others

Code	Degree	Eigenvector
L1. Indoor positioning is a key element	100	22.12
M7. Interchangeable lenses	100	22.12
U1. Privacy issues	100	22.12
F2. Detect and Avoid obstacles	86.21	21
K8. Safety	86.21	21
M8. Interchangeable camera (like in DJI)	86.21	21
C5. Ability to record and repeat a flight (repeat the shot would be the best, like with a slider)	78.16	20.38
J2. Yes (design routes and shootings in advance)	78.16	20.38
K13. The size (as small as possible)	78.16	20.38
K18. I want to be in the air as long as possible	78.16	20.38
O2. Turn around 360° with the camera alone and not the drone	78.16	20.38

Table 17. Clique 1

Codes
Codes C: C1. Autonomous like an autonomous car; C2. Two inches nearer; C3. Possible to fly really close and if something is touches then do a small correction and back off; C4. Reliability; C5. Ability to record and repeat a flight (repeat the shot would be the best, like with a slider); C6. The drone fly itself and you only control of camera; C7. Make it smaller; C8. Something which scans the environment before flying; C9. Filming upwards
Codes F: F1.Safety; F2. Detect and Avoid obstacles; F3. Sound constrictions;
Codes J: J2. Yes (design routes and shootings in advance);
Codes K: K1. The battery is not the most important; K2. In very big buildings be able to go to the top; K3. Customizable to use lots of extra things (like DJI does); K4. Lighter battery; K5. Modifiable will increase complexity and difficulties; K6. Easy to use and very easy customizable; K7. Modifiable battery in size (to adapt to the fly); K8. Safety; K9. As easy to use as possible; K10. Uncrashable; K11. Reliability; K12. Something like the Inspire 2 by DJI; K13. The size (as small as possible); K14. Live image quality on your smartphone; K15. Small sensors like in the iPhone; K16. Great film quality; K17. Recording; K18. I want to be in the air as long as possible; K19. Batteries easy to adapt quickly;
Codes L: L1. indoor positioning a key element
Codes M: M1. Able to fly a five kg or 1 kg camera; M2. Resolution; M3. The compression; M4. A small compact camera; M5. Capability to record in Raw or Log formats; M6. A small camera; M7. Interchangeable lenses; M8. Interchangeable camera (like in DJI);
Codes N: N1. Roll; N2. roll but only when you do a creative shot
Codes O: O1. The pan and the tilt; O2. Turn around 360° with the camera alone and not the drone; O3. Smooth motion of the camera (It has to be moved like nobody touches that camera); O4. The three axes; O5. to shoot upwards
Codes S: S1. View of camera not blocked by the landing gear;
Codes T: T2. Something like an airbag to reduce impacts; T3. Safety for the camera
Codes U: U1. privacy issues

Table 18. Clique 2

Codes
Codes C: C5. Ability to record and repeat a flight (repeat the shot would be the best, like with a slider);
Codes F: F2. Detect and Avoid obstacles;
Codes J: J2. Yes (design routes and shootings in advance);
Codes K: K13. The size (as small as possible); K18. I want to be in the air as long as possible; K8. Safety;
Codes L: L1. indoor positioning a key element;
Codes M: M7. Interchangeable lenses; M8. Interchangeable camera (like in DJI); M9. Camera 360; M11. Option for mounting the camera on top or below; M12. 4K;
Codes O: O2. Turn around 360° with the camera alone and not the drone;
Codes T:T7. Sensors; T8. Propeller protection;
Codes U: U1. Privacy issues

Table 19. Clique 3

Codes
Codes C: C10. Duration of battery;
Codes K: K20. Something like a calibration pad to hold the drone in position;
Codes F: F2. Detect and Avoid obstacles;
Codes K: K8. Safety; K21. Sensor to help in landing; K22. Your stick is your pilot; K23. Flexibility for the user; K24. Updating apps; K25. The drone must have the specifications; K26. Affordable; K27. A drone that does not hit the wall;
Codes L: L1. Indoor positioning a key element;
Codes M: M7. Interchangeable lenses; M8. Interchangeable camera (like in DJI); M9. Camera 360 M10. Movements in timing; M11. Option for mounting the camera on top or below; M12. 4K;
Codes T: T4. Fly indoors when there are not people over there; T5. Use controllers in the entire place; T6. Use FPV cameras; T7. Sensors; T8. Propeller protection; T9. The pilot has the distance in a monitor; T10. Qualified drone pilots have been trained more on safety than on how to fly; T11. Integrated safety system; T12. Collision avoidance;
Codes U: U1. Privacy issues; U2. Problems when connection between drone and remote control knock out (i.e. Wi-Fi booster); U3. Hijacking of drones
Codes U: U1. Privacy issues

Table 20. Clique 4

Codes
Codes C: C5. Ability to record and repeat a flight (repeat the shot would be the best, like with a slider); C11. Sensors for positioning; C12. Lighting system (for example, with LED); C13. Thermography;
Codes J: J2. Yes (design routes and shootings in advance);
Codes K: K13. The size (as small as possible); K18. I want to be in the air as long as possible; K28. Possibility to create 3D indoor map with reference grid; K29. Sensor in the camera needs to be flexible;
Codes L: L1. Indoor positioning a key element;
Codes M: M7. Interchangeable lenses; M9. Camera 360; M11. Option for mounting the camera on top or below; M12. 4K; M13. Have a support to add an additional camera; M14. Not a drone with camera but a support to adjust any camera; M15. Able to avoid abrupt camera movements;
Codes N: N3. Flexibility to adjust colour, zoom, everything;
Codes O: O2. Turn around 360° with the camera alone and not the drone; O6. All the movements;
Codes S: S2. See the image in a screen while drone is filming;
Codes T: T1. Safety for goods; T7. Sensors; T8. Propellers guards;
Codes U: U1. Privacy issues

5. CONCLUSIONS

The project first step, consisting in identifying the creative industries' needs for indoor filming using RPAS, has been fulfilled. The three focus group sessions were successful. The selection of the informants, the appropriateness of the questionnaire was confirmed, and the comfortable environment that was created. Moreover, a high interest of this new product was aroused. All this help to gather valuable information to define the features that the indoor drone needs to fulfill. In general, the focus groups were an opportunity to generate expectancy among informants in relation to the new product.

The detailed list of features which should incorporate the new product will be created based on the CIs' need, and now the AiRT consortium is looking forward to do the next step. This will include the evaluation of all the ideas and to select those which can be included in the prototype. The inclusion of as many features as possible, expected by the Cis, creates value for the end-users and will be the key point for a successful product. In 2018, it is foreseen to test the new product in real environments with the same informants (users/clients) who participated in the focus group, and it will be tested whether AiRT drone meets expectations/ needs of the participants, thus the Creative Industries.

REFERENCES

- http://www.red.com/
- http://www.dji.com/
- https://www.arri.com/camera/alexa/
- http://freeflysystems.com/alta-8

GLOSSARY

AiRT	Arts indoor RPAS Technology Transfer
CIs	Creative Industries
FPV	First Person View
RPAS	Remotely Piloted Aircraft, commonly also known as drones. Here, and in the other deliverables, RPAS and drones are used as synonyms.
SNA	Social Network Analysis