XpeCAM

A NEW PORTABLE SPECTRAL CAMERA SYSTEM FOR THE CULTURAL HERITAGE CONSERVATION MARKET

XpeCAM solution at a glance

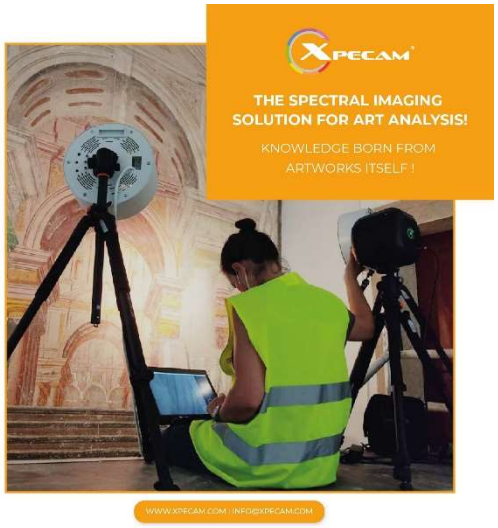
XpeCAM Solution is a user-friendly solution based on non-invasive and non-destructive, state-of-the-art proposal using spectral imaging technology and Artificial Intelligence combined together. It brings a fully automated device, with auto focusing and auto iris system, lightweight, remotely controlled, known as XpeCAM X02, with Solution analysis capabilities for image data processing and sharing (including PCA and MSM test capability), data sharing, enabling to work as a community.

XpeCAM allows for users to perform themselves the tests (wireless connection to laptop/tablet) that before could take weeks and require specialist lab teams and equipment and receive the results in seconds, in a user-friendly way due to proprietary image recognition and analysis SW.

Due to this disruption, the expert can perform the analysis several times.

Uses of XpeCAM include:

- Regular imaging to catalogue conservation progress, or between each step of an intervention.
- Recording a high-resolution, multi-spectral digital image of the cultural asset, that provides information not visible to the naked eye.
- Solution-based data bank for archiving images online and sharing them with experts and laymen, including several functionalities for user-friendly cooperative work;



PCA and MSI tests allow for precious help in several working procedures like varnish/de-varnish of paintings and also to detect mold, rot and other organic contaminations in a precise way.

We have already received a European Provisional Patent (P367.7 PP 2016.06.22) for our XpeCAM prototype. This patent describes the mechanical and electronic solution of the multispectral approach in our design. It provides evidence of the advantages versus the existing solutions.

XpeCAM Solution

The business opportunity

Cultural Heritage preservation is performed by specialists that have been educated in the use of specific diagnostic tools. These tools include a photographic camera which is their main tool for documentation, and a microscope that they are using for diagnostic imaging. These tools, although they evolve, they have their limitations in terms of diagnostic capabilities. Particularly, although they increase in spatial resolution, and optical magnification, they are limited in the visible region and moreover in trichromatic vision.

This technology is unable to provide information regarding the material or to acquire images beyond the visible spectrum. For that reason, users are obliged to buy expensive instruments which are big and/or heavy and require specialized knowledge to use them, or to request the support of a scientific laboratory. As a result, this increases the time and effort of the users and increases significantly the final cost for the customer/collector.

Based on our own perceived needs, we have developed the solution of our improved, truly disruptive solution – XpeCAM. XpeCAM was developed in response to very real needs that our conservators have identified in the lab and in the field (cultural heritage sites). As described previously, to achieve exceptional work, the conservator needs to rely on analytical data, obtained usually from dedicated external labs that use specialized staff and equipment.

With the use of XpeCAM, there are no second-class art works – this portable spectral system performs in a user-friendly way all the support tests that a conservator needs in his daily work, without the need to subcontract lab services. XpeCAM empowers the art conservator with a new tool that increases the quality and speed of the restoration process.

Multispectral imaging is a technology that has been used in cultural heritage for multiple years. The main problems of this technology were the high cost of the equipment, the specialized skills required, and the complicated user interface to acquire, process and analyze data.

Nowadays, technology has advanced to a point where the price of hardware has dropped significantly, and software has evolved to a point where automation can be performed easier. These facts together with our novel designs in hardware and software, which have created a solution that is able to perform all the tasks required in the conservation market, in a cheaper and more user-friendly way!

By allowing the conservator to cut costs, the high-quality conservation work that was reserved for first class art works is now available for new market segments that can afford it. This is a new market opportunity, as users can use XpeCAM Solution to

produce the analytical data previously subcontracted and keep the value to themselves. It also gives more versatility to the restoration professional and speeds up the conservation process, as professionals receive the data almost instantly, not needing to wait for the results to come from the lab.

XpeCAM allows for conservators to harvest new business opportunities and grow their market by reaching new clients that want to preserve cultural heritage. This means larger sites (e.g. frescoes, in situ art works, etc.) can now be intervened at a lower cost, and also be recorded for posterity in high definition and in several spectral layers – this is a disruptive addition to the conservation services that can bring about new markets for cultural heritage SMEs, that is in line with best practices for cultural heritage site preservation.

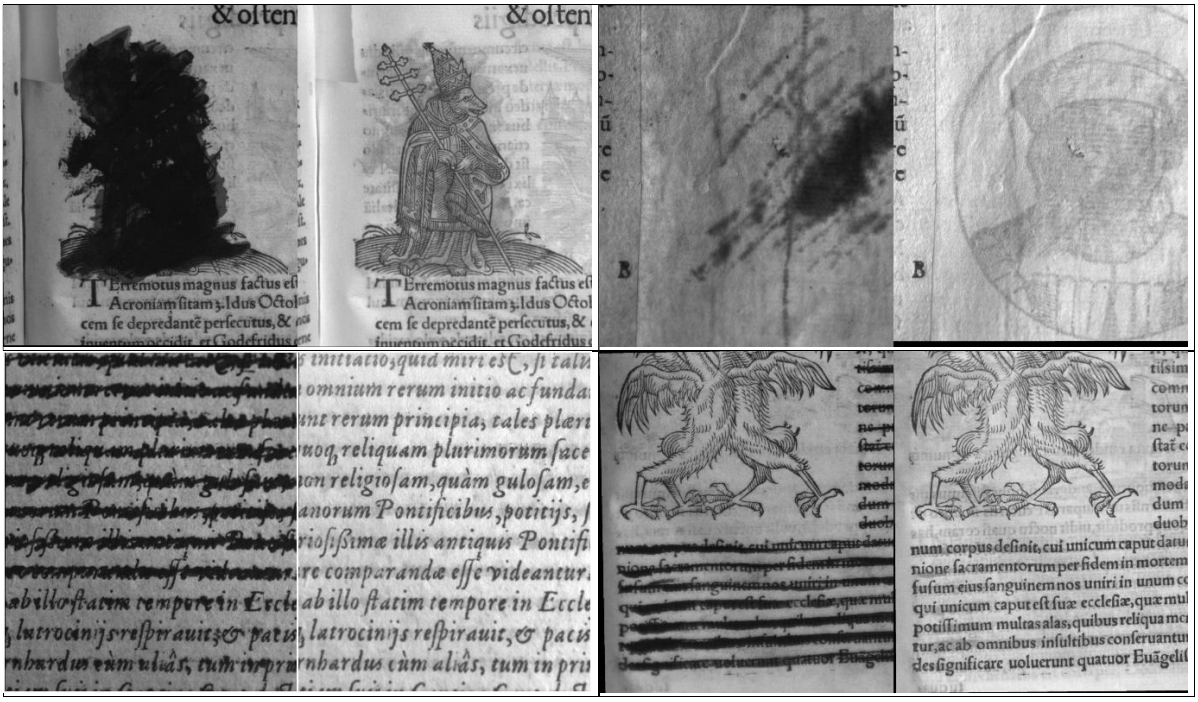


Figure 1. Censored by the inquisition, XpeCAM reveals what lies beneath.

Commercialization roadmap

The New XpeCAM

The new proposed XpeCAM is expected to have the upgraded specifications in both software and hardware designs. Particularly, on the hardware we have already worked on two different designs with slightly different specifications which are described in the following table for comparison:

	XpeCAM X01	XpeCAM X02
Spatial Resolution	**5M Pixels**	**> 5M Pixels**
Wavelength sensitivity range	350-1200 nm	350-1200 nm
Max Exposure time	1 sec	3 sec
Number of bands	30	30
Portability – No power supply need	√	√
Real time imaging	√	√
Automated system	NO	√
Auto focus & auto iris system	NO	√
Cloud processing and storage operation	to be integrated	√
Remote control for acquisition	NO	√
Interchangeable objective lenses	√ (C-Mount)	√ (F-mount, C-mount)

Table 1. Comparative table of current and new XpeCAM hardware specifications.

A major update was focused on the software design of XpeCAM Solution. This cloud proposal is able to work on various tasks as described in the following table:

	XpeCAM X01	XpeCAM X02 upgradeable on demand
Storage	Local HDD (1TB)	Cloud (>50T)
Processing	Local CPU (i3 core)	Cloud (multiple CPU and GPU cores)
Max RAM	Local RAM (4GB)	Cloud (>32GB RAM, 8GB VRAM)
Processing time for a single dataset	Approximately 10 minutes	Within seconds
Visualization of results	Locally on screen	Web based on any screen or device. Option for augmented reality solution
User database	No	Yes
Data database	No	Yes

Reference database	No	Yes
Metadata storage	No	Yes
Semantics	No	Yes
Automated report generation	No	Yes
Data and results sharing	Through storage media	Through the web (XpeCAM Solution or any other social media)
Social network tools	No	Yes (XpeCAM Solution own social network)
Importing data from other spectral imaging systems	No	Yes, both Multispectral and hyperspectral data

Table 2. Comparative table for XpeCAM software specifications.

XpeCAM Solution focus on two main directions: hardware and software. More specifically into the features we may point out:

HARDWARE FEATURES

- **ADVANCED SENSOR** XpeCAM is based on a new sensor that will support the imaging quality improvement. We currently have two directions of focus, one on the improvement of the spatial resolution and second on the improvement of the signal sensitivity.
- **AUTOFOCUS SYSTEM** An important feature that is required to improve system automation is autofocus. XpeCAm is able to perform autofocus, by the use of specific objective lenses and electronic control by the system. The system supports a standard for interchangeable objective lenses (F-, C- mount).
- **ADVANCED HUMAN-COMPUTER INTERACTION** XpeCAM Control and operation is performed through smaller and easier to handle computers (tablets) where all the control is done through touch-screen gestures. This will enable visualization (imaging) of the object on a full screen mode, without losing control of the system.

SOFTWARE FEATURES

- **ACQUISITION APPLICATION** The acquisition application support 12bit sensor operation and saving in 16bit image formats. Further developments will include touch screen gestures control and operation.
- **SOLUTION STORAGE** The acquisition application is designed to be linked with a Solution storage service that enables the synchronization of the measured data with XpeCAM's Solution server with specific end-user permissions and privileges. Achieving the goal of autofocus and automated acquisition process, the amount of data gathered on everyday use of XpeCAM will increase significantly. Particularly, with the current version of XpeCAM, each dataset consists of multiple high resolution images, resulting to over 250MB size. A typical artwork or document requires multiple measurements (>10) resulting to over 1.5GB of data collected within a few hours of work. All the above data will be saved to the Solution server enabling key services including Solution processing for fast data processing, Solution analysis, reference databases, social tools and other

technologies.

- **SOLUTION PROCESSING** The processing of such a large amount of data requires significant processing time, which increases with the algorithms' complexity. Processing algorithms require information to be obtained from the reference database, to allow analysis. The multidimensional datasets resulting from analysis is processed in real-time in order to avoid delay in the interpretation of results (i.e. pigment maps or deteriorated areas) and real-time visualization of image maps together with the objects surface. Visualization of results is be achieved by compressed transfer of data to the end-users' screen and soon on augmented reality device.
- **SOLUTION REFERENCE DATABASE** To support analysis of measured data from XpeCAM, a core database was created. In this database a list of reference reflection spectra is stored, deriving from pigments, binding media and varnishes in a large spectral range (300-2500nm). Multiple parameters were taken in account including but not limited to the: thickness of material layer; particle size; ageing factors of the materials (temperature, relative humidity, UV light, natural conditions, etc.); historical period that the material was used; the artists that have been using them; region of origin; and additional measurements from other analytical methods (LIBS, FTIR, XRF, etc.).
- **SOLUTION ANALYTICS** Data analysis involves methods and algorithms that enable pigment characterization and mapping of specific spectral characteristics on the surface under analysis. Those spectral characteristics derive from materials such as: as pigments, mediums used and coating layers but also from chemical variations as deteriorations and ageing. Furthermore, development of pattern recognition algorithms that enable the enhancement of the stratigraphy of an artwork with multiple visualization techniques.
- **RESULTS VISUALIZATION** Appealing visualization algorithms to present results in a friendly way to the end user, and for sharing and working in the Solution with a community of practitioners. Advanced imaging of the resulting data after analysis through augmented reality glasses, for real-time imaging of selected information that will assist scientists on their everyday conservation tasks.
- **AUTOMATED REPORT GENERATION** This feature includes the necessary images from the measurements that contain important information from the sample, and the significant results from the analysis. The main structure of the report is chosen by the end-user from a template list or designed under a specific methodology. Text is automatically generated based on the principal wavelengths that contributed to the results.

- **DATA SHARING** Through the Solution services the user is able to have the option to share the results and/or data with others users, creating a community of users.

From our analysis, in collaborations with end users, beta testers and conservation laboratories, we have identified the customer demands as they are optimized under the use of XpeCAM Solution. The main application solutions that can be achieved with the use of multi-spectral imaging as core technology are the following:

a) detection of underdrawings,
b) detection of over-paintings, and
c) detection of any other existing artefact.

The automation of the above applications will provide a much more user-friendly environment, which together with the automated report generation will reduce the time spent in the analysis of one object. For this reason, an automated system that includes autofocus, auto-iris, auto-calibration, and enhanced real time visualization that will occur closer to the objects' surface (by the use of tablet pc and touch screen control with optional augmented reality solutions) was developed. Lastly, as time management is very important in conservation work, automated report generation feature that will use artificial intelligence technology to identify semantic results for reporting, are already reducing the time required by the conservation scientists for documentation.

The technology that is used for the XpeCAM development has multiple applications in different markets. The main targeted markets that need to be exploited, after the conservation market, are the Agriculture and Industrial market. Particularly, in the agriculture, XpeCAM Solution holds the potential to identify specific diseases, pests and nutritional problems and create image maps to assist in the direct confrontation of the problem. Likewise, it may be used in food quality control, inside stores to early diagnose the deterioration of the products.

In the industrial market, quality-control during the various steps of the production is essential. XpeCAM Solution can be of assistance to improve the identification and characterization of problems that can occur, improving the quality of the end product.

XpeCAM´s road to commercialisation

The road to commercialization of XpeCAM Solution will be greatly affected by many technical and commercial risks if these are not taken into consideration in advance. Our main technical risks relate to the need to develop good user interfaces that allow end users to easily work with our product. We have involved end-users since the beginning of our project, and the use of focus group and client interviews as we develop the software in Phase 2.

We also expect that our competitors can adjust to our innovation, but we will cover this by patenting our innovations during Phase 2.

Our main commercial risks focus on the need to gain reputation and develop willingness to buy. With our initial prototype, we've been doing roadshow of our technology in Museums and Universities in Portugal, Spain, Italy, France and Brazil for the past 2 years, presenting our product and hearing expert's needs and requests. We have sold three prototypes in Portugal, and have the interest of several Museums, Labs and Conservators, as our Letters of Intent demonstrate.

Another concern is to define the price range of XpeCAM and the potential need to have two or more versions, at different prices – we have focused on this aspect in detail when we performed our interviews with end-users.

XpeCAM Solution is today state of the art on technology innovation used in the cultural heritage conservation market regarding spectral imaging, redefining the standards of object documentation.

XpeCAM Solution is constantly used in the everyday work of conservation scientists, art historians, museum curators, and collectors. From its social capabilities, multiple application will be developed enabling communication between interdisciplinary professions and discussion.

Competitors Analysis

State of the art – Current solutions

The existing competition on multispectral imaging is based on different approaches. Particularly in our knowledge, there are 4 companies (Proficolore, Art Innovation, Pixelteq, Ximea) that could be considered as competition. The solutions that they offer are for multiple markets, except the first two that are focused particularly on cultural heritage. These two solutions (Proficolore and Art Innovation) have a main difference which is automation. The solution of Proficolore, is based on a standard photographic camera (Nikon), and the manual adaptation of filters in front of the objective lens. The second solution (Artist) from Art Innovation, is based on a color CMOS sensor and an automated filter wheel with 4 filters on.

The sensitivity range of both solutions is from 380nm-950nm. Regarding the other two solutions (Pixelteq and Ximea), they are developed as generic instruments that can be applied in multiple markets including Cultural Heritage. The main advantage that they have compared to the others is the fast acquisition of the whole spectral cube, which enables the study of dynamic phenomena. Particularly, the solution from Pixelteq has a constantly rotating wheel with 8 filters on that enables acquisition of all wavelengths in less than a second, depending on the application.

Ximea's solution is based on a pattern of filters that are placed on top the sensor chip, and creates single snapshot spectral cubes with 16 or 25 filters. The advantage of such a solution is that it can achieve acquisition speeds of a full spectral cube of 120 cubes per second, which is not applicable for the conservation market. Based on the above, the main competing technologies can be described in the following table:

PixelTeq produces a multispectral imaging camera system capable of providing images at 8 distinct wavelengths. Those wavelengths can be pre-selected through a list of filters available from the manufacturer. The cost for such a camera system is $43K. The main weakness of this solution is the limited number of filters that it operates with. Moreover, it is very expensive, and it requires multiple cables to operate it.

Proficolore, produces a multispectral imaging solution by the use of a photographic camera system and a set of filters. The cost of such a system is 5K Euros. The main disadvantage of such a solution is the manual installation of each filter. This requires a lot of time spent on changing filters for an acquisition with multiple filters. Moreover, the total number of filters available is 8.

Art Innovation produces a multispectral imaging solution called Artist. This system is fully automated but it only has 4 filters (UV, Vis, IR1, IR2). The cost of such a system is 45K Euros.

XIMEA produces a multispectral imaging solution XiSPEC, with 16 or 25 spectral bands in a snapshot approach. The wavelengths are preselected under two spectral operational ranges (470-630nm, and 600-950nm). The main weakness of this solution is that it is reducing its spatial resolution to achieve the spectral dimension.

Competitors worldwide

Comparing our technology with the rest of technologies found in the art-conservation market worldwide, we can summarize the differences in the following table:

	XpeCAM	Standard Lab Test	Proficolore	ARTIST	SpectroCam	xiSpec
Sensitivity range	350-1200 nm	350-1200 nm	380-950 nm	380-950 nm	400-1000 nm	470-630 600-950
Number of bands	30	30	8	7	8	16 25
Portability – No power Need	√	√	√		√	√
Real time imaging	√	√	√	√	√	√
Automated system	√	√		√	√	√
Acquisition & Visualizatio	√	√		√	√	
High definition	√	√			√	

Market price (Euros)	17K	20K	5K	45K	43K	13K

XpeCAM – Better than alternatives

As mentioned in previous sections, the benefits of this solution for the end user are numerous.

The described solution will be a report that will be automatically generated by the Solution, which can be further processed by the end-user if needed. In order to achieve this, multiple features, hardware and software, are incorporated. Starting from the top of the pyramid, automated reporting requires identification of the important key-findings from the analysis.

Automated data interpretation will be achieved by the most advanced machine learning algorithms and a database of solved cases by specialists and scientists. Automated data processing and analysis requires strong processing and storage capacity, which is only achieved in Solution solutions.

To reach this point data must be acquired in a way that quality and repeatability are ensured, a solution that will come by the automation of the hardware varying parameters, and the methodology that will be developed.

Hardware automation refers to the automated filter selection, auto-shutter, auto-focus, and auto-iris solutions. Methodology solutions include calibration method and software as automated Solution synchronization for data, and acquisition control will be implemented.

Lastly, social networking tools, will enable sharing of information with others, discussions, and dissemination of data and results.

Entry barriers for potential competitors

Many barriers have been set to stop, or at least, delay the entrance of competitors in the cultural heritage market, such as:

Technological reasons

XpeCAM Solution includes the development of an AI Cloud Solution that allow the maximum exploitation of the existing and proposed hardware data results. This combination is very strong and holds the development of the technology in the hands of one company. The fact that the software Solution will be also available to be used with the competitors' hardware as a commercial product, will enhance our sales and promotion. The AI cloud solution created is available for free limited access for customers that purchase our hardware products.

IPR reasons

XpeCAM XpeCAM is a product that has already been protected by patent in EU and USA. The proposed advances in the technology will also be protected by patents, the moment the designs and final specifications have been completed.

Economic/resources reasons

With XpeCAM Solutions the end users will be able to do one-in-a-lifetime purchase and will have a return in their investment in a short period of time. Using our complete solution, customers will be able to save time, and improve their documentation and final reporting.

Currently, acquisition time with XpeCAM competition is for: full measurements require a lot of time ~15 minutes per measurement; post-processing of data at least half an hour; analysis and interpretation of data requires another hour; and finally reporting of all the results requires at least a few hours.

This results to a total time spent by conservation scientists approximately around 4 hours per measurement. Taking in account that one painting might require 3-4 different measurements, makes the whole process of documentation and analysis very time consuming (2 days), increasing the overall cost of the project.

With our XpeCAM solution users are able to have a return in their investment in a short period of time, while competitors, will have to use our Solution or try to develop their own which will require time and investment. If competitors decide to move towards new developments, we will have developed much further and we will have the market with our side.

Market Assessment

Introduction and methodology applied

In order to assess our market, we have executed a comprehensive assessment of hypothesis and assumptions combined with an analysis of environmental forces, market trends, competition and market entry obstacles, risks, opportunities and comprising our resources and constraints.

The selected team experience and expertise to implement this project brings to this project a considerable understanding of the art conservation and Cultural Heritage preservation EU market. Since XpectralTEK has now more than 10 years of existence it has a clear and profound knowledge of not only the potential clients & end-users for this technological solution but also the segmentation of this market according to the needs of each specific user.

XpectralTEK beta testers partners, entities that deals with real cases and works both in the private and public sector, has been used as a field test proxy since the beginning of XpeCAM Solution development, giving a constant feedback about the improvements that needs to be done to each phase of the project.

Having also a wide European network of contacts related to the Cultural Heritage market, a profound and non-stopping dialogue has been made by our team with these different shareholders in the EU Cultural Heritage preservation regarding the development of such potential technical solution. These activities have start more than three 6 ago and are still on the way with the implementation of periodic events regarding the XpeCAM Solution international promotion.

Also the experience obtained by our team in the last ten years in several EU projects from the FP6, FP7 and H2020 related all to this field of imaging systems for art conservation gives us a good idea about the profile of the potential end user for the solution to be created.

Understanding that this was not enough in order to have a broader idea of the potential market, the team considered that a deeper understanding was need about this reality, at least in our potential EU clients/end users.

With this in mind we have been, for the last 4 years, analyzing what our partners and potential clients are already using to solve the challenges/problems that such a proposal as XpeCAM Solution can solve.

Legal framework / Legislation affecting the project

Digital technologies and the internet bring unprecedented opportunities to access cultural material for leisure, study or work, reaching out to broader audiences,

engaging in new user experiences and reusing it to develop learning and educational content, documentaries, tourism applications, games and other innovative applications.

The European Commission Recommendation on digitization and online accessibility and **digital preservation of cultural material (2011/711/EU)**, endorsed by the Council in May 2012, asked Member States to step up their efforts, pool their resources and involve the private sector in digitizing cultural material, in order to increase online accessibility of European cultural heritage and boost growth in Europe's creative industries. The digitized material should be made more widely available through Europeana, Europe's digital library, archive and museum.

The support by Member States for the Recommendation overall and the underpinning topics remains wide. Member States consider that the Recommendation continues to address an important policy area today. More specifically, the Recommendation is deemed to have been a useful instrument for setting up national policies and coordinating activities, as well as for raising awareness of the need for action, keeping up with progress, or giving momentum to existing policies.

Among high impact provisions are those concerning national strategies for digitization , digital preservation and Europeana, while some Member States highlighted the importance of the "digital life cycle" approach[2] of the Recommendation.

The national progress reports on **the implementation of the Recommendation 711/2011/EU** during 2013-2015 provide a clearer, more comprehensive picture of the situation in the Member States compared to the reports delivered by the European Commission for 2011- 2013.

Conditions in Member States are more mature overall, though there are still differences across Member States and across the different areas addressed by the Recommendation.

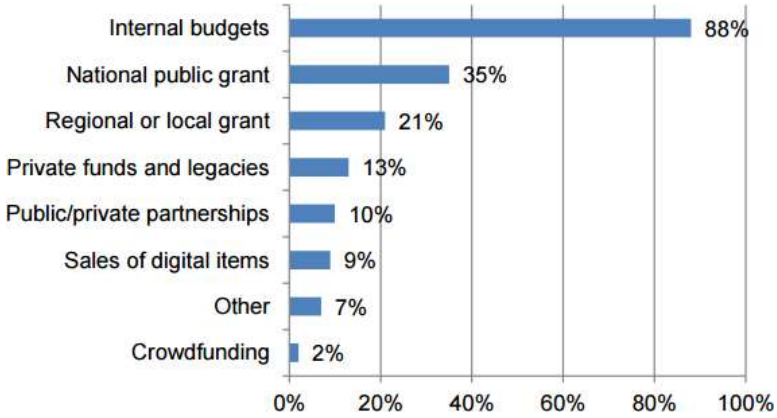
Overall, almost all Member States have achieved good progress with the digitization of cultural material, reporting continuity of plans that have been established in the past few years, or new developments such as the inclusion of digitization in an ambitious national strategy for the digital agenda in Romania.

Different approaches in planning digitization were again reported, with schemes ranging from national strategies (10 MS) supported by national funding programmes or implemented through domain-specific digitization plans, to domain-specific initiatives (6 MS) led by Ministries or by national institutions, to regional schemes or even planning based on strategies of individual institutions.

National networks for cross-domain coordination and cooperation have emerged in

some Member States as complementary measures to address digitization planning. However, monitoring digitization at national level needs to be more systematically addressed (with only 13 MS reporting some kind of national overviews) and a comprehensive overview of digitization progress at European level remains a major challenge.

The costs involved in digitizing Europe's cultural heritage, estimated at €100 billion over a 10- **year period**[3], remain as another major challenge, given the reductions in public sector spending on digitization. Structural funds have been successfully used for financing the digitization of cultural material and related services by 15 Member States in the programming period 2007-2013, with certain countries (e.g. EL, LV, LT, PO and SV) using them as the main funding source for implementing their digitization plans. From these Member States, 10 have already reported plans to use structural funds for digitization and e-culture activities in the 2014-2020 period, among them BG, HR and RO where such funding programmes can play a crucial role.



In addition, private partnerships at local level is again limited to the UK, FR and NL, while public-private partnerships with major private partners in libraries (Google, Proquest) or archives (FamilySearch) continue in a number of Member States. Still, smaller MS report the difficulty in defining such partnerships given the small market size in their countries.

National sponsoring from big foundations (e.g. Telefonica in Spain, Kone Foundation in Finland) and lottery funding (e.g. UK) have been reported again in this period as examples of alternative funding sources. In comparison, in the ENUMERATE[4] survey results for 2015, internal budgets were mentioned as a financial source for digital collection activities by 88% of institutions, followed by national public grants, mentioned by 35% of institutions.

Regarding steps to optimize the use of digitization capacity and achieve economies of scale, shared services (such as repositories or IT tools) for the digitization workflow of cultural institutions are new for this period, alongside previously reported competence/digitization centers, collaboration projects between them and bundling of material for digitization into single tenders. Cross border collaboration is mainly achieved through participation in European competence centers and networks, such as IMPACT, ENArC or CLARIN.

On the other hand, public domain material remains an area of concern. The Rijksmuseum has widely opened for free re-use their digitised public domain material in high resolution format and the Museum für Kunst und Gewerbe (MKG) Hamburg decided to publish substantial parts of its collection online, explicitly marking them,

where possible, as public domain, but examples like these remain exceptional.

Intrusive watermarking of public domain material often remains a challenge, as do low resolution or visual protection measures and the prohibition of reproduction or use of such materials for other than non-commercial purposes (e.g. on grounds of cultural heritage protection rules). Collaboration with the Wikipedian community is also being reported by some institutions as having a significant positive impact. However, it is fair to say that contractual or statutory constraints often still remain in the way of the Recommendation objective.

The **Orphan Works Directive, adopted in 2012**, will help in digitizing and bringing copyrighted content online, now that its implementation has reached cruise speed in the vast majority of Member States (twenty four countries reported transposition measures, a twelve-fold increase with respect to the previous reporting period). Legal backing of licensing solutions for the large-scale digitization and cross-border accessibility of out-of-commerce works, called upon by the Recommendation, is gathering steam with an increasing number of countries reporting initiatives in this area, particularly in the print sector.

Encouraging progress was noticed, such as the legally-backed collective licensing solutions for wide-scale digitization of out-of-commerce works in CZ, DE, EE, FR, PL, SE, SK and UK, a four-fold increase with respect to the previous advancements.

Europeana reached **48,838,150 objects in January 2016**, of which 44,187,278 came from data providers in the EU Members States[5], **significantly exceeding the overall target of 30 million items by the end of 2015 set in the Recommendation**. The target of two million sound or audio-visual objects by 2015 has reached 98%. The percentages of meeting individual targets vary among Member States, but overall the effort of Member States has been high. Eight Member States reported obstacles to reaching their targets, mainly lack of financial resources, poor organization or lack of infrastructure. It is worth noting that Member States stress the importance of considering quality issues alongside quantity, a preoccupation shared by the Commission.

Member States consistently report initiatives to encourage cultural institutions as well as publishers and other rights holders to make digitised material available in Europeana. National, cross- domain or domain-specific, aggregators are well established in the majority of Member States (17 MS). Special workshops, events and campaigns to promote Europeana and local networks for sharing information and support are present in most Member States.

Nationally agreed recommendations and guidelines for metadata formats as well as aggregators ensure the interoperability of cultural institutions' metadata with the standards defined by Europeana. Though only in a few cases accessibility through Europeana is set as a condition for public funding, several Member States require that publicly funded digitised material is made available through the national aggregators which have links to Europeana. However, initiatives by Member States to raise awareness of Europeana among the general public and notably in schools are

generally lagging behind.

The second reporting period for the Recommendation has also witnessed an increase in the number of countries supporting open cultural heritage data and promoting its re-use, by making the data available through API services, or in some cases as linked open data.

An Increased number of initiatives (projects, hackathons and other events) to explore the possibilities of open cultural data have resulted in several experimentation prototypes and some first applications re- using open data (in AT, DE, ES and the UK, among others). These provide an improved experience of re-use compared to the previous reporting period, although there is clearly plenty of scope for further exploiting the re-use potential of these resources.

A growing number of countries are already implementing comprehensive digital and long-term preservation strategies, by testing the necessary digital infrastructure, standards and protocols, together with the required digital legal deposit arrangements and provisions to enable the collection of digital cultural materials such as web-harvesting.

In spite of a noticeable number of new countries reporting provisions under this heading (e.g. new digital legal deposit laws), this is an area where implementation of the Recommendation still requires further efforts, if the objective is to properly preserve the digital heritage for future generations.

Implementation difficulties such as clashes with political realities, stakeholders' traditional practices or lack of resources, have also been mentioned. An update/reinforcement of certain areas of the Recommendation was suggested by several Member States, to take into account latest developments (such as born-digital content, quality aspects when measuring progress or Europeana) as well as a review of low impact provisions (such as the provisions on masterpieces or PPPs).

The implementation of these legislations open up XpectralTEK´s field of action, as we intend to promote the preservation of cultural heritage, not only in the commonly known way but applying the best new practices by using state-of-the-art technologies.

Description of XpeCAM end-users

Art Conservators-Restores, Museum Curators and staff, Art historians or students from any one of these fields have the profile for potential end user for the XpeCAM technological solution.

Basically, anyone that needs to study Art and/or control procedures in art objects, being it in a diagnostic perspective of the object, or a conservation intervention monitoring in Cultural Heritage. They will need a solution like XpeCAM to better understand Cultural Heritage and guarantee the excellence of their work at the end.

Description of XpeCAM potential clients

We are considering and already working with two generic profiles for our potential clients & end users.

In a B2C transaction we will deal directly to an end user of XpeCAM solution.

This type of clients is mainly single persons that need spectral imaging solutions to improve their work and differentiate themselves from their competitors. From an art historian that needs to access a powerful web tool to understand better the document he is studying and unlock it secrets, or an art conservator that needs a tool to run not only a profound diagnostic assessment of the art piece he is working in, but also to control the conservation intervention as he is implementing on it.

In this case the end user will be usually the client.

In a B2B transaction we are dealing with public and private entities that are related to Cultural Heritage as museums, universities, companies, etc.

In the case of B2B the challenge is to give to those entities a tool to understand the Cultural Heritage they are working on and control those conservation interventions, but also to give them a technological Solution for them to share and promote that same work in their own communities or others if they want/need.

Being it an University staff that wants to use such a toll to disseminate live a conservation intervention between his students, or share the outcome of a give project by all the entities community, or a museum team that wants to promote a live conservation intervention to the visiting public of its own facilities, the task is to deliver a powerful toll that helps to get the job done and also do show it to a wider audience.

For each type of clients, the promotion, commercialization and selling channels are different, although the pricing is practically the same.

Potential clients in the European market

EU market - General figures and market trends

Being such a new technology and starting to be only now disseminated between potential clients in the Cultural Heritage market, spectral imaging solutions is starting to be currently considered a must to guarantee safe and efficient conservation interventions in Art.

According to the last bulletins and meetings from EU entities all the photographic acquisition of any Artwork intervention must be done not only in the visible light but also in other wavelengths to guaranty that the maximum information about that particular European cultural asset is obtain.

The digital preservation of Cultural Heritage in general and of libraries and archives

in particular, brings another challenge to this kind of technological solutions. Spectral Imaging solutions like the XpeCAM Solution can guarantee the future preservation of our European identity for the future and also help to understand it better in the present.

This creates a huge potential market in all the Cultural Heritage EU market, since in the following years spectral imaging acquisition in wider wavelengths is going to be a standard for data acquisition in most EU projects.

In the private sector the acquisition of Spectral Imaging solutions are starting to be consider by companies as an advantage regarding other competitors in the market, giving them more sales argument to sell their services. As XpectralTEK private companies are also using these new technological solutions to create a new way to promote and explain the work they are doing to the client's art pieces.

With the constant need to share everything that is being done using all the available channels of communication, from the web, social network or the organization of events, the need and the ability to create interesting and appealing contents is more and more demanding.

Spectral imaging is right now bringing that new of looking to our reality in general and art in particular, but is and will be used to understand that same reality and the impact that our actions is creating in that same reality.

With this we will have finally a clear answer if our actions are protecting or destroying what we need to preserve.

EU market - Economic factors

The need to understand better our Cultural Heritage, plus the demand to guarantee it best protection and preservation, is increasing more and more the search for technology and solutions to do a better job.

The considerable increase in the interest for Spectral Imaging solutions for the last years in the Cultural Heritage markets, in EU and worldwide, being it in the public as in the private sector, is a direct consequence of this situation.

Right now, the demand for this kind of solutions from entities that deals with the preservation of Cultural Heritage is starting to increase considerably. Therefore, we have felt an increase of interest from the specialized public to participate in the several events and workshops related to Spectral Imaging in Art Conservation that XpectralTEK is organizing trough all over Europe.

Technicians as Art conservators are demanding more and more solutions as they start to understand the technology behind it and how it can help them to understand better their object of work and to control a conservation intervention.

From our analysis we have identified also considerable differences in the several EU regions and countries we have been operating regarding the perception of such technological solutions. Some countries have more mature markets than others and in those cases the effort to sell and the selling cycle is much shorter than others.

It seems to exist a direct correlation between this situation and professional exploration of culture assets and Cultural Heritage in general for touristic offer. Were Cultural Heritage has been seen for a long time not only something that needs to be protected but also a resource that can be explored to create wealth, the market for such technological solutions is much more prepared to absorb such technology since they understand it better and it potential.

Being a relatively new technology in the Cultural Heritage preservation, the supply for such solutions to this increasing market is going to be a big challenge for industry. There are some technological solutions appearing in the market but giving the feedback we have from our partners those products don´t address the potential end user need accordingly.

This happens mainly because those end users are still seen by the industry as specialized technicians, when what they want is not instruments but tolls to work with in their daily life.

The desire to create tolls, iconic Spectral Imaging solutions rather than analytical instruments for the end users is a corner stone for XpectralTEK developments. This attitude guarantees an access to a much wider market of potential end users, the creation of a relationship between XpectralTEK and the user of such solutions.

Instead of focusing our developments only in the solutions we have been, for the past 5 years, earing and learning the real needs of our clients for such a Solution as XpeCAM.

EU market - Technological factors

Spectral Imaging solutions are essentially non- destructive analysis technologies, that compared to the ones used today in Cultural heritage, brings speed and more information to it end user without damaging the art works.

Currently there is an increase of investment in such technologies in several fields of expertise as agriculture; industry and any other field were the concept of Industry 4.0 is being implemented in search of more efficiency and faster production levels.

One of the main advances that the spread of such a technology will bring regarding the creation of new standards are the need to record and work other that in the visible wavelengths as it has been happening until today. Wavelengths other than the visible will be considered as essential to assure that all the information from a given cultural asset is preserved and protected for future generations.

Also, the perception by the end user and general public for the need to work with the information acquired not only from the visible light bit also from other wavelengths are of great importance for the success of such technology, as we are constantly seeing during the promotion of XpeCAM Solution.

Thanks to the new trends concerning the preservation and use of Cultural Heritage data are being dictated by the EU, there is right now a clear tendency to gather as much data as possible from each artwork, being it in the visible or the invisible.

This situation is creating a profound change in the actual standards for the digitalization of large cultural archives, since it is forcing the developments of new digitalization solutions that are able to acquire in more wavelengths than in the visible.

EU market - Social and political factors

Cultural Heritage is seen today in the occidental world as having two faces on the same coin.

In one side it is considered extremely important for the identification and definition of any culture and country, a point of great importance since the identity crises is more and more present in European countries. Culture is the reference of our past, of where we have come from. Its protection and promotion is then critical to guarantee our present and future identity as a people, a nation and a country.

In the other side Cultural Heritage has today an important role in tourism industry. Without culture it would make no sense to visit Paris, the Alentejo landscapes, or test the Italian food.

But this role is presenting more preservation challenges to that same culture, since

todays mass tourism is endangering more and more our unique art works all over the world by the pressure of so many people that wants to know it, see it, and live it.

The new technologies that emerge every day, as spectral imaging, and that are considered potentially applicable to this present challenge in order to assure an efficient preservation of that Cultural Heritage, are seen today as a key factor to guarantee that same end result.

EU, UN and most of the countries in the world are continuously promoting new approaches, new directives to access, control and promise that our Cultural Heritage is going to be well preserved and protect for the future generations.

Studying the number of resources that only EU allocates to this kind of action is a clear and concrete concern about this subject, being also an indication of future resources that can and will be invested in such a technology.

End-users in the European market

Users - General figures and market trends

Professions and careers associated to Cultural Heritage are one of the fast-growing ones compared to other more traditional fields of expertise in social sciences. Since Cultural Heritage has been seen as one of the key resources that promote more the tourism industry, there have been more people allocated to the management of this specific resource for the last decade than all the time before.

Never as before there have been so many degrees in Art conservation, Art management, Cultural Heritage promotion, etc. giving to the cultural industries a growing weight in the national economies, namely the ones where tourism is a rising industry.

EU countries are a particular case where the statement of such a situation is concrete. Youth in general and the youngster that needs to decide which career to follow in particular, starts to understand culture as a potential object to gain their lives, dedicating their time to create and manage that same resource, Culture, increasing the importance of creative industries in the economic fabric of each country.

Having in mind that this is the best generation prepared in terms of technology since ever, they are going to ask for new and more productive solutions to do their work now and in the future.

Looking at the actual situation and the trends that are right now present in the market, we can easily identify the critical features of the solutions that are being in demand:

- Portability – A fashion that is a direct consequence of the integration of more and more functionalities in continuously smaller devices like smart phones.
- Iconic solutions – Design is considered as a plus in today's moment to choose the buy of any technological solution, being even, in some cases, a factor of choice

instead of the price.

- Processing speed - The end user is no longer used to wait for the end results of the data is collecting and working in. He wants it right now.
- Individuality – End users wants to feel that the solution being used can be addressed at their own desire, adjusting it, and sometimes, recreating it at his own image.
- To share – Never as today the sharing of info between communities as been so critical for the success of any new technology that is lunch to the market;
- Intelligent solution – Solutions will have to bring some IA behind it in order to help the end user to perform a better job in a more efficient and productive way.

The Design and thinking of the XpeCAM Solution has been prepared, since the beginning, to consider all these critical features. It will consider the needs and desires of the end user as a primary directive to be use in technological trade-offs, bearing in mind the technical questions for each solution as a secondary option during the decision phase.

Users - Economic factors

With the rising in the demand from end users to have access to solutions that are smaller, faster and more portable, the industry will have a big challenge to follow this demand from the market.

For the next years industry will have to rethink the way it has been looking for this particular market, reinventing the way it will supply a constantly changing market.

XpeCAM Solution has been prepared to respond to the specific demands of this market, focusing is attention primarily in the markets real needs instead of only in the product by itself.

Users - Technological factors

Technology is bringing a new power to the players that are currently working in the Cultural Heritage preservation, permitting the appearance of a new range of methodologies never seen until now.

The need to control all the interventions and the quality of the work realized by any technician is also a new trend, that associated to the introduction of new technological developments created for other application in the art conservation, is changing the new players in this particular field as conservatores or even historians, are seeing their daily work changing.

It is no longer just a question of doing something different but also the replication of tasks in a faster and much safer way to the object of their attention.

Technology is permitting these players to know actually even better the art object they are working one, leaving them to know all their secrets and innuendos. This is a major

breakthrough since it will guaranty a much better job done and a more reliable conservation and preservation of the European Cultural Heritage for the future.

Users - Social and political factors

Cultural Heritage in general is today a very big trend in all over the world.

Most of the national symbols of any region or country his related to our past and Cultural Heritage. This is not new, for sure, but the role that this kind of items have today in several industries related to tourism is bringing a new look to them. They are starting to be considered not only a reference from the past, but mainly an active for the future and something that as a real value for the present.

This new situation as shift the way we had and are now looking to Cultural Heritage preservation, being it the ruins of a roman city in the middle of a field or a nice painting in a museum room.

This new opportunity is happening very fast, too much fast for what we can handle it. Studying the actual status, it is easy to understand that we are not ready for such a fast move in other directions regarding this topic. That is why such new technologies, as XpeCAM, will at least help us to try to control the impact of such a new reality in our past heritage.

Overview on worldwide market

The World - General figures and market trends

The International Discussions about Cultural Heritage (CH) brings together researchers, policy makers, professionals, and practitioners to explore some of the more pressing issues concerning cultural heritage today.

In particular, the main goal of those discussions is to focus on interdisciplinary and multi-disciplinary research on tangible and intangible Cultural Heritage, the use of cutting-edge technologies for the protection, restoration, preservation, massive digitalization, documentation and presentation of the CH content.

At the same time, the movement is intended to cover topics of research ready for exploitation, demonstrating the acceptability of new sustainable approaches and new technologies by the user community, SME's, owners, managers, and conservators of Cultural Heritage.

Several organizations have decided to join together in order to create an optimal environment for the discussion, explanation of new technologies, exchange of modern ideas and in general to allow the transfer of knowledge between a maximum number of professionals and participants during one common time period.

The World - Economic factors

The situation that is happening in Europe about the actual role of Cultural Heritage in the economy is also replicating in the entire world. This pattern is more present in the so called occident as Europe and the Americas, but Asia and the Middle East is also in the same path.

The increase of tourism, associated to culture as an increasing trend, is one of the reasons for the importance of such economic assets as Cultural Heritage, but not only. Although this kind of objects or items were already used to differentiate nations, they have been, during the last decades, regarded more and more of real symbols of those people and regions.

The most visited countries worldwide are the ones that present an interesting balance between culture-safety-new experience, and in this mix culture plays a major role, since it is the one element that makes a visit a unique experience.

Considering this actual status, the increase in the demand of new solutions to solve old problems but mainly new ones in Culture preservation is a foreseen certainty, leading to the rise of the potential market to such technology as XpeCAM.

The World - Technological factors

As mentioned before, Spectral imaging is being regarded as a must in the technological world of art conservation. Thanks to its ability to acquire a set of data without damaging or event touching the surface of the studied object, it is starting to be considered as a standard.

Being this system a multi spectral one, it is competing with the more advance but much more expensive ones hyperspectral systems. Looking to the comparison of both technologies there will be a place for each one of them, since each has its own applications.

The outcome that such a technology as multi spectral imaging is able to deliver is adequate to the need s of the art preservation field.

The World - Social and political factors

The existence of countries with different maturity in the adoption of such technology is related to a set of several realities as the presence of degrees in art conservation, the overall investment in culture, and how long the art conservation discipline has been applied in those countries.

Usually there is a tendency to consider occidental countries as the most favorable ones for the penetration of such a technology in the market in question, but for the last decades the investment in new projects related to art and culture in other geographic regions have been considerable also.

Countries in the Middle East or Asia are increasing their investment in new cultural assets as art museums, having the need to furnish them with ancient or new pieces of art.

This new reality is also creating the need for the acquisition of new devices and technology to control all these procedures, and those countries are looking for the last news in conservation technology, leading them to new solution as XpeCAM.

There is also a great challenge regarding the regulation of such new solutions in art conservation, as well the modification or change in new proceedings in the way things in art conservation used to be done. These new technologies will oblige the creation of new approaches towards Cultural Heritage preservation, in a way that some of those cultures are note prepared yet.

Customer segmentation: Focus on targeted

The two main criteria to segment this product will be geography and client profile.

Thanks to the work done during the last 4 years we have today the clear notion that there are countries much more mature than others regarding the use of this technology in the Cultural Heritage preservation sector.

Our experience indicates that the effort to sell these spectral imaging solutions in countries like UK, Italy or Holland is much smaller than to other countries like in the Eastern Europe or Iberia (Portugal & Spain). In the more mature countries not only we have strong and well-set tourism industries but also a long and constant tradition in the art conservation trade.

This is directly linked to the general school / trends and profile regarding the Cultural Heritage preservation. The mature markets are more related to the English school, were there has been always a concern of the analytical aspect during art conservation.

The less mature markets are more associated to the French school of art preservation, where the focus was more in the end result of the conservation intervention with a clear intention for it to make the art work more pretty.

Although there has been a tendency in Europe for the two school to merge thanks to EU directives and a sharing of experience between EU countries, this process is going still to take some time, which is going to create several levels of maturity in the countries, making in some of them harder to promote and sell some solutions than others.

Considering the previous assumptions, the commercial focus is today in the following countries: UK, Italy, Germany and France.

Segment 1

Definition – Institutions with Conservation staff & lab. It is considered that it represents a potential community of potential end-users. Client is potentially different from end user. It will imply a direct negotiation. The entity will buy the full pack of XpeCAM Solution (X02 & Cloud).

Can comprehend several users other than the ones that will use XpeCAM applications.

Promotion & Distribution channel – Institutional sells channels with several levels of approval that needs to be achieved.

Purchasing power – High level of acquisition and used to deal with this kind of buying characteristics. The selling cycle is usually long and very bureaucratic.

Segment 2

Definition – Art Conservator, freelance historian, single end user. Can buy full XpeCAM pack Solution (X02 & web) or only the web feature. Direct channels of negotiation, web site, promotion events, workshops, social network, etc

Promotion & Distribution channel – Direct selling channels with very low levels of approval for the buying.

Purchasing power – Usually low power for acquisition that is why we have a financial renting program with GRENKE Renting company to help in the acquisition process.

Overall market assessment

According to EGMUS, the European Group on Museum Statistics, in 2014 there were around 25.000 museums in the 25 EU countries, and 70% of those were art & archaeology museums. Today the number of museums is much higher thanks to the investment that has been made in Culture Heritage associated to tourism, a growing industry all over Europe.

As a reference, and according to the IMLS (Institute of Museum and Library Services), there are around 35.000 museums only in the US, 65% of them being of art & archaeology.

Looking at the data from ECCO (European Confederation of Conservator-Restorers) the estimation of active Conservators-Restorers in Europe, the individuals that are currently working in the field after acquiring an official degree, are around 15.100. Those professionals are precisely the ones that have more probability of needing such a technological solution as the XpeCAM Solution.

The EBLIDA (European Bureau of Library, Information and Documentation) is another key body to have an idea of the potential clients that we can consider for public libraries and entities that are responsible for the digital management and preservation of critical documents and other papers.

There are other potential clients for XpeCAM technological Solution in Europe, but we will focus our estimate market and objective on this scenario:

	EU Museums	EU Art Conservators	EU Universities with a degree in art conservation	EU Graphic Document Archives & Libraries
TAM	25.072	9.140	957	59.750
SAM	10.000	4.000	127	15.000
SOM	2.000	1.500	95	1.000
SOM in numbers	50.000.000 €	37.500.000 €	2.375.000 €	25.000.000 €

SAM – The value shown for each potential profile is related to the geographical countries where we are going to invest our resources at this first phase regarding promotion and sales of the XpeCAM Solution.

The main criteria use to decide this trade-off was the maturity of the countries regarding the application of this technology in Cultural Heritage and art preservation.

The selected countries selected for this first phase are UK, Spain, Italy, Germany, and France.

Considering the actual and foreseen competition in the geographical selected markets, the competition is still very low for this kind of solution. In fact, since this is a relatively new technology, the interest would be for more competition to appear and help to promote the use of spectral imaging solutions in Cultural Heritage preservation. And since XpeCAM cloud Solution will be able to work with data obtained by any other device that acquire spectral data, including photographic cameras, the appearance of new players will be consider a plus.

As mentioned before, our primary geographical markets are the ones we consider as mature as possible for this technology. This means where the introduction of such technology will be much easier for potential end users to understand it and it benefits, and with a much faster selling cycle.

The first geographical market to be penetrated will be the UK, since there is already some experience in this market from our commercial team. It is a high mature market were a technology such as the XpeCAM Solution can be easily understood from end users and clients, and sold out thanks to the large experience of a high number of conservator all over the country that are used to such solutions for their day-to-day work.

The other very similar geographical markets are Italy and Germany.

These three geographical markets are the ones also that present the vast majority of conservators, end users and clients. And were also the investment in such solutions will continue to grow according to the last reviewed information.

The Business Model

Sales channels and revenue streams

Being such a new solution for a well-known technology for art preservation and conservation, the promotion and sales of XpeCAM Solution have considered several paths and channels in order to disseminate it as much as possible to obtain the maximum payback of this investment.

Considering the profile of our product and the kind of end-user/ client that it can serve, we have contemplated two main kind of transaction type, B2C & B2B:

In the B2C transaction type we will deal directly with professionals that are related and in direct contact with art works, being the real end-users of such a system. Usually, we are talking about freelancers that do work for other institutions or entities and are highly trained professional in their field.

The profiles that we have considered for this phase of the project, for the main B2C clients, are:

- Art Conservators – Restorers
- Book & Graphic documents Conservators
- Art Historians
- Art photographers

In the B2B transaction type the deal will be made with entities that have potential end users as collaborators, being them employees, students or general collaborators.

The profiles that we have considered for this phase of the project, for the main B2B clients, are:

- Universities with art conservation degrees and post graduate programs;
- Entities with art museum with access to a Conservation Lab (inside or outside the
- facilities)
- Local, regional and National archives;

Considering the key differences in both transaction profiles, we can highlight the following crucial points:

- The potential number of clients in the B2C is much higher than in the B2B. They are all end users of XpeCAM Solution that works as single entities. But according to our analysis, the ability and resources to acquire such a technological solution is much lower since they have to consider the amortization of such investment in several years, a situation that can create some resistance in the acquisition of such solution.
- The potential B2B clients, although in a lower number than the previews ones, are more probable of investing in the technology, as it is happening already with the X01 version. The investment question is not seen as an issue since they consider it as a need for their overall work and are used to realize such kind

of commercial operation often. The most interesting high profile end users as personas are usually employed in those B2B entities.

This is a key factor for the commercial promotion success, since we can consider those individuals as the ones that are going to validate the technology in each one of the markets, being them geographical or sectorial ones.

Using the already approved PT2020 internationalization program, a certain number of events (workshops, conferences) in each one of the targeted geographical key markets are and will be implemented.

In parallel, a commercially aggressive network campaign will be lunch using the web and it social networks already available as LinkedIn and Facebook.

Revenue streams

Regarding the kind of revenue streams that we have considered for the X02 phase, we have sorted out several potential channels that will be worked out as creators of income generators:

- Sell of the XpeCAM X02 solutions. Two versions: X02 and DOC. This is the most straight forward source of revenue income since it will imply the sale of concrete physical systems to the clients, being them end-users or not. Each system will give access to a standard profile for analytical software web access.

- Fees for the analytical software web access. Annual fees with two profiles: standard and Premium. Since this analytical software will be able to work with any kind of spectral data generated by any spectral imaging device, the end user can use it even don't having access to a XpeCAM solution;

- Paying services. Although the main objective is to sell XpeCAM solutions to clients, we can consider that some clients will ask for paying services like it is already happening with the X01 version. In fact, this is a potential commercial channel since it is a good way to promote XpeCAM solution between potential clients;

- System rental. More and more potential clients are asking to rent the system before they consider buying it. Right now we are sending those requests to clients that already have shown interest in XpeCAM.

One of the main revenue streams that we can consider is the annual fee that each user will have to pay for the premium profile in the web Solution. This is going to be the first product to be delivered by this project implementation having in mind the calendar that was previously consider.

With the lunch of our cloud solution for the diagnostics, and analytical work of any set if spectral data, it will be instantly easy to link any spectral imaging device to it. Not only we will have already a product that can exploit the XpeCAM already available in the market, but this web solutions will also permit the link of any hardware that is able to deliver spectral data to it.

Distribution model and Sales channel

The outlined strategy to be followed in each geographical market will demand different approaches having in mind the expected response from each set of potential clients and end-users.

Our Distribution Model will consider de following different phases:

- Direct Distribution. Each geographical market is going to start with a direct approach from our commercial team to potential end clients since we will need to understand it better, or confirm our assumptions, before we take any commercial decision. For that we are organizing several events like workshops and fair participation to study and understand better all the local players.

With these actions we are also already looking for potential local representatives of our products as potential distributors / commercial agents. To enforce this Model, all the direct available channels to potential clients will be implemented, from web resources (dynamic website, social networks) to specific advertising.

Although this is considered to be a starting point for this commercial phase, this will not be our main distributions model for all the targeted markets.

One of our main concerns will be the after-sale relationship with the end-user and client of each solution sold, since in the first phase the feedback given by this first clients in each market are going to be crucial for the overall success of the all operation.

This will oblige of a careful and constant follow up of each one of these specific clients, not only to see if their expectation regarding the system is levelled, but also, and mainly, for us to see how we can use their experience with the system to promote it even more.

Our cloud solution will be a major and valuable channel to guarantee a real and constant follow up of our client progress and utilization of the XpeCAM system that they are using, always with the care about the private data of each client and end-user.

- Indirect Distribution. With a better understanding of each market to be exploited, it will be possible to identify potential partners to promote and help in our products commercialization in the selected geographical markets.

From our past experience that we already have in this subject, the potential partners to be selected as our potential retailer will also have to know with deep knowledge the CH market to be able to promote and sell the systems.

The specifications and idiosyncrasies of the CH market will oblige of to consider this feature to be one of the major criteria for its selection.

Pricing strategy

XpeCAM solution commercialization and promotion as already given much of the date that we need to set the best pricing strategy as possible for this phase.

The three main criteria considered to set the pricing strategy are:

- R&D and productions costs of each one of the solutions to be sold, being it the full solution or only the access to the analytical web service. This criterion is already considering the effect of mass production of the hardware solution to gain some reduction that such a procedure can give us, not only to set a better commercial margin of each system, but also to improve the final quality of each system;

- Commercial margin needed to enable future negotiations with our potential retailers or local representatives. This is a critical facture for the commercial success of the overall project since the higher the commercial margin the higher it is the possibility to attract the best commercial partner for the project;

- The specification of each geographical and sector market the operation is going to be developed which can lead to a differentiation of the prices from the same products.

Customer relationship

The perception of the difference between cost and value of such a technological solution reach and perceived by our client / end-user will be one of the main marketing and commercial endeavour of all this project.

The relation to be built with the client will be based exactly in this assumption, that the value of the XpeCAM Solution is very high compared with the cost that it as to pay at the end of the day, since XpeCAM will be a critical asset for him to attained an high quality in his work, regardless of the money he has to pay to have access to it.

Thanks to this reality to be constructed during the implementation of this project, t he professional and even personal relationship that each client is going to create and maintained with XpeCAM Solution will have to be one solid and long lasting one. This relation will reach a moment where the end-user will not know how to do is work without having access to such a technological solution.

The reach of such status can be considered as a critical phase for the overall project success, since the foreseen future will make our project to sell mainly services than just physical products. This project reality obliges then to never put in jeopardy the relation constructed between XpeCAM Solution and it end-user.

Although XpeCAM will have a physical hardware during the implementation of the project that can be bought, touch and sense by people, in the future the main reality of this project will be the services provided by our Solution solutions. This will permit the creation of the constant growing relation between XpeCAM and the end-user.

This is a challenge for the project implementation, since the project that has start from a hardware physical solution will have the tendency to present itself as a software

/ virtual one, even though the creation and commercialization of iconic hardware devices to acquire the spectral data will always be a concern for the project.

Key Stakeholders

We easily identified the key stakeholders of our business proposition:

Clients / End users

Having in mind that for the first phase of the project we will deal directly with the clients, the value chain will be rather short. This will imply more effort and work from our team but will give us direct access to real and constant feedback from our actual and potential clients, being this critical information in this initial phase to guarantee a healthy growing of the several steps that are going to guarantee the project implementation.

As soon as the project is implemented in the geographical markets already identified, one of the first tasks to be made is the identification of local representatives of our products, being it retailers, local clients that are able to dress and promote the XpeCAM spirit in order to represent and pass over the benefits of having and working with such a system in the art preservation & conservation world.

At this first phase we also consider that our clients, the ones are going to be the first to exploit the system potential, are going to be our main value stakeholders since they are going to be also the ones that will spread the word, confirming that full potential XpeCAM and what it can really provide to it users.

Suppliers

Some of the development of XpeCAM Solution will have to be guarantee with the customization of a certain number of our supplier products. This is a key factor to the certainty of the overall project success. So, we have to consider specific suppliers as critical, namely the ones that will provide the optical filters or the monitoring system.

They are already well identified and there is already a well based relationship stablish. In a certain way, they consider also this project as a strategic one for their own business having in mind the potential revenue that it can bring to them.

The constant work that will be done with this kind of key partners is going to be a primary aspect of relation management, giving them as much importance and follow up as to potential clients.

Commercial partners

The promotion and sales of XpeCAM products will have to be made forcedly with the help of several commercial partners to potentiate the maximum of the promotion and sales as possible in each market.

Although we are considering a bigger investment of our commercial team in a first phase in order to understand better and validate our market assumptions in each one

of the selected markets, this first phase will also serve to identify, work with and train any commercial partner that might be regarded as potentially able to help in this endeavour.

As it can be seen in our previous list of key stakeholders, there is already some players well identified with this commercial propose but the need to promote XpeCAM in several markets obliges us to search for more.

Overview – Business Model Canvas

We have resumed our business model in the following business model canvas:

<table>
<tr>
<td rowspan="2">Key Partners

- First Clients in each market;
- Component Suppliers as optical filters & sensors;
- Knowledge from each market;
- Promotion of the XpeCAM Platform</td>
<td>Key Activities

- Identification of the right commercial partners in each market;
- Direct distribution at first;
- CRM as personal assistance and communities;
- Revenues from direct sales of XpeCAM and web-platform services</td>
<td rowspan="2">Value Propositions

- Give clients a bigger knowledge & control of their Culture Heritage (CH);
- Fast, accurate & reliable data about their work;
- Solving the lack of knowledge about their CH;
- Giving data acquisition, analytical & sharing power of their work</td>
<td>Customer Relationships

- Close, direct virtual relationship, being a single user or a communitie;
- Starting relations with academic communities now;
- As the relations starts to evolve they are going to be cheaper</td>
<td rowspan="2">Customer Segments

Two main segments:
- Single user, B2C segment & Community user, B2B segment;
- The B2B segment is consider for now the most important for it scale and number in existence</td>
</tr>
<tr>
<td>Key Resources

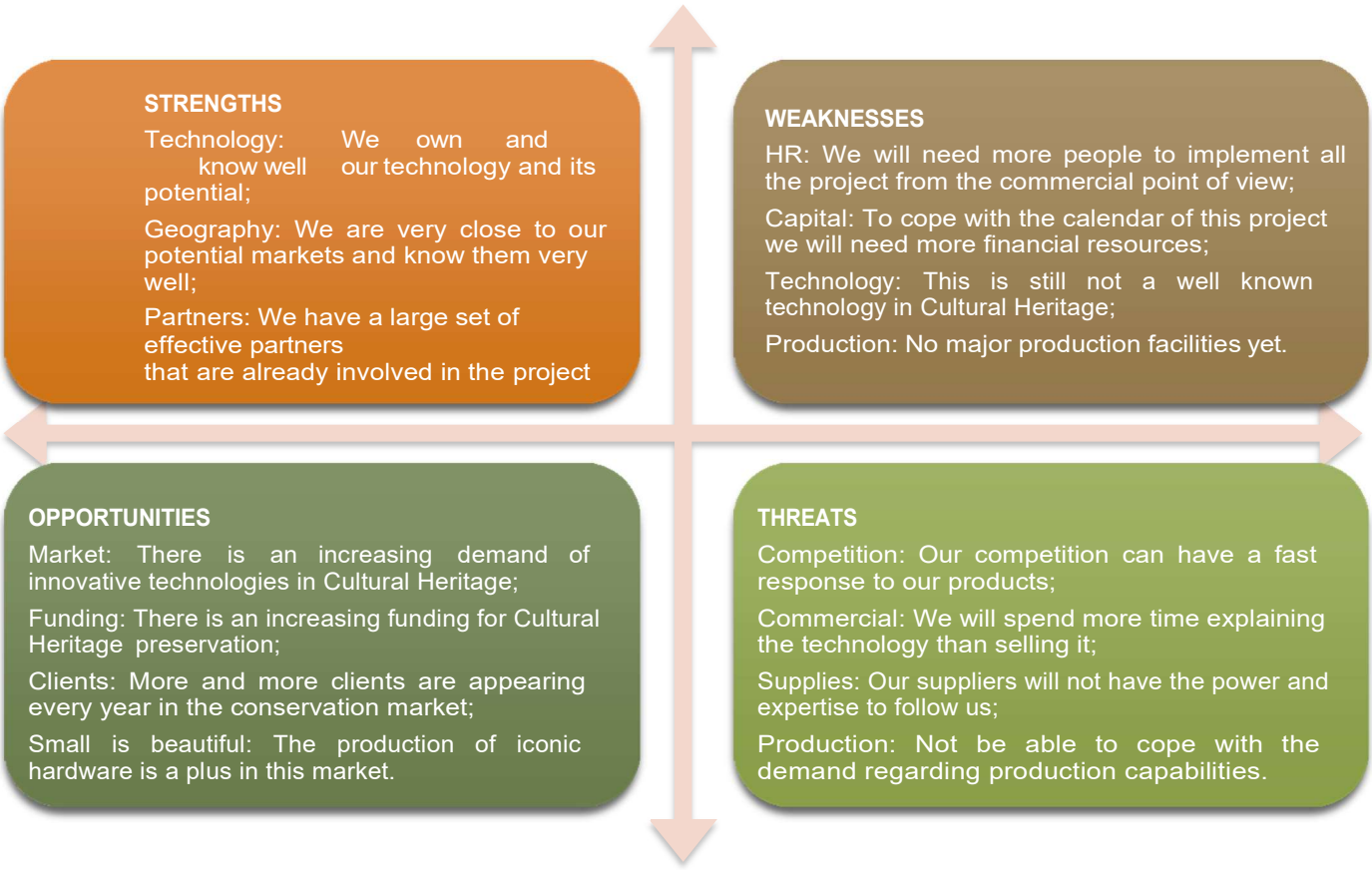
- The HR already exist;
- Fast & Constant Market Access;
- Financial, associated with the revenue streams
- Identification & implementation of the best sales & distribution channels</td>
<td>Channels

- Using direct channels for now (workshops, social events, fairs);
- With the web platform we can reach them faster, a channel that will be integrated with our social network</td>
</tr>
<tr>
<td colspan="3">Cost Structure

- There are three main costs: HR - Components - Promotion;
- The most expensive ones are Promotion costs;
- The most expensive activities are R&D - Promotion</td>
<td colspan="2">Revenue Streams

- For each XpeCAM system 25 K€;
- For each standard web access 100 €;
- They would prefer to pay it in slices;
- The contribuition for each revenue stream is...</td>
</tr>
</table>

SWOT Matrix



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Conclusions

Through our market study we found that according to EGMUS, the European Group on Museum Statistics, in 2014 there were around 25.000 museums in the 25 EU countries, and 70% of those were art & archaeology museums. Today the number of museums is much higher thanks to the investment that has been made in Culture Heritage associated to tourism, a growing industry all over Europe. This indicates a strong and mature work ground to exploit all XpeCAm potential.

According with the IPR analysis, XPECAM platform has freedom to operate. All the competing patents will be tracked to ensure that there will be no infringement. Regarding the brand names and according with the Global Brand Database from WIPO, the search results for global brands and names for XPECAM showed 0 coincidences.

The proposed XpeCAM is expected to have a constant upgraded specifications in both software and hardware. Particularly, on the hardware, and based on the component market research we performed, we have already worked on three different prototype solutions (sensor and monochromatisation) with slightly different specifications. On the cloud design, it is identified the new software attributes and functionalities of XPECAM to execute on the cloud, allowing access of this solution all around the world. Development of those prototype solutions will enable testing of their specifications under real everyday practice.

Through the feasibility study of the XpeCAM, we defined a realistic and attainable work program to ensure that all the objectives are met, focusing our attention on specific technical and commercial obstacles that could present limitations to our market introduction. For this reason, we understood which tasks will be performed by our own staff, as well as which activities will be externalized; all in order to guarantee the success of the project within the set timeframe.

All these conclusions allow us to believe that XPECAM´s implementation and further commercialization activities after the conclusion of the project will be successful.