

SMARTSET – User Requirements Definition



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Executive Summary

The vision for the SmartSet project is to develop a low cost virtual studio solution that, despite being ten times less than the cost of comparable solutions on the market, will have the same quality of high cost solutions currently used by larger broadcast media companies, but with a simple and limited functionality. The project will increase the competitiveness of the European creative industries, particularly in the broadcast media sector.

The SmartSet project objectives include prioritising user requirements and mapping these to project capabilities to ensure project outcomes are driven by user needs, and devising mechanisms to verify that user requirements are being met and specify variables to be monitored during the validation process so that the market demand for the solution and the innovation potential can be clearly demonstrated.

This document, resulting from the project task 2.2 and following a program of consultations with the creative industry partners, will detail a range of user requirements which will feed into the virtual studio specification.

SmartSet User Requirements Definition research has been executed by the project partners from Lapland University of Applied Sciences with the help of the SmartSet developers team. This report has also been published on the project's website at: http://www.smartsetproject.eu/plantilla_outcomes/.

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1 INTRODUCTION

1.1 Project description

Creative industry SMEs in the broadcast media sector, such as small-scale TV stations and production companies, have a need for Virtual Reality and Augmented Technologies to remain competitive, bearing in mind their limitations in facilities and resources. The possibility of expanding the use of advanced graphics technologies which are only within reach for large-scale TV networks, will be an important step forward to creative industry SMEs in the competitiveness of this industry. (User Consultation Process Protocol and Tools 2015.)

The vision in the **SmartSet project** is to develop a low cost virtual studio solution that, despite being ten times less than the cost of comparable solutions on the market, will have the same quality of high cost solutions currently used by larger broadcast media companies but with a simple and limited functionality so that the project will increase the competitiveness of the European creative industries, particularly in the broadcast media sector (User Consultation Process Protocol and Tools 2015). In this sense, the SmartSet concept is a “game changer” and will provide creative industries’ SMEs with the capability to compete with the big broadcast media players in the market. Moreover, the SmartSet solution will provide any organisation with an interest in broadcast media with the means to set up broadcast television capability. (Project Implementation Manual and Quality Control Plan 2015.)

The SmartSet project aims to meet the following challenges:

- Creative industry SMEs in the media sector, in particular, have highlighted the need for a high performance, low cost, virtual studio solution. In order to meet this challenge, the SmartSet technology must be both cost effective and meet a wide range of diverse user needs.
- To increase the probability of commercial success, relevant stakeholders must be involved from the outset, not only to ensure that the validation criteria to be used are appropriate and in line with user needs but also as an early step towards market preparation.
- Existing virtual studio solutions are complex, expensive and beyond the reach of many creative industry SMEs. Therefore, building on existing industry standards, the SmartSet consortium is intended for producing a more cost effective, market-ready solution, comparable to existing high cost solutions available in the international market in terms of quality, graphic resolution and realism etc. There are low-cost solutions available but the quality of performance is poor. (Project Implementation Manual and Quality Control Plan 2015.)

1.2 Document description and purpose

The challenge to be addressed is that creative industry SMEs in the media sector, in particular, have highlighted the need for a high performance, low cost, virtual studio solution. In order to meet this challenge, the SmartSet technology must be both cost effective and meet a wide range of diverse user needs. (Project Implementation Manual and Quality Control Plan 2015.)

The SmartSet project objectives include prioritising user requirements and mapping these to project capabilities to ensure project outcomes are driven by user needs, and devising mechanisms to verify that user requirements are being met and specifying variables to be monitored during the validation process so that the market demand for the solution and the innovation potential can be clearly demonstrated (Project Implementation Manual and Quality Control Plan 2015).

The special objective of the project's Work package 2 is to:

- consult, collect and analyse stakeholder needs
- understand the motives and desires of end user groups
- list and prioritise their desires according to functionality, cost, time, flexibility, effectiveness, and development or design team constraints
- match the demands and requirements of end-users with the project limitations
- seek user requirements on a number of scales: geographical, technical profile, user profile, and application profile.

Task 2.2, Identification of functionality requirements, involves a consultation process with end users to determine the functionality requirements for development and integration. Task 2.3, Identification and monitoring of user needs and interests, will initially be carried out through a series of consultation events with end users. Following initial input into the adaptation work, ongoing tracking of user needs and interests will be conducted, continually feeding into the SmartSet development process.

This document, resulting from the task 2.2 and following a program of consultations with the creative industry partners, will detail a range of user requirements which will feed into the virtual studio specification.

2 METHODS FOR GATHERING DATA

2.1 User consultation process

The user consultation process is divided in three phases:

- 1) first impressions
- 2) work in progress
- 3) aftermath.

During phase 1, end users (project partners) have been introduced to SmartSet project by Brainstorm in the Valencia kick off meeting. After seeing the video demo material about the potential of the virtual studio system, the Infinity Set (current Brainstorm's Virtual Studio application used by large and medium broadcast industry), and the technical simplifications and adaptations envisaged for SmartSet, end users have been able to create first impressions on how to utilise the virtual studio technology and, specially, SmartSet in their businesses, projects and productions. Based on those impressions, end users have written down their expectations and presented their ideas for demos during the SmartSet project. User requirements are also collected by carrying out a questionnaire and interviews with both end users and stakeholders.

Phase 2 includes implementing the virtual studios (hardware and software) in the end users' facilities by Brainstorm and organising a workshop on learning how to use the hardware and especially the SmartSet software. Phase 2 will be the implementation and during this phase all demos mentioned earlier will be actualised and produced by using SmartSet.

Phase 3 will be the evaluation, and during this phase the end users will give their concluding feedback about the SmartSet, its pros and cons and development suggestions based on their experience of how the expectations from phase 1 were actualised during phase 2. In short: is there a market for SmartSet?

During each phase, end users and stakeholders will answer to user consultation questionnaires and/or join Skype meetings/interviews organised by Lapland UAS and Brainstorm. The main object of the overall consultation process is to gain information to obtain the specifications of the SmartSet solution at the beginning of the project and also during the project after the end users have more experience in using the actual hardware and software. All these consultations help to monitor things to ensure that the requirements are met after the solution is ready.

2.2 Target groups

Participants in the SmartSet project comprise:

- **developers** of the SmartSet software,
- **end users** who are also the SmartSet project partners with developers,
- **stakeholders** who are professionals of the broadcasting or production field or other relevant industry, and
- **Commercial Impact Advisory Group (CIAG)** which is formed from the group of stakeholders to share a more general opinion among professionals in the creative industry concerning the commercial potential of the SmartSet product.

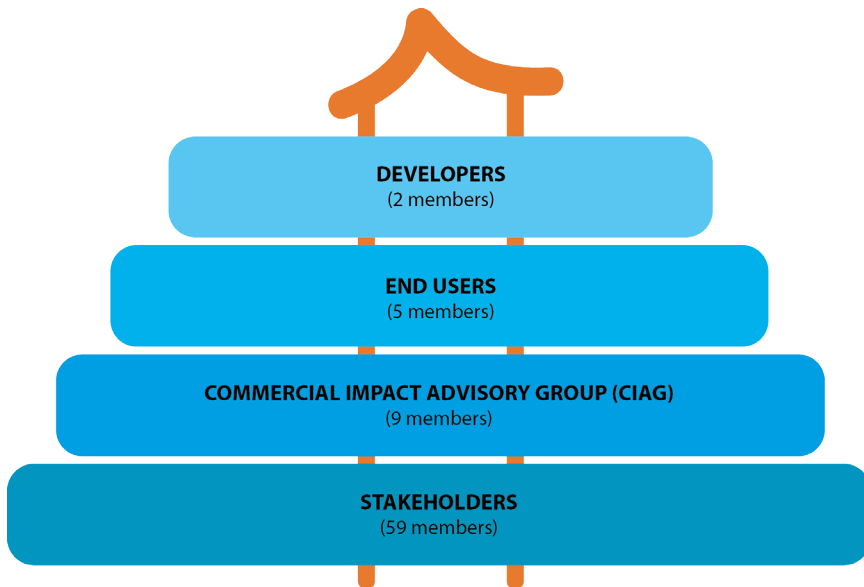


Figure 1. Various participants' groups involved in the SmartSet project

The target groups for gathering the data of SmartSet user requirements were the end users, stakeholders and CIAG.

The project partners represent the end users in the project. These partners are:

- Lapland University of Applied Sciences (Finland)
- The Association Remar España – Solidaria TV (Spain)
- BonumTV (Hungary)
- Hallingdølen AS (Norway)
- Joulupukki TV Oy (Finland)

The group of stakeholders are professionals working in the field of the media, broadcast and creative industry sector. From this group, the Commercial Impact Advisory Group (CIAG) was chosen. The criteria were to have an international group of experts from creative industry from the different regions of the world in order to have a very global vision and direct interaction/advice. The CIAG advises on the development and refinement of the business model for the SmartSet technology based on the market research gathered by the consortium. In particular, the CIAG members will be asked for feedback on the requirements and needs of the potential users of the SmartSet system to ensure specifications include a good balance between low cost and high quality capabilities in an operational system which is adapted to the needs of small creative media and educational organisations. (Commercial Impact Advisory Group Composition and Management Plan 2015.)

The professionals selected to be a part of the CIAG are (Commercial Impact Advisory Group – CIAG 2015):

- Hannu Kahakorpi (Director; Finland)
- Trond I. Hovland (Project manager for NxtMedia; Norway)
- Eero Leppänen (Online news producer at Lapin Kansa; Finland)
- Martin Hainfellner (Managing Director of Signum Bildtechnik; Germany)
- Bae Sung Uk (Director of Uwin Info Sys; South Korea)
- Fady Boustany (General Manager of Pharaon Broadcast; Libanon)
- Joseph Li (Director of international department at Beijing Xingguang Film and TV Equipment Technologies; China)
- J. David Hoffman (President of QVIZLABS; USA)
- Ann Cudworth (Virtual Set Designer/Manager of Design and Fabrication at CBS television; USA [pending from approval of her company CBS NY/July 2015]).

To continue to evolve and refine SmartSet solution and its possible markets, there's a need for a constructive channel for healthy debate and discussion. CIAG serves as a forum to provoke, stimulate, and challenge our practice to foster its health and growth. (Commercial Impact Advisory Group Composition and Management Plan 2015.)

Webropol-questionnaire was sent to all of the end users (5) and stakeholders (59). As a result, we received 5 responses from the end users (100%) and 18 responses from the stakeholders (30.5%). After the questionnaires, each end user was interviewed either in face-to-face meetings or online. Also CIAG members were consulted online as representatives of the stakeholders. All and all there were a total of 5 interviews with the end users and 5 interviews with the CIAG members. The role of the developers (Brainstorm Multimedia) was to be involved in the interview sessions providing questions and answers for the interviewees.

2.3 Questionnaire

The first step to user requirements consultation is a questionnaire to form a general opinion of the end users and stakeholders.

There were two different questionnaires: a wider one for the end users and a more compressed and targeted one for the stakeholders. Both questionnaires were carried out with Webropol by Lapland UAS. The developers contributed to the questionnaires' contents by providing more specific, technical questions to which they need answers for in their development work.

End users' questionnaire was based on 11 categories/themes:

1. **Background information:** Respondent's and his/her company's (size, business branch, clientele) information.
2. **Personnel's competence:** Evaluation of the current and needed competence of the personnel in using virtual 3D studios.
3. **Financial issues:** Respondent's company's investment capability concerning the SmartSet hardware and software as well as the operating personnel's salary.
4. **Buying decision:** Reasons why the company would or would not purchase the SmartSet solution and an evaluation on the different aspects that affect the buying decision.
5. **Target groups:** Potential of reaching existing and new target groups with SmartSet and choosing the right marketing channels.
6. **Content:** Evaluation on what kind of content the company could produce with the SmartSet.
7. **Hardware:** Company specific requirements concerning the SmartSet hardware.
8. **Software:** Company specific requirements concerning the SmartSet software.
9. **Other solutions and add-ons with SmartSet:** Possible need for compatibility with 3rd party software/hardware solutions.
10. **Geographical point of view:** Country specific characteristics/requirements and mobility of the 3D virtual studio.
11. **Maintenance:** Issues concerning maintenance, e.g. maintenance service location, time for reaction and software updates.

The questionnaire for the stakeholders was further developed from the end users' questionnaire. This compressed questionnaire consisted mainly of these themes: background information, personnel's competence, financial issues, buying decision and maintenance. In addition to these, hardware and software requirements were asked. The emphasis of the stakeholders' questionnaire was on what kind of things

affect the buying decision the most and what should be taken into consideration in planning the maintenance services for low-cost 3D virtual studio.

Link to the online Webropol-questionnaire was sent to all of the end users (5) and stakeholders (59). After getting the link, respondents had approximately 2 weeks to answer the survey. As a result, we received 5 responses from the end users (100%) and 18 responses from the stakeholders (30.5%). Through these responses we were able to gather data for the identification of functionality requirements. The sampling was not extensive but adequate for the purpose as our primary aim was to collect qualitative data.

The user requirements data is collected in two phases, in the beginning of the project in May 2015 and at the end of the project in September 2016. The questionnaires will be for the most part uniform in both phases. If necessary, some more specific questions will be added for the second phase questionnaire, as there already are user experiences and wider knowledge of the SmartSet at the end of the project.

2.4 Interviews

To complement the data from the questionnaires, there were also a series of online interviews and face-to-face meetings organised by Lapland UAS with the help of Brainstorm. The interviews were based on the data gained from the questionnaires.

During the online and face-to-face meetings, end users' suggestions about the SmartSet product were gathered. In addition, the Commercial Impact Advisory Group members were interviewed online (via Skype) to gather more feedback and country specific user requirements information. All and all, there were a total of 5 interviews with the end users and 5 interviews with the CIAG members. The role of the developers (Brainstorm Multimedia) was to be involved in the interview sessions providing questions and answers for the interviewees.

All of the online interview sessions were realised personally with different interviewees. Interview questions were based mostly on end users' and stakeholders' replies to questionnaires but naturally those replies created new questions that needed to be discussed during interviews. These meetings also offered a chance for the end users and CIAG members to ask questions from the developers. Interviews were led by Lapland UAS accompanied by Brainstorm whose responsibility was to provide answers to end users' and stakeholders' questions concerning SmartSet technology.

The user requirement interviews will be organised in three phases: in the beginning of the project on May–June 2015, in the middle of the project on January–April 2016 and in the end of the project on September–October 2016. The first and the last session are intended for supplementing the data collected by questionnaires. The centremost session is mainly intended for gathering user experiences gained in the early stages of the project and tangible examples of the SmartSet testing work by end users. All the online sessions will be recorded for research data purposes.

3 METHODS FOR ANALYSIS

3.1 Data analysis process

It will be essential to develop the SmartSet product and ensure that the quality of it satisfies the needs and expectations of creative industry SMEs who are asking for a low-cost, high performance solution. Therefore, the user consultation data and requirements are crucial information for the developers of the SmartSet.

The research data will consist mainly of feedback from the use of the technology in order to refine and improve the SmartSet solution during the development phase of the project. The first questionnaires and interviews (phase 1) aim to reveal user expectations and requirements. The later data collection (phase 2 and phase 3) is based on actual user experiences when the end users have had time to utilise SmartSet in making demos.

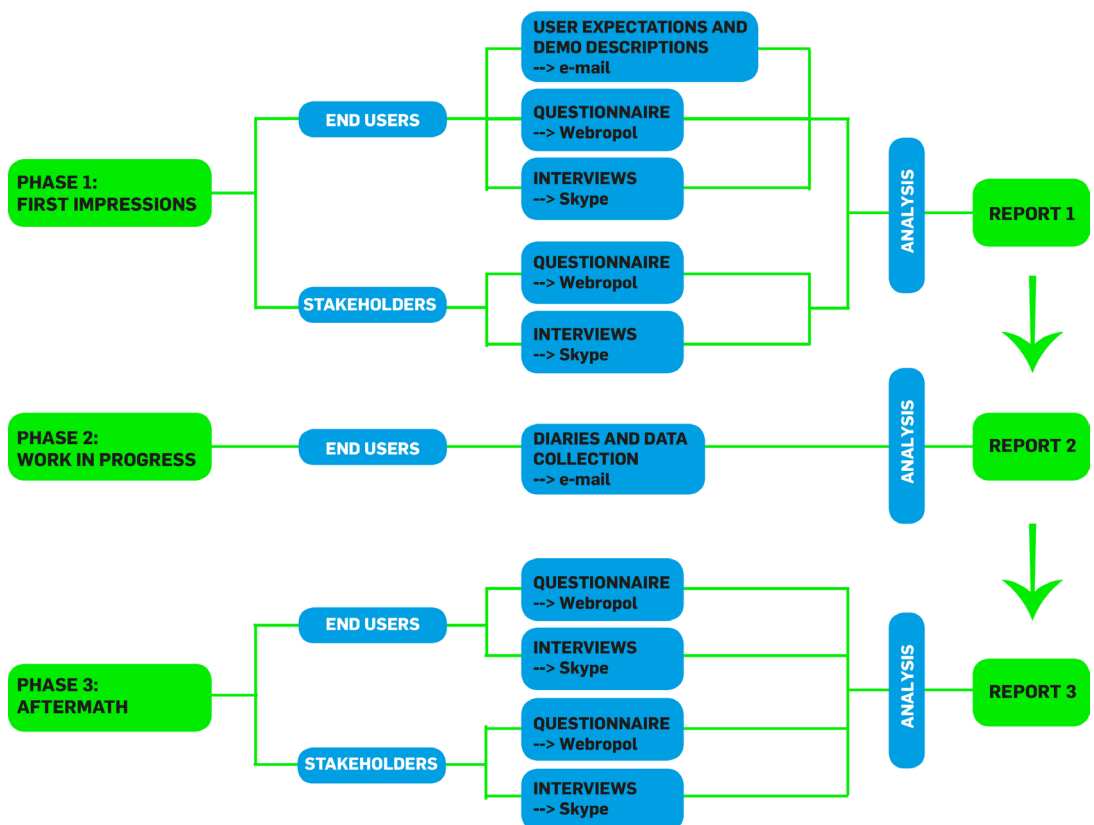


Figure 2. User requirements' analysis progress

As shown in Figure 2 (previous page), the analysis report will be made after each of the three user consultation phases: 1) first impressions, 2) work in progress and 3) aftermath. The reports will consist of both quantitative (technical user requirements) and qualitative (user expectations) analysis. The focus group questionnaires and interview process helps in identifying the functionality requirements for the SmartSet solution.

The research is based on SWOT analysis and the results of the consultation will be guided by a user-centred design. These methods served as a starting point and basis for the research and setting up the questionnaires. The most important information to be obtained is the technical requirements. All User Requirements Definition reports will consist of specific technical user requirements as well as mapping of the user requirements' expectations.

3.2 SWOT analysis

SWOT analysis is a structured planning method used to evaluate the strengths, weaknesses, opportunities and threats involved in a project or in a business venture. A SWOT analysis can be used to:

- explore new solutions to problems
- identify barriers that will limit goals/objectives
- decide on direction that will be most effective
- reveal possibilities and limitations for change
- to revise plans to best navigate systems, communities, and organisations
- as a brainstorming and recording device as a means of communication
- to enhance “credibility of interpretation” to be utilised in presentation to leaders or key supporters. (SWOT analysis 2015.)

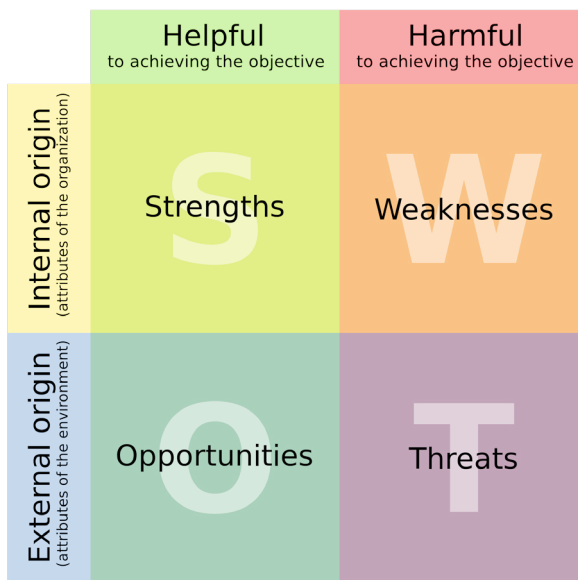


Figure 3. The basic division of the SWOT analysis (SWOT analysis 2015)

During the user consultation process, we aim to reveal what kind of strengths, weaknesses, opportunities and threats different target groups (end users) and different organisations see in the usability of the SmartSet product (primarily content, hardware and software). By SWOT analysis, we can also reflect on how these views change during the project.

3.3 User-centred design

User-centred design (UCD) is a process in which the needs, wants, and limitations of the end users of a product, service or process are given extensive attention at each stage of the design process. User-centred design can be characterised as a multi-stage problem solving process that not only requires designers to analyse and foresee how users are likely to use a product, but also to test the validity of their assumptions with regard to user behaviour in real world tests with actual users. Such testing is necessary as it is often very difficult for the designers of a product to understand intuitively what a first-time user of their design experiences. UCD tries to optimise the product around how users can, want, or need to use the product, rather than forcing the users to change their behaviour to accommodate the product. (User-centered design 2015.)

In today's world, where interacting with technology is an integral part of everyday tasks, the most important factor that will make a service successful is end user satisfaction. This is mainly true for products that people would want to use and not for ones they have to use. UCD's main goal is not to just make decisions based on user requirements, but also involve the user in the development cycle from the starting point. A vital part of the UCD process is that the developer does not rely on the feedback acquired through questionnaires or collected by a different team. The developers need to demo the product in person and then collect information while the user is trying it out. This is especially true in the early stages of development. (Psychogios 2014.)

UCD goes directly to the user instead of building User Stories out of thin air. Slowly and iteratively, even the most cumbersome systems can become a pleasure to use and get rid of the clutter that only makes a user's experience worse and offers nothing to the overall picture. (Psychogios 2014.)

While defining the SmartSet functionality requirements, user-centred design ensures that the developers can offer the right kind of solution to the market and find the characteristics that make their product a game changer. The users' opinions are not only collected through questionnaires and interviews; the whole research process is mainly focused on the demo phase when the end users test the product and figure out the user requirements that finally will be consulted with all the end users and stakeholders of the SmartSet project.

3.4 Technical analysis and needs analysis

Technical analysis focuses on the requirements related to needs of the end users and professional opinions based on expertise of stakeholders and CIAG members. The data for technical analysis has been gathered from three different sources

1. user expectations and demos – written document
2. stakeholder and end user questionnaires
3. CIAG member and end user interviews

Needs analysis focuses on the requirements related to the goals, aspirations and needs of the users and/or the user community and feeds them into the system requirement analysis process. The main purpose of needs analysis is the user's satisfaction. (Needs analysis 2015.) Ongoing tracking of user needs and interests will be conducted, continually feeding into the SmartSet development process.

During this first phase of the project, most of the data is based on the first impressions, which means that some adjustments will be done to the final SmartSet solution during the later phases of the project when end users have gained more experience on hardware and software, and project demos have been introduced to stakeholders, CIAG and public audience. This data will be gathered by questionnaires and interviews as well as demo diaries during “phase 2: work in progress” and “phase 3: aftermath.”

4 RESULTS OF THE USER CONSULTATION (PHASE 1)

4.1 Respondents' description

Webropol-questionnaire was sent to all of the end users (5) and stakeholders (59) of the SmartSet project. As a result, we received 5 responses from the end users and 18 responses from the stakeholders.

The end users' companies represent four different countries (Finland, Spain, Norway, and Hungary) as well as various sizes and business branches. According to the European Commission's definition (What is an SME? 2014), one of the end users represent micro enterprise and three are small enterprises. The fifth end user has stated having more than 200 employees. Among the end users there are, for example, an educational institution, religious community television, online video production company and (online) newspaper.

Among the 18 stakeholders who responded to the questionnaire, there are 17 companies from 12 countries all around the world (Bulgaria, Norway, India, United States, United Kingdom, Germany, Argentina, Finland, Spain, South Korea, Venezuela, and Australia). Most of these companies represent micro and small enterprises. The stakeholders come from multiple business branches including e.g. education and e-Learning, media and television production, broadcast industry, distribution and system integration, graphic solution providing and movie making.

The respondents' companies also have a wide range of clientele. The target groups or customer base of the companies include, for example, production and media companies, broadcast stations, news and entertainment audiences (TV, Internet and cinema), consumer retail, government and public financiers, tourism industry, corporate and educational visual media creators and consumers as well as educational institutions and students in general.

From all of the 23 respondents, only 2 were women. This reflects the current gender balance in the broadcast media sector. We also asked the respondents to estimate the percentage of men and women working in their organisations, and only three of the respondents informed that his/her company has more women employees than men.

21 of the 23 respondents stated that they are familiar with the SmartSet concept. The two who answered no were end users, and therefore they have become familiar with the concept while being a partner of the project.

4.2 Personnel's competence

The respondents were asked to estimate the knowledge and competence in their companies in using virtual 3D studios in a scale from “not at all” to “active and professional user”. All of the 23 respondents stated having at least some knowledge.

Among stakeholders there were two companies that were active and professional users of virtual 3D-studios. Altogether 9 answered that they have good or very good knowledge, 7 respondents instead stated having only some or average knowledge. These differences can be explained by the versatility of the respondents' companies as many of them don't use or are not going to use virtual 3D-studios in their companies (e.g. distributors and retailers).

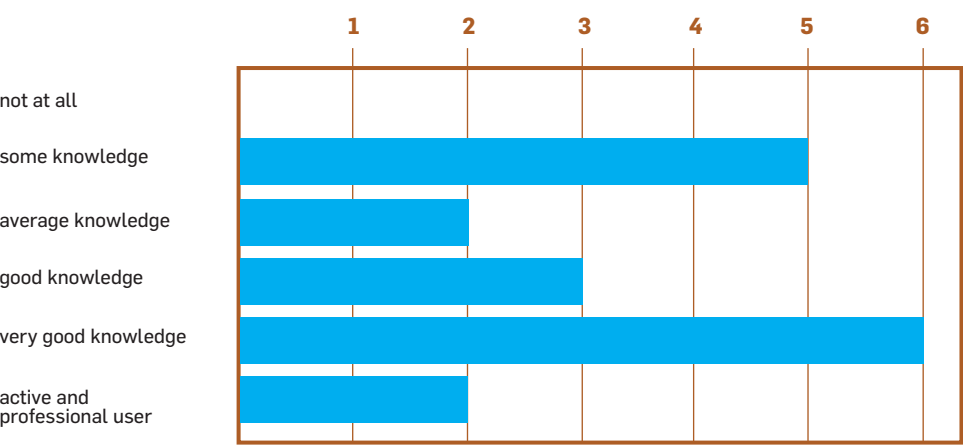


Figure 4. Stakeholders' estimation of the knowledge and competence in their companies in using virtual 3D studios (number of answers in each option)

Understandably the end users had less knowledge in virtual 3D-studios. Only one respondent said that the company has good knowledge, others stated having only some knowledge. As the SmartSet project seeks to find new markets and target groups for a new and user-friendly software program, the end users' lack of knowledge can offer a realistic approach for development.

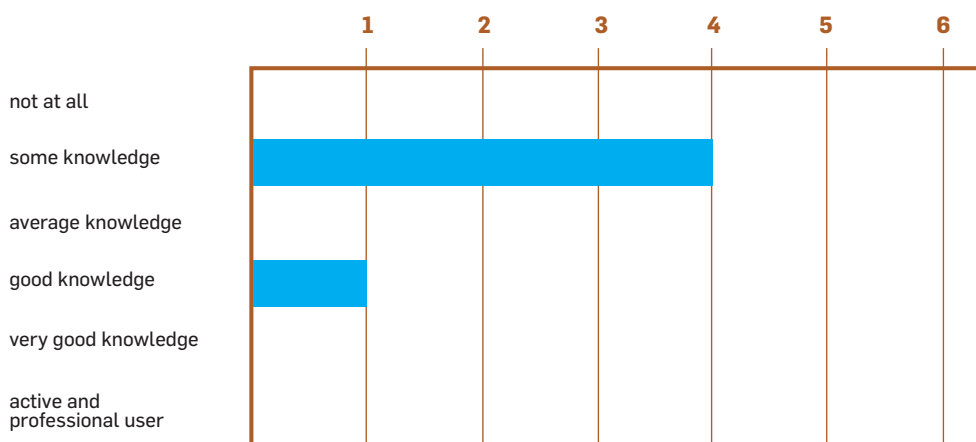


Figure 5. End users' estimation of the knowledge and competence in their companies in using virtual 3D studios (number of answers in each option)

With open questions, the respondents were asked to evaluate the need for technical and creative knowledge acquired from the personnel in order to use SmartSet in their organisation and also what kind of education and training would be obligatory before taking SmartSet into active use in the company.

The answers revealed that the need for technical and creative knowledge are vital to the successful deployment of the SmartSet solution, as selling and/or using any equipment successfully relies on knowing the product and all its possibilities. Some of the respondents stated that they won't need any extra knowledge, presumably because of the current competences of the personnel in virtual 3D studios.

Overall, it was seen as an asset if the company's personnel had previous experience in TV and media productions. However, if the company is, for example, used to more traditional television production, the personnel might need some transitional information about how to work in a more software oriented environment. Furthermore, the issue was raised that although the technical side wouldn't be a problem, the creative side of the SmartSet usage might ask for some special knowledge of the personnel, at least if the company has to design a set from scratch. By examining the diversity of the answers to this open question, it is clear that one shouldn't forget the need for creative knowledge while concentrating only on the technical requirements.

The question about the necessary training also concluded with a set of versatile answers. In many respondents' opinion, basic usage training and familiarising themselves with the software specifics are sufficient. There were also comments that online training and/or reading the manuals give the needed information for operating the SmartSet.

The need for instructional videos/webinars/courses on how to create and use graphics in the most complex way possible came up in order to understand the full potential of the SmartSet technology and how to adapt SmartSet technology in

everyday work. For example, the following issues were mentioned as requiring more instructions:

- use of software, simple design and customisation of virtual sets and objects
- computer use, camera concepts, direction and production
- use of the virtual 3D studio equipment
- improving the knowledge of 3D backgrounds, for example.

A few interesting ideas were raised in these answers. Firstly, few respondents mentioned the possibility to learn from the pilot cases or other companies that have already implemented a virtual 3D studio. Learning from the peers could open eyes for new approaches. Secondly, one respondent would like to see an introductory course in 3D modelling, composition and virtual sets as part of everyone's training, so that they are aware of the dynamics of a virtual environment. The need for basic creative visual media and design training was raised in other answers as well. While planning the training of the SmartSet software and hardware, the developers must take into account both the technical and creative design aspects.

4.3 Financial issues

When talking about financial issues the first thing people usually think about is the retail price. In SmartSet, the pricing of the product, both software and hardware, has an essential role when thinking about the potential market for the product. As shown in Figures 6 and 7, the standard price for that new market should be estimated as 9,000 euros in a price range of 5,000 to 15,000 euros. There was a clear consensus between both stakeholders' and end users' answers with averages of stakeholders estimated at 8,900 euros and end users at 9,000 euros.

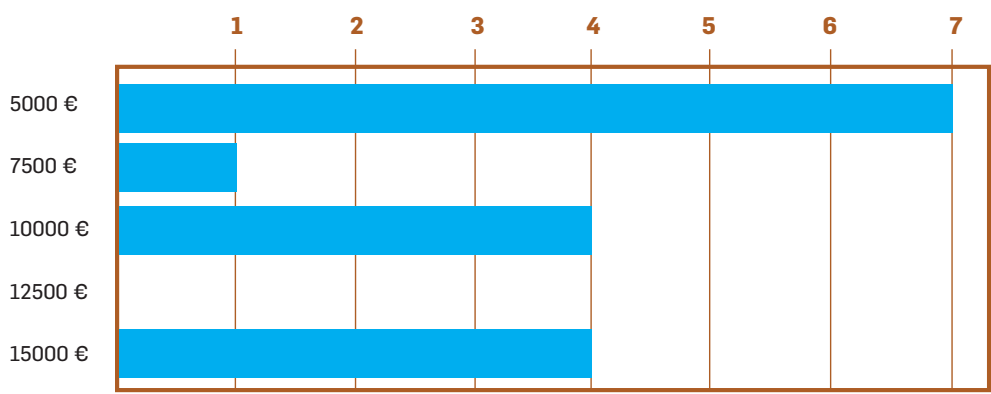


Figure 6. Stakeholders' estimation on how much they would be willing to invest in the SmartSet hardware and software (number of answers in each option)

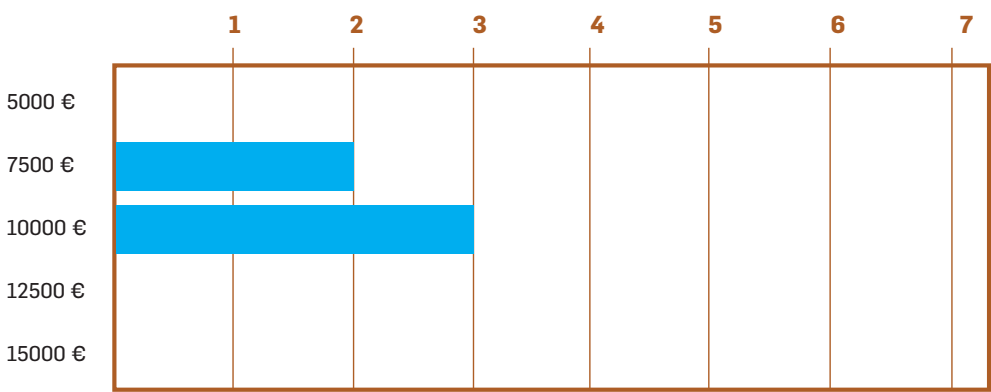


Figure 7. End users' estimation on how much they would be willing to invest in the SmartSet hardware and software (number of answers in each option)

If looking at the pricing from the different market areas point of view, pricing had the greatest difference between the European and South American markets:

- European market area: average estimated 8,000 euros
- Asian market area: average 10,000 euros
- Australian market area: average 7,500 euros
- South American market area: average 12,500 euros
- North American market area: average estimated 11,700 euros

Other important factors, and in many cases the most important factor, in pricing are the personnel costs in addition to SmartSet product costs: how much the customer has to and is willing to invest on personnel using the SmartSet virtual studio.

Based on the open questions, stakeholders were willing to invest approximately 1.1 persons' salary in the beginning of the training phase and then approximately 2 persons' salary later on when operating the SmartSet. End users were willing to invest approximately 2 persons' salary in the beginning of the training phase and then 1.5 persons' salary when operating the SmartSet.

So called "normal" studios usually need lots of personnel to operate the set: electricians, gaffers, camera operators, sound department, director, editor etc. Based on the open questions, it's easy to summarise that SmartSet should be simple and easy to operate by one or two persons when set on location and functional.

Third factor when thinking about pricing is costs for necessary training, support and updates to maintain the functionality of the virtual set. This factor will be processed in the chapter 4.10. Maintenance.

The fourth minor factor on pricing will be the transportation costs of the hardware, possible customs payments for delivering the hardware etc.

In conclusion, it is clear that the price has great importance when creating a new market for the SmartSet solution. However, defining the final price is not so simple. Based on CIAG member and end user interviews, there were very different points of view: even though low-cost pricing could be appealing for small enterprises with a lesser need for the virtual studio solution, for larger broadcast companies cheap pricing could even cause a negative response because they might think that product and the quality are not good; the virtual studio market has become used to high prices. On the other hand, the price could also have a lesser importance if the customer, e.g. small TV stations, newspapers and radio channels with online streaming etc., is willing to make a strategic choice and invest in a SmartSet solution to be able challenge bigger studios and other competitors in their businesses and to provide new services. However, in general, the lower the price, the more customers you will have. Based on all the data, the starting price for the SmartSet solution, both hardware and software, should be estimated at 9,000-10,000 euros.

When thinking about pricing, it is also very important to find a balance between basic users and more advanced users. Because SmartSet virtual studio software is not coming out from scratch, but is based on very established professional software

(Infinity Set and eStudio), it would be a good idea marketwise to provide some sort of a basic package for beginner users and companies with only a basic needs for the standard starting price and then if the customer needs more advanced features or specific personalised templates they can buy such packages from “SmartSet Online Store”. With this kind of marketing strategy it would be easier for customers to make the important first step towards virtual studio user.

When thinking about different market areas, more deeper and detailed market research is necessary.

4.4 Buying decision

The respondents were asked to contemplate the reasons as to why their company would buy or use SmartSet and, on the other hand, why they would not buy or use the solution.

The reasons for acquiring the SmartSet solution can be summarised into two main qualities: lower production costs and ease of operation. Therefore, the keyword seems to be cost-effectiveness, not to forget the quality of the production: producing impressive output with less input.

Cost-effectiveness includes the costs to own and the costs to operate. It was mentioned, for example, that it's important that the SmartSet solution is also operable in small budget productions of small studios, even if the user is a freelancer or private entrepreneur. Also in slightly larger companies, the SmartSet reduces the amount of personnel needed to create productions in comparison with a real set. Cost-effectiveness also includes the possibility to use the same studio for multiple programs and to save on storage and set costs.

Other reasons to buy and use the SmartSet were, for example:

- fast installation
- increasing the quality of production
- the ability to integrate a person in real live footage
- movable solution with track-free.

For some respondents, the SmartSet solution offers an opportunity to create stunning presentations in custom virtual sets as a part of live and recorded events and productions. New kinds of production opportunities and more advanced productions were also expected to provide new partners, enriching creative and programming and increasing competitiveness. Therefore, SmartSet solution can enable the possibility to make a source of income as companies can offer to their customers a solution they haven't had before.

The main issues that could prevent the respondents from buying or using the SmartSet solution are price and functionality problems. At this point, it isn't specified as to what the respondents mean with the price (i.e. what is the limit), but it's safe to assume that the pricing is an important factor for the possible buyers. Instability and problems with functionality are also mentioned in several answers, so it's important to make sure to provide a package that offers easy usage and a stable operational system.

One respondent pointed out that their company's lack of scripting and presentation skills would be a reason why they wouldn't buy the SmartSet solution. The respondent

mentions that the tools won't be sold if the end users don't know how to produce programs that sell or educate and, therefore, (web) program production should be included in the SmartSet package.

There were also a few answers for why the company wouldn't buy the SmartSet solution that should be taken into consideration when developing the final product. One respondent pointed out that they wouldn't use SmartSet as a substitute for a real set; it seems that it would be better to market the SmartSet as its own solution, not necessarily compared with a real set. Few answers emphasised that not to be able to design a nice looking virtual set, or limited feature set and functionality expansion potential would be a reason not to buy the product. Also, it's important to make sure that the potential buyers know what they're going to get, as the answers show that it reflects negatively on the buying decision if the final product looks like a low budget production with cheap, awkward graphics and bad lighting, unstable cameras and an unrealistic environment.

Additionally, the respondents rated, on a scale from 1 to 5, the importance of certain characteristics' effect on the decision to buy SmartSet. In this scale, 1 means not essential at all and 5 means very essential. The characteristics to be rated were:

- Price
- Availability of the training
- Availability of the support
- User-friendliness
- Maintenance issues
- The competence of the current staff
- Presentation videos
- Amount of virtual sets and object library
- Possibility to create own virtual sets
- Potential new markets
- Increasing the competitiveness
- Profits
- The physical space acquired

As shown in the Figure 8, the stakeholders appreciate the possibility to create their own virtual sets, the user-friendliness of the product, and the potential new markets and target groups for the company and profits the most. In comparison, as can be seen from the Figure 9, the end users emphasise user-friendliness, the possibility to create their own virtual sets, price and the availability of the support.

Issues affecting on the buying decision:	1	2	3	4	5	Altogether	Average value
Price	1	1	3	5	8	18	4
The availability of the training	0	2	6	5	5	18	3,72
The availability of the support	0	1	3	9	5	18	4
User-friendliness	0	1	3	5	9	18	4,22
Maintenance issues	0	1	3	9	5	18	4
The competence of your company's current staff to utilize the SmartSet	1	1	5	6	5	18	3,72
Presentation videos	0	3	9	3	3	18	3,33
The amount of ready virtual sets and object library	0	1	6	9	2	18	3,67
The possibility to create your own virtual sets	0	1	1	7	9	18	4,33
Potential new markets and target groups for your company	1	1	2	6	8	18	4,06
Increasing the competitiveness	1	2	1	8	6	18	3,89
Profits	0	1	2	10	5	18	4,06
The physical room/space that the SmartSet acquires	0	3	4	7	4	18	3,67

Figure 8. Stakeholders' ratings of how certain issues affect the decision to buy SmartSet (1 = not essential at all, 5 = very essential)

Issues affecting on the buying decision:	1	2	3	4	5	Altogether	Average value
Price	0	0	1	1	3	5	4,4
The availability of the training	0	0	1	2	2	5	4,2
The availability of the support	0	0	0	3	2	5	4,4
User-friendliness	0	0	0	1	4	5	4,8
Maintenance issues	0	0	0	4	1	5	4,2
The competence of your company's current staff to utilize the SmartSet	0	1	2	0	2	5	3,6
Presentation videos	0	1	2	1	1	5	3,4
The amount of ready virtual sets and object library	0	0	2	2	1	5	3,8
The possibility to create your own virtual sets	0	0	1	0	4	5	4,6
Potential new markets and target groups for your company	0	1	1	2	1	5	3,6
Increasing the competitiveness	0	0	1	2	2	5	4,2
Profits	1	0	2	2	0	5	3
The physical room/space that the SmartSet acquires	0	1	3	0	1	5	3,2

Figure 9. End users' ratings of how certain issues affect the decision to buy SmartSet (1 = not essential at all, 5 = very essential)

The interesting realisation of these differences between the answers is that as the end users aren't necessarily targeting the new markets, the stakeholders value the profitability and new target groups very highly. Actually, in the end users' answers, profit is the least important factor. Although the end users are piloting in the project and testing the product, the stakeholders represent the demand of the industry in general. Therefore, the developers must also take into consideration how the SmartSet solution can be marketed as a tool to reach new markets.

In the least important factors concerning the buying decision, both the stakeholders and the end users list the presentation videos and the physical room/space acquired to use SmartSet.

Furthermore, the end users were asked to think how often their companies should utilise SmartSet solution to make it a profitable investment (see Figure 10). One of the end users pointed out in the reasons why their company wouldn't buy the SmartSet solution that it would negatively affect the purchasing decision if the usage of the product would be too low and, therefore, hardware/software and the space needed for the virtual studio would be just a waste of time, space and money.

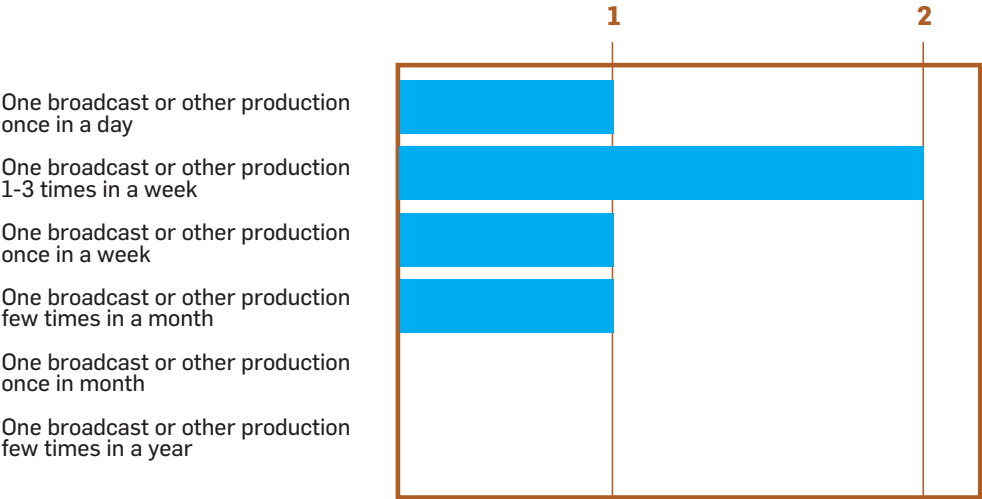


Figure 10. End users' answers on how often their companies should utilise the SmartSet solution to make it a profitable investment (number of answers in each option)

According to end users' answers, it's not enough to produce one broadcast or other production once in a month or more seldom. However, only one respondent answered that their company should utilise SmartSet daily. These results imply that the usage should, however, be relatively frequent.

4.4.1 COMPARISON BETWEEN REAL AND ONLINE STUDIOS

The questionnaires also included some questions that asked the respondents to think about the differences between virtual sets and real sets. We listed some claims in the subject matter and the respondents rated on a level from 1 to 5 how much they agree with the claim. In the scale, 1 means I totally disagree and 5 means I totally agree. The idea was to find out what could be the asset of the SmartSet solution as a virtual set in comparison with the existing real sets.

The main results of this section of the stakeholders' questionnaire are as follows:

- The respondents generally don't think that acquiring a virtual set is too expensive compared to a real one. Both of the solutions seem to have their own costs.
- The claim that operating a virtual set requires specialised personnel while a real one doesn't didn't create strong feelings of agreement or disagreement. It's quite obvious that both virtual and real sets require special knowledge and competence that can't be in all cases compared to each other.
- Only a few respondents thought that maintenance and support in a virtual set are expensive compared to a real set. It seems that a whole package for maintenance must be established, not putting too much focus on the price in the marketing.
- It was mainly agreed that a virtual set requires much less space than a real set. It appears that the less space needed could serve as a valid marketing point for the SmartSet solution.
- Almost all the respondents totally agreed that virtual sets allow for using the same studio for different scenarios. This must be the key factor in marketing SmartSet as it's a fact that makes the virtual set unique and different from the traditional real set solution.
- It was mostly agreed that a real set offers more natural images but virtual sets can offer a more compelling final. It needs to be considered whether there's a need for making the virtual set outcome more natural and realistic looking or should the "virtual look" be considered as an asset.
- The excellence of current virtual sets' graphic quality didn't raise strong agreement or disagreement. This result shows that the graphic quality of today's virtual sets is quite good but maybe not as excellent as it could be.

How do you agree with the following statements:	1	2	3	4	5	Altogether	Average value
Acquiring a virtual set is too expensive compared to a real one	6	4	5	1	2	18	2,39
Operating a virtual set requires specialized personnel while a real one don't.	3	5	3	6	1	18	2,83
Maintenance and support in a virtual set are expensive.	3	5	6	2	2	18	2,72
Virtual sets require much less space than real ones.	3	1	1	7	6	18	3,67
Virtual sets allow for using the same studio for different scenarios.	1	0	0	1	15	17	4,71
Real sets final images are more natural.	3	1	2	7	5	18	3,56
Virtual sets final are more compelling.	1	4	6	5	2	18	3,17
Current virtual sets' graphics quality is excellent.	0	3	8	4	3	18	3,39

Figure 11. Stakeholders' ratings on different claims concerning the comparison between virtual sets and real set (1 = I totally disagree, 5 = I totally agree)

How do you agree with the following statements:	1	2	3	4	5	Altogether	Average value
Acquiring a virtual set is too expensive compared to a real one	3	0	0	2	0	5	2,2
Working in a virtual set is too software based and much more complicated than working in a real set.	0	1	2	1	1	5	3,4
Virtual set is not as reliable than a real one.	0	0	4	1	0	5	3,2
Virtual sets look too artificial when compared to real sets.	0	1	1	2	1	5	3,6
As a director working with talents/actors in a real set is easier, more natural and interactive than in a virtual one.	0	0	2	3	0	5	3,6
Working in a virtual set narrows my cinematic ideas, e.g. not enough space to operate (pan/tilt/dolly/jib) with the camera.	1	1	2	1	0	5	2,6
Virtual set allows realisation of ideas, that cant be realised in a real set.	0	1	0	1	3	5	4,2

Figure 12. End users' ratings on different claims concerning the comparison between virtual sets and real set (1 = I totally disagree, 5 = I totally agree)

For the end users, the comparison questions were divided into different categories based on the theme (e.g. buying decision, software, maintenance). There were also some additional questions compared to the stakeholders' questionnaire. The end users' more specific comparisons are examined in more detail in chapters 4.7. Hardware, 4.8. Software and 4.10. Maintenance.

4.4.2 MARKETING CHANNELS

Although the presentation videos about SmartSet didn't seem to have an important effect on the buying decision for the end users or stakeholders, for both of these groups presentation videos online are the main promotional channel they'd prefer. The secondary way to reach the target audiences is, according to the results, personal contact. Figure 13 shows the combined answers from stakeholders and end users about marketing channels.

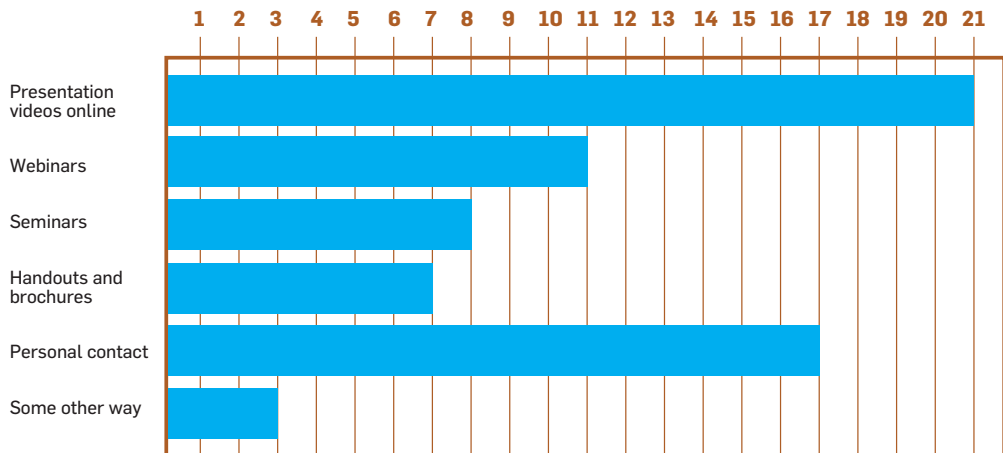


Figure 13. Which marketing channels could best help reach the target audiences (number of answers in each option)

The respondents were able to choose as many options as they wanted, not only the one they'd most prefer. Although there were clearly two main marketing channels that the respondents prefer, all of the other given options (webinars, seminars, handouts and brochures) received at least 7 picks. "Some other way"-option received few answers like real situation/on-site demo, YouTube and Twitter.

4.5 Target groups

Some questions about the target groups of the SmartSet productions were targeted only for the end users. The current customer groups of the end users include, for example, schools, students, small and local TV, YouTube users. These target groups are expected to be the main consumers of the material produced with the SmartSet technology.

The end users were also asked to think about whether they could gain some totally new customer groups by producing material with SmartSet. Only one of the respondents answered no. Others had some ideas as to how they could reach target groups that they aren't yet targeting. For example, the following new uses were raised:

- possibility to sell a different kind of product to other paying clients that are in need of info and presentation films that could be created with the SmartSet solution
- renting a virtual set and even taking the set to the customer's place is an advantage
- new target groups could be some public institutions and big companies for the corporate communication
- we could expand our services to local enterprises e.g. in tourism and we could start selling our eLearning business to other educational institutions nationally and internationally.

The end users were then asked to contemplate how their organisation could reach these new target groups. These questions seemed to be hard to answer at this point when no one has any actual experience of productions with SmartSet. The answers revealed that the online or live production possibility is the key point in reaching new target groups (e.g. video presentations, online lectures in virtual classrooms). One of the respondents said that they feel like the biggest strength is the ability to use a trackless universe with dynamic graphics and the ability to teleport.

Concerning the target groups in the marketing of the SmartSet solution, the end users were asked if they felt that the solution could be marketed and targeted evenly for the representatives of both genders. All of the end users shared the opinion that the solution is marketable for both genders. The respondents felt that the SmartSet solution is gender-neutral and should be designed to be user-friendly and not complicated to use once set in the site. As the end users' opinion was that the product is gender-neutral, they didn't seem to find any point of why or how it could be better marketed for both genders. One respondent, however, thought that marketability could be assured by underlining the fact that when the SmartSet is set into the site, the

usage of the SmartSet is simple and it is more like a visual tool to express a person's ideas than a complicated "technological nightmare".

4.6 Content

The end users were given a task to consider different strengths, weaknesses, opportunities and threats of the SmartSet content. The answers are displayed in Figure 14.

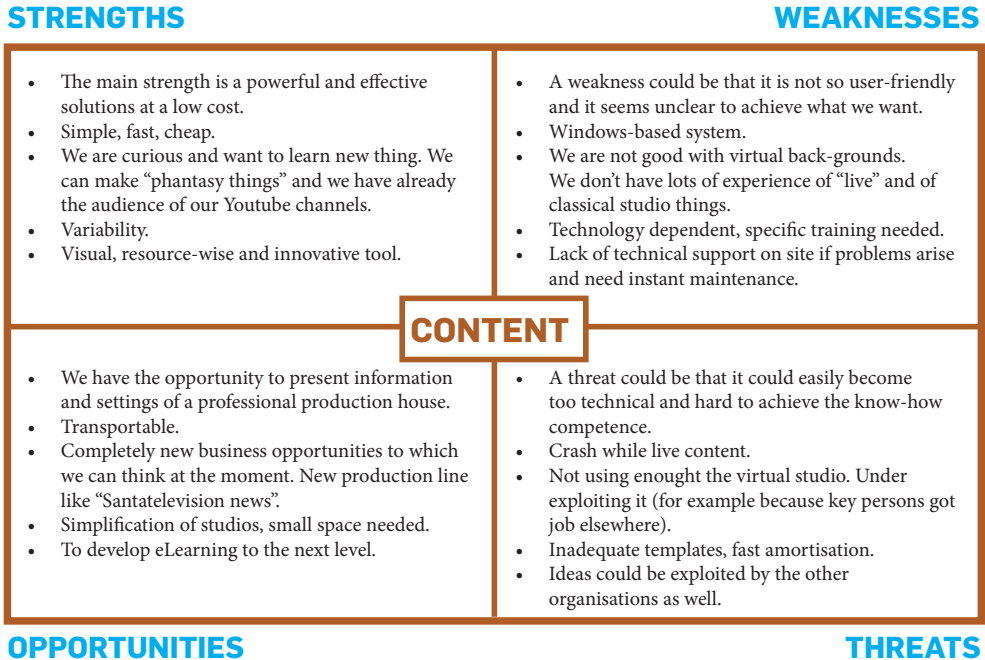


Figure 14. End users' SWOT analysis concerning the SmartSet content

For marketing the SmartSet solution, it's important to emphasise the strengths and opportunities and limit the weaknesses and threats in the development work. The answer “simple, fast, cheap” outlines the main points of how the solution could be marketed content-wise. However, the content includes so much more, and as was raised in the answers from the end users, innovativeness, visuality and variability can also be the main key points in developing and marketing the product. In opportunities, the respondents see the possibilities to find new customer groups. Also, the simplification of studios (small space needed) and transportability plays a vital role in the usage of the SmartSet.

The issues concerning the content (weaknesses) that the developers must address include the Windows-based system, the lack of user-friendliness and the idea of the solution being technology dependent. It's also important to be aware that the potential

end users are not accustomed to utilising virtual sets. Therefore, it's essential to provide technical support on site if problems or the need for instant maintenance arise.

A threat could be that the SmartSet solution could easily become too technical and hard to achieve the know-how competence. Also, an answer concerning crashing while live content must be considered before marketing. In addition to these, the end users raised the point of the low usage of the virtual studio. Under-exploiting can cause deprivation in the company. Other threats raised were inadequate templates and the fact that ideas could be exploited by the other organisations as well. The developers have to think how to market this new solution in a way that that it offers something new as well as offering a solution for current needs of the companies.

The stakeholders and end users also considered what kind of content their organisation could produce by using SmartSet. Potential ways to use SmartSet can be roughly divided into few categories: live productions (TV shows, news, magazines), presentation videos (for own company or for clients), music videos and movies (or parts of these) and educational productions. The potential ways to use SmartSet was asked with an open question, and the answers reveal that at this point the target groups see the usage of SmartSet in somewhat traditional ways. As the SmartSet project goes forward into the demo phase, it offers an opportunity to test different ways to utilise the SmartSet solution. These examples can then work as marketing material to show the future clientele new and innovative ways to do productions with SmartSet; not forgetting the traditional use either but rather to expand the vision of all of the ways a company can utilise the solution.

In the end users' questionnaire, we asked the respondents to contemplate more specifically the potential for making a new kind of content by utilising SmartSet. The end users visualised ways to use SmartSet outside the normal and traditional material that would be the obvious usage of their company. The answers included: creating new ways of displaying information in a very detailed virtual studio, making interviews over Internet, news and live programmes, new kind of b-to-b corporate videos, weather forecasts and infotainment programmes, eLectures nationally and internationally and TV-broadcasts locally (for online distribution and TV).

The respondents also made an estimation of the division between their need for recorded and live productions (from a total of 100 per cent). Although earlier responds showed that there could be a need for more live productions, the answers for this question revealed that the usage of the SmartSet would be mostly based on the recorded productions. As shown in Figure 15, 3 respondents answered that they'd use the solution only for recorded events as the highest usage percentage for live productions was only 70 (from 3 respondents).

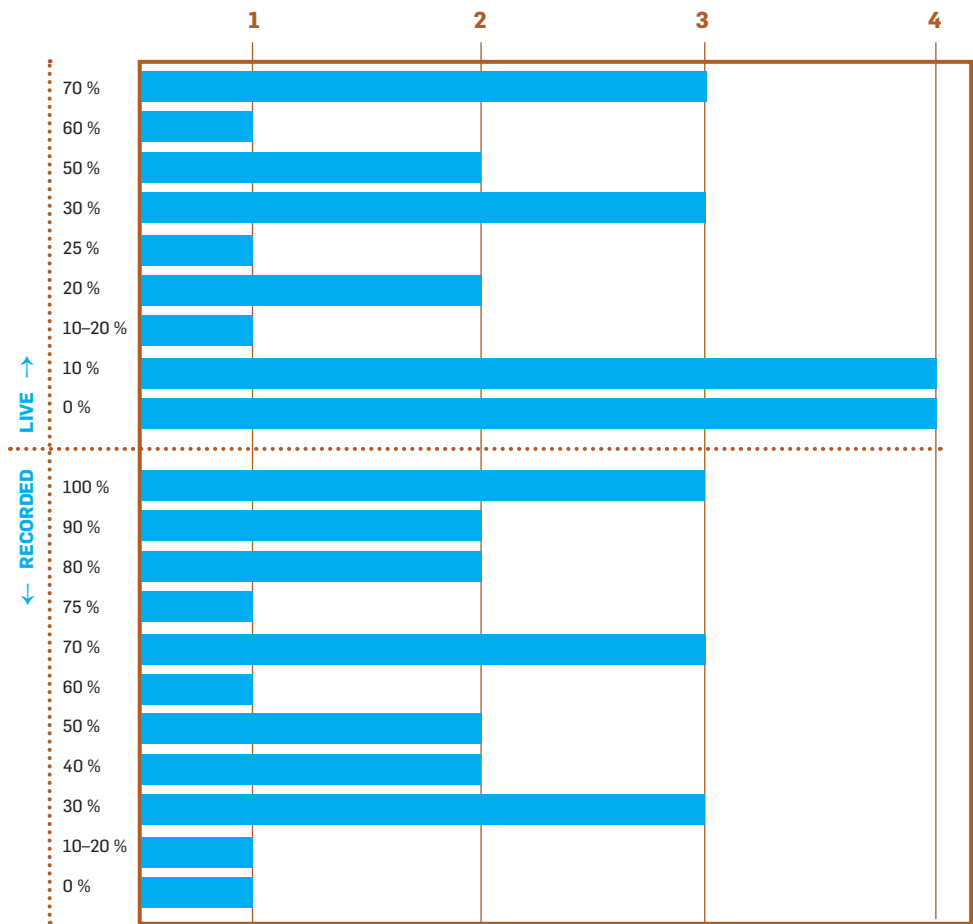


Figure 15. Estimation on the division between respondents need for recorded and live productions from a total of 100 per cent (number of answers in each option)

The percentages, however, only serve as directional information on how the SmartSet solution could be used, as all of the respondents haven't fully understood the questions (i.e. their percentages don't match each other). Nevertheless, a clear outcome is that there's a need for both live and recorded productions, and one or the other isn't substantially more preferred than the other.

4.7 Hardware

Even though SmartSet is more software-based than hardware based solution at least from the developer’s point of view, SmartSet is set to be a complete virtual studio solution including as well the necessary hardware: desktop computer with competent video and audio embedding cards, green screen, camera, microphones, audio delay and media recorder.

During the current phase of the project when the implementation of the virtual studio hardware has just started but not yet finished in all the end user locations, the questionnaire feedback was slightly bicentric; on the one hand, feedback was detailed based most likely on the earlier experiences with virtual studio technology or expectations and prejudices and, on the other hand, end users felt that they weren’t able to answer hardware related questionnaire questions.

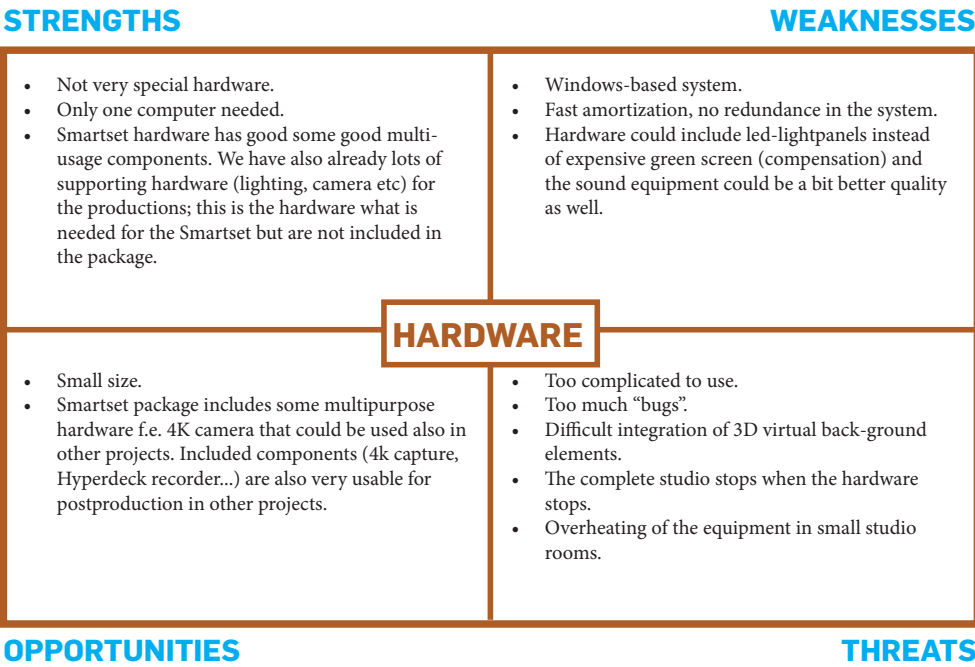


Figure 16. End users' SWOT analysis concerning the SmartSet hardware

As shown in Figure 16, the main strength of the hardware was that it’s a very basic setup without too specific hardware elements, which makes SmartSet more user-friendly, especially when only one computer is required to run the virtual studio. The same equipment could also be used in other kinds of productions as well and for post-

production, if needed, and this was also seen as an opportunity. Such weaknesses as bugs and the integration of 3D virtual background elements are clearly more software based issues and they will be processed in the next chapter but in the sublevel it was easy to note that end users had a concern about the reliability of the virtual technology, which is understandable at this phase of the project. Therefore, as regards threats, end users mentioned their concern about possible hardware failure which could endanger the whole production. Because virtual sets are designed in such a way that no huge studio stage rooms are needed (which is also important marketing-wise), end users also showed some concern on the possible overheating issues while using lighting, fast computer and other hardware in somewhat small spaces. At the same time, the lack of need for large studio spaces was also seen as an opportunity, which is easy to notice in virtual set vs. a real set comparison.

How do you agree with the following statements:	1	2	3	4	5	Altogether	Average value
Virtual sets require much less space than real ones.	0	0	0	1	4	5	4,8
Virtual sets allow for using the same studio for different scenarios.	0	0	0	1	4	5	4,8

Figure 17. End users comparison between virtual set and a real studio set (1 = I totally disagree, 5 = I totally agree)

As shown in Figure 17, end users saw virtual sets as an economical, low-cost alternative to expensive and large real studio spaces. End users also put lots of value in the fact that once virtual studio was set it could be used for different kinds of scenarios and productions. This is because virtual sets are located on the computer’s hard drives, not in large storage rooms (e.g. concrete set structures in regular studios).

Requirements for a cost effective virtual set system:	1	2	3	4	5	Altogether	Average value
4K standard compatibility	1	0	0	2	2	5	3,8
Use of wide angle view in order to simulate camera pan, tilt and zoom	0	0	1	1	3	5	4,4
Talent tracking on the green-screen and translation into virtual movement	0	0	1	2	2	5	4,2

Figure 18. End users' evaluation for possible requirements for a cost effective virtual set system (1 = not essential at all, 5 = very essential)

When thinking about a bit more detailed hardware issues, end users opinions were more varied (see Figure 18). For example, some end users either had already or would have soon in the future a need for 4K technology. On the other hand, most of the end

users would be using 1080p/1080i FULL HD output resolution, because that is currently the software's maximum output resolution; one of the end users didn't currently have any need for 4K compatibility and that's most likely because in many countries it will take a long time before their networks are 4K compatible or the Internet connection bandwidth is as high as required for online streaming etc. However, as some sort of crossover-question between hardware and software issues, the use of 4K wide angle view in order to simulate camera pan, tilt and zoom, which means possibility to do similar camera movement like in the regular set but in virtual environment by using the software, end users had certainly need for such a function; this function would be possible by using 4K input in HD output in which an extra resolution allows zooming in without suffering low resolution artefacts. Also in the question of talent tracking on the green screen and translation into virtual movement, end users found importance. With this function, end users are able to let their talents walk and turn in front of the green screen and be captured, calculated and placed in the virtual environment properly in the real time; on a common fixed camera systems the talent image is just placed in the scenario on a fixed position and talent is not allowed to walk in order to avoid perspective artefacts.

Based on the user expectations and demo descriptions and interviews, end users' different kinds of productions caused specific demands for each of them. For example, one of the end users will be using two cameras in their productions when others will be mainly working with only one camera. Some demo productions will also have more than one talent, which can cause problems when trying to arrange all the action in front of a limited sized green screen to be able to capture talent movement to the virtual environment. Also some end users preferred to produce more live online streaming than broadcasting recorded programmes. For some of the end users, it was important to be able to easily transport and set up the studio also elsewhere, not in one location for example in customers' premises and even in other continents, if necessary. Therefore, the SmartSet solution should be designed to be as mobile as possible.

4.7.1 OTHER SOLUTIONS AND ADD-ONS WITH SMARTSET

End users were also asked in the questionnaire if their organisation has a need for any specific third party hardware or software solutions in addition to the complete SmartSet solution. 80% of the answers were "yes".

The only third party software solutions mentioned were Maya or 3DMax, which would be used for creating own virtual sets. For the hardware solution, a teleprompter was needed by two of five end users in their productions. Only one end user had a need for talent's possibility to control some of the virtual environment functions with his or her body movements and arm gestures recognised by Myo or Kinect; such a gesture recognition devices could be used in virtual environment e.g. moving 3D objects, video playback buttons, zooming etc.

In conclusion, the hardware should be of professional quality but not high-end. It must get the work done well enough, easily and it has to be reliable. On the other hand, hardware issues are very case-sensitive, meaning that different users have different technical needs: some might have a need for 4K resolution and others would be satisfied with FULL HD (benefits of the 4K resolution were explained in the chapter 4.7), or someone might have a need for a teleprompter and someone else for Kinect or Myo gesture recognition. There were also some discussions whether or not LED-lighting equipment should also be included in the complete SmartSet solution. Most likely the best solution for the hardware question would be to offer not only a standard set but also an optional, more personalised hardware set for customers in need. However, then there should be some precautions: it is difficult to create functional maintenance and support for the SmartSet solution if there are too many variables in need of specific drivers, settings etc. If the hardware would have not so many different sets of components, replacing malfunctioning hardware could be much easier, faster, simpler and cheaper. It is important to make the product as problem-free as possible not to lose customers when they have become tired of problems and started negative word of mouth.

4.8 Software

Even though the questionnaire data concerning software issues was again a bit bicentric, because of a lack of experience with the software, there was already a clear vision on the strengths and opportunities of the SmartSet solution: user-friendliness and simplicity were keywords (see Figure 19). Also the possibility to produce up-to-date professional quality material was important to end users, which they had seen in the demo productions produced with developer’s other software (in which the actual SmartSet software will be based). Reliability issues and user-friendliness were main topics in weaknesses and threats; end users were worried about buggy and unstable software but also doubted their own knowledge and skills on using the software. Therefore, user-friendliness was the keyword which goes through all the SWOT-structure.

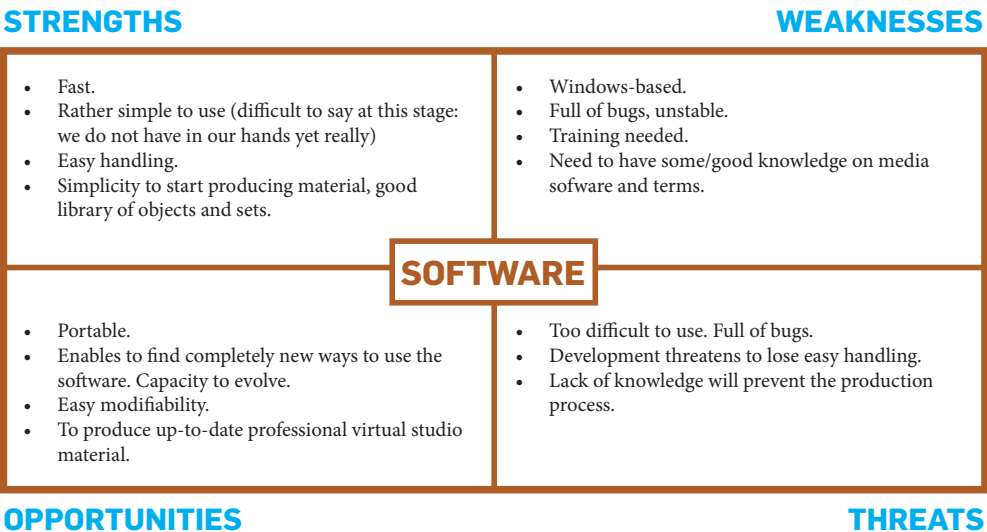


Figure 19. End users' SWOT analysis concerning the SmartSet software

Based on questionnaires and interviews, both the end users and stakeholders had the same kind of opinions, thoughts and worries concerning the comparison between virtual set and a real studio set: virtual sets could give the freedom to express those ideas, that would otherwise be impossible or too expensive to be produced with real studios, but on the other hand the reliability of the real sets and possibility to feel and touch the real set without too computer-based solution attracted still some stakeholders and end users. What was a little bit of a paradox was that real sets’ final images were seen same time more natural but virtual sets more compelling, which could be

explained by more detailed and powerful graphic engines with better shading, shadowing, virtual lighting etc.

Especially in interviews, the end users had some worries of the artificial and plastic feel of the virtual sets but based on the questionnaire the current virtual sets' graphics quality was just above mediocre (see Figure 20). Therefore, special effects were required to enhance the quality of the sets and integration of the talent to the virtual environment by using shadows, lights, bump mapping etc. Interestingly widest deviation (from 2 to 5) in questionnaire were in the questions on if "virtual sets allow to integrate graphics easily" and "modelling professional virtual scenarios is a costly process" which could be explained either by the lack experience or end users were not so interest of producing complex 3D sets. Producing complex sets could take lots of working hours which makes them expensive to create; instead of such complex sets, end users were more interested in using set libraries and set templates. Questions about tracking results were again a bit paradox, because when end users had consensus on "current virtual sets relay on expensive camera tracking systems" (average 4), then in "trackless virtual sets, not using camera tracking systems, provide poor results" and "cheaper and easier to calibrate tracking systems will make a huge difference" both results got over 4 average (4 and 4.4); what is the paradox in these questions was the fact that SmartSet is a trackless virtual set solution and one of its main advantage is to become a cheap and easy trackless solution with professional quality. This paradox could be again caused by lack of experience or by prejudices concerning the virtual studio technologies.

How do you agree with the following statements:	1	2	3	4	5	Altogether	Average value
Real sets final images are more natural.	0	0	0	2	3	5	4,6
Virtual sets final images are more compelling.	0	0	2	1	2	5	4
Current virtual sets' graphics quality is excellent.	0	0	3	2	0	5	3,4
Virtual sets allow to integrate graphics easily which is a common requirement.	0	1	2	1	1	5	3,4
Special effects that virtual sets provide are often required.	0	0	2	1	2	5	4
Current virtual sets relay on expensive camera tracking systems.	0	0	2	1	2	5	4
Trackerless virtual sets, not using camera tracking systems, provide poor results.	0	0	2	1	2	5	4
Cheaper and easier to calibrate tracking systems will make a huge difference.	0	0	1	1	3	5	4,4
Modeling professional virtual scenarios is a costly process.	0	1	1	2	1	5	3,6

Figure 20. End users' comparison between a virtual studio set and a real studio (1 = I totally disagree, 5 = I totally agree)

Requirements for a cost effective virtual set system:	1	2	3	4	5	Altogether	Average value
Authoring tool for creation of basic scenarios based on existing sets of assets	1	0	0	3	1	5	3,6
Internal chromakeying in the software	0	0	0	2	4	6	4,67
Talent casted shadows on virtual objects	0	0	1	2	2	5	4,2
Talent capture colour adjustment for better integration	0	0	0	3	2	5	4,4
Tracked talent insertion over recorded tracked footage	0	0	1	1	3	5	4,4
Compatibility with 3DMax and Maya models and animations	0	0	1	1	3	5	4,4
Creation of simple primitives inside the application	0	0	3	1	1	5	3,6
Editing materials and textures of imported 3D objects	0	1	2	0	2	5	3,6
Simple animation of elements done inside the application	0	0	1	2	2	5	4,2
Interface for creation and management of different virtual cameras and camera shooting positions during production stage	0	0	0	2	3	5	4,6
Lens calibration wizard	0	0	2	1	2	5	4
Basic talent interaction with virtual objects	0	0	2	1	2	5	4
Simulation of defocus both on the scene and on the talent based on its' position	0	1	2	0	2	5	3,6
Integration and play of video clips in the virtual scenario	0	0	0	3	2	5	4,4
Capture of more than one video source and integration of more than one talent	0	1	0	2	2	5	4
Materials improvements based on shaders	0	0	3	1	1	5	3,6
Full scene based effects based on shaders	0	0	3	1	1	5	3,6
Management of fonts and insertion 2D and 3D texts	0	0	2	1	2	5	4
Design of patterns of events to be triggered during production	0	0	2	0	3	5	4,2

Figure 21. End users evaluation on a possible requirements for a cost effective virtual set system (1 = not essential at all, 5 = very essential)

As shown in Figure 21, the most valued requirement was to have an internal chromakeying in the software, even though end users are also able to use external chromakeying solutions with the SmartSet. Interface for the production stage had also a clear importance for end users, and based also on both end user and stakeholder interviews, interface should be developed as user-friendly and simplified as possible where the design of patterns and integrated video clips etc. could be triggered easily. End users also showed lots of interest in how to enhance talents' integration to the virtual environment by being able to adjust and cast shadows and adjusting talents' colour and contrast. Software also has to be compatible with most of the 3DMax and

Maya models and animation. One interesting function that end users also showed interest in was augmented reality (AR), which means inserting tracked talent over recorded tracked footage.

In conclusion, the keywords for the software were user-friendliness, easiness and simplicity. Based on all of the data, it was clear that SmartSet software should be appealing for a wider not-so-experienced general audience to wipe out technophobia concerning virtual studio systems and to create good word of mouth for the SmartSet solution. If a potential customer finds out in the first try that the solution seems even a little bit too complicated, he or she will move on to find another product, or continue without any at all. Therefore, the system should have both “plug and play” -and “drag and drop” - based functions combined into a simple and clear user interface, which makes it possible for the customer to get the benefit of the virtual studio system from the very beginning. With this kind of simplified interface and more user-friendly approach the developer could also make a difference between their high-end products. The template-based system also received very positive feedback in the CIAG and end user interviews. The main idea in templates is that customers will receive in SmartSet solution ready-made functional set-templates with some minor adjustment possibilities, and if they need some new, more personalised and specific templates they could purchase them from the “SmartSet Online Store”. This kind of thinking would support the user-friendly and marketwise “plug and play” ideology behind the product and customers would not have a need for a specific person to provide 3D sets for their organisation which is quite time-consuming and expensive.

Because the final SmartSet will be a downgraded version of Infinity Set and eStudio, many of the more advanced functions need to be removed to make it possible to become a low-cost solution (and to create a difference between high-end products) but without losing the professional output quality of SmartSet’s predecessors. Again the solution would be to offer a basic standard version for all the customers with a possibility to buy some add-ons, e.g. augmented reality, more polygons and detail adjustment possibilities, based on customer needs.

4.9 Geographical point of view

One of our goals was to find out if there are some geographical issues that should be considered while developing and marketing the SmartSet solution. The questions included country specific requirements, possibilities for international cooperation and mobility of the virtual studio.

The question of what kind of country specific characteristics/requirements there are in the respondent's country concerning using SmartSet in their organisation was addressed to both stakeholders and end users. For the most part, the respondents didn't see any country specific requirements that should be taken into consideration. Several answers revealed that the Internet connections are not (or could not be) in all areas fast enough or reliable enough for online streaming. Other answers pointed out that unfamiliarity might be an issue as there's not a large amount of virtual studio content produced in some countries and also, low cost is a huge requirement. Few laws were also mentioned, but for the most part there are not any country specific laws that restrain the development work of the SmartSet solution.

The end users were asked if they can see any potential in working in an international operational environment, for instance new business and cooperation, new clientele and so on. Four of the end users answered yes and one answered no. The negative answer was explained because the company hasn't got any internationalisation ambition at the moment. The ones with positive answer explained how they could internationalise, for example in the following ways:

- lot of opportunities in growing economies countries
- international company with lots of international customers offer possibilities for further internationalisation
- eLearning services are possible for international online community.

Finally, the end users were asked if their companies have a need for mobile virtual studio and if yes, for what kind of locations. One respondent said that their company doesn't have a need for mobility at the moment, and the other four answered yes. Another respondent stated that for them it is an asset to be able to move a studio. The locations needed varied as one respondent said "in our facilities and in different countries" and another "inside the country". The marketing point was also raised up as one of the end users said that for example they would like to advertise their online eLearning services in seminars and conferences and, therefore, to set the studio in such occasions.

4.10 Maintenance

When talking about professional hardware or software solutions, the maintenance, support and updates have a great importance: after purchasing something the customer needs maintenance for the hardware and updates for the software to get the most out of the product and even for years to come. Stakeholders and end users were asked in the questionnaire about how much they would be ready to invest in maintenance and support in addition to SmartSet solution costs.

Based on questionnaire data, stakeholders were willing to invest an estimated 4,250 euros and end users 1,400 euros for 1 year; for both stakeholders and end users the average was estimated 2,825 euros. Interesting in this data was that the investment range was from 200 to 17,000 euros. This was based on many different factors, e.g. small companies with a few but highly experienced employers don't need so much technical assistance and don't have financial resources for high maintenance costs but then on the other hand bigger companies, that have more resources for the maintenance, are willing to invest more to keep things on running smoothly and without problems, especially if SmartSet would be used daily or weekly in different kinds of productions. In generally maintenance and support costs are usually 10-15% of the product's retail price, so in SmartSet's case it should be around 1,000-1,500 euros in a year.

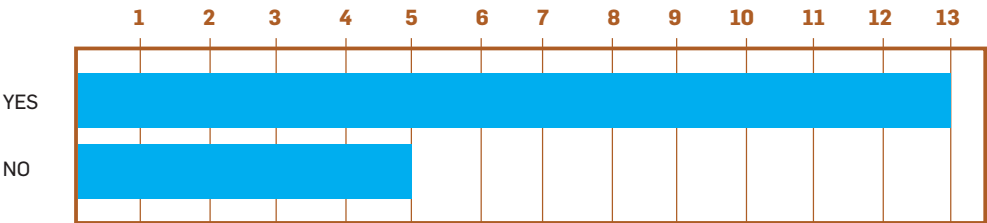


Figure 22. Stakeholders' answers on whether or not there is a prerequisite to have SmartSet maintenance services in their countries (number of answers in each option)

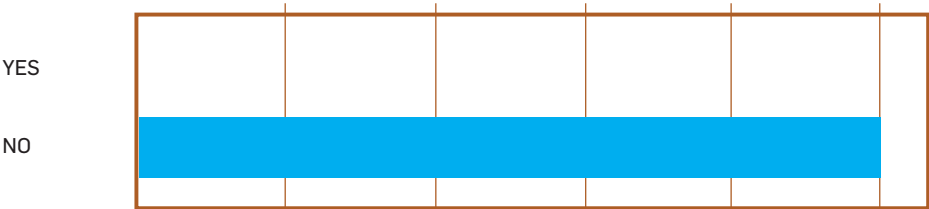


Figure 23. End users' answers on whether or not there is a prerequisite to have SmartSet maintenance services in different countries (number of answers in each option)

When asked about whether SmartSet maintenance services should be located in stakeholders' countries, the answer was 72% "yes", and especially in the United States, the stakeholders' opinion was that maintenance should be organised for their continent (see Figure 22).

But as shown in Figure 23, end users' answer for the same question was 100% "no". In their case, the feedback was based on the fact that they have been in SmartSet project already over 6 months and they were already somewhat familiar with the hardware and software and they knew that SmartSet will be very user-friendly and simple solution that could be supported via online. For example, Brainstorm sent all the hardware to the end users for an ulterior implementation. In the case of Lapland UAS's and Hallingdolen's studios, the staff managed to install the hardware in their own facilities with an online support organised by the developer Brainstorm and feedback for such a maintenance was very supportive. This online support was actualised by Skype calls and Team Viewer remote control software. End users' trust on online maintenance services was 100% positive and 80% of end users didn't find need for 24/7 maintenance services. Because of this possibility to install both the hardware and software in Lapland UAS's and Hallindolen's end user sites without a need for a specific technician from the developer's side, the actual implementation process got advanced and end users were able to start to explore possibilities of the virtual studio system earlier than planned.

In the case that problems would appear, end users expected to get maintenance and support between some hours and few days; rough average would be in 24 hours (see Figure 24). These answers were explained more detailed in open questions: some of the end users' productions were pre-recorded and not daily which allows them to reschedule their productions if problems appear, but on the other hand some productions were live broadcasts. If working on recorded productions there is usually more or less time to solve possible problems but while on live broadcasting technical problems could endanger the whole production already in a few seconds or minutes. Only 40% of the end users' organisations are equipped and prepared for sudden technical problems.

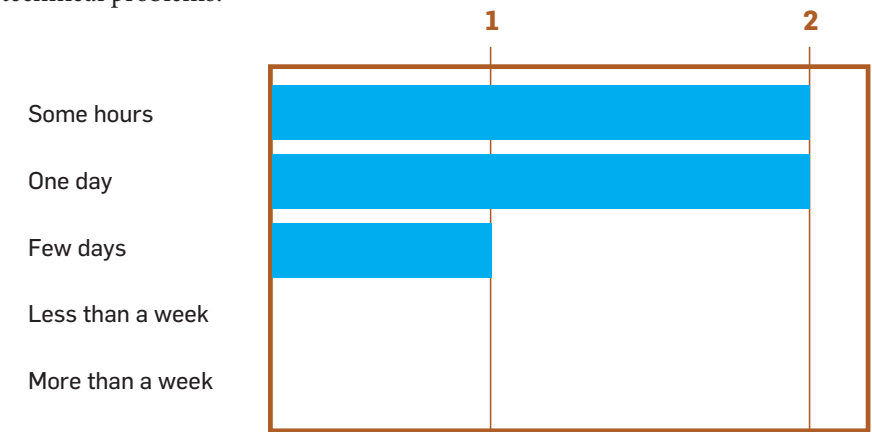


Figure 24. End users' answers on how long they would be able to wait for the maintenance if problems arise (number of answers in each option)

Nowadays, almost every single person who has bought some digital device (e.g. handy, tablet, laptop) or software knows that those devices or software need to be updated time to time for better performance and possible add-ons. As shown in Figure 25, most end users (80%) wanted to get updates for SmartSet once in 3-6 months. 60% of them were willing to pay extra for those updates; depending naturally on the content of those updates e.g. if new libraries or functions will be included or is the update making SmartSet compatible with some third party hardware or software not included in the complete SmartSet solution. Also 60% of the end users believed that they were able to update the software on their own without the maintenance.

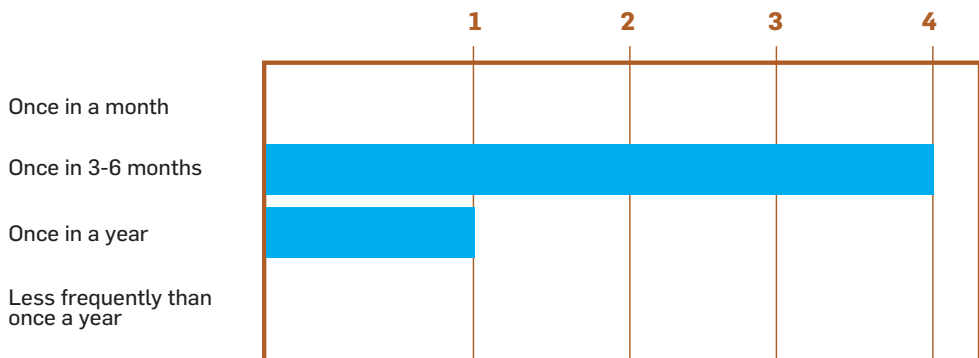


Figure 25. End users' answers on how often software should be updated (number of answers in each option)

As the last questions on maintenance and support, the end users were asked if operating a virtual set requires specialised personnel while a real set doesn't, and if they thought that maintenance and support in a virtual set are expensive. As shown in Figure 26, the scale was wide: based on their answers 60% agreed that specialised personnel are required while 40% disagreed, and end users both agreed and disagreed on the question if maintenance is expensive (average 3).

How do you agree with the following statements:	1	2	3	4	5	Altogether	Average value
Operating a virtual set requires specialized personnel while a real one don't.	2	0	0	3	0	5	2,8
Maintenance and support in a virtual set are expensive.	0	2	2	0	1	5	3

Figure 26. End users' comparison between a virtual set and a real studio set (1 = I totally disagree, 5 = I totally agree)

In conclusion, most of the stakeholders and end users agreed that online-based maintenance, support and software updating would be the best solution to able

SmartSet solution to become both functional and low-cost; if the solution would need personal maintenance on location, the maintenance costs (technician salary, travel costs etc.) would have an impact on the product's pricing.

Therefore, there must be well-organised and updated tutorials-website to explain step-by-step all the possible problem situations. As to the question of whether or not face-to-face customer training was needed, the majority of the feedback was negative: well-prepared tutorial video clips and online webinars should be enough. General opinion on maintenance costs was also in consensus that 10-15% of products retail price would be reasonable cost yearly. Once again, if the average customer would be satisfied with online-based maintenance, support and software updates, there could also be an optional possibility to buy training courses, if needed.

4.11 Novelty of the SmartSet

The SmartSet project is figuring out how to make the SmartSet solution a game changer. All the respondents were asked if they feel, at this point, that the solution we are developing could be a game changer. 16 answered yes, 6 answered no. The reasons behind these answers give more insight into where the development of the solution should be targeted.

The ones that considered the SmartSet as a game changer offered for example the following reasons:

- I think it would introduce in production SmartSet study and direct new elements that would make rich programmes. In addition, the possibility of reducing production costs, and travel to other locations. Although it should work on making the increasingly credible virtual studios.
- If it is easy to use and cheap enough, even mobile use should be possible.
- Cost point.
- Opening markets.
- Portable, low Price and easy.
- Price & simplicity.
- Contained price with unlimited functionality pair with ease of use.
- We need it.
- Much more advanced production for low cost.
- It is relatively easy to use and it is quite reliable.
- I think it could be a game changer, if it could become the standard in a well-established production company.
- People tend to follow the leaders in an industry.
- SmartSet will enable us to produce very professional-looking productions at a very low cost.
- Make professional results in a very competitive price will be essential.
- If the expected price and quality meet, we would be able to produce professional quality content and, therefore, able to create new services and innovations.

On the reverse side, the reasons why we are not offering a game changer are the following:

- It is not an entirely new idea, just a practical implementation of an existing technology. No drastic change in the demand situation.

- It is just a tool. The story is the main game changer.
- If SmartSet is really cheaper than all other virtual studios, then it will be used only for small budget productions that cannot dictate the rules of the game. Also I don't think, at least to my knowledge, that there is a big need for small budget TV shows. If SmartSet is used somehow for Internet broadcast, for web series and stuff, then it could make an impact. Because productions intended for Internet use typically have smaller budgets.
- There are other competitors with similar product.
- Because competition is trying to do the same now.
- There are many similar virtual set creators.

It seems to be essential that the low price doesn't mean bad quality. In addition, the ease of use is a key point as well as portability. These factors can be the reasons why SmartSet could become a game changer. It's also important to notice few answers that state that it would give a huge marketing value if the "main players" of the field start using the SmartSet. By giving an example, they could lead the way for others to start using the same technology.

Why SmartSet isn't a game changer is mostly based on the fact that there are other similar virtual set creators in the market. Therefore, to make SmartSet a game changer, the developers must figure out a way how this solution differs from other similar kinds of products. It's also important to understand the statement that "the SmartSet is only a tool and the story is the main game changer". This addresses the same issue that has raised up before in the answers that it's not enough to educate people on how to use the SmartSet solution (software and hardware) but also let them know to which kind of material it's best suited for (content). By figuring this out, it's possible to create a totally new market that SmartSet is an answer for.

5 CONCLUSIONS

The vision in the SmartSet project is to develop a low cost virtual studio solution that, despite being ten times less than the cost of comparable solutions on the market, will have the same quality of high cost solutions currently used by larger broadcast media companies but with a simple and limited functionality. In this way, the project will increase the competitiveness of the European creative industries, particularly in the broadcast media sector. (User Consultation Process Protocol and Tools 2015.) This report has detailed a range of user requirements which will feed into the virtual studio specification.

The first step to user requirements consultation was a questionnaire to form a general opinion of the end users and stakeholders (two separate questionnaires). To complement the data from the questionnaires, there were also a series of online interviews and face-to-face meetings that were based on the data gained from the questionnaires. The research was based on SWOT analysis and user-centred design. These methods served as a starting point and basis for the research and setting up the questionnaires.

The user consultation was based on 11 themes: 1) background information, 2) personnel's competence, 3) financial issues, 4) buying decision, 5) target groups, 6) content, 7) hardware, 8) software, 9) other solutions and add-ons with SmartSet, 10) geographical point of view, and 11) maintenance. The goal was not only to find out the specific requirements concerning the SmartSet software and hardware but also to figure out needs of the current markets and possible ways to make the solution better marketed and targeted for the right audience.

Webropol-questionnaire was sent to all of the end users (5) and stakeholders (59) of the SmartSet project. As a result, we got 5 responses from the end users and 18 responses from the stakeholders from various countries all over the world to represent the changing markets. The detailed results are displayed in the chapters 4.1–4.11, but in summary, we can state the following:

All of the respondents considered their companies having at least some knowledge in using virtual 3D studios, and many stated having good or very good knowledge; in general the end users had less experience than the stakeholders. This previous knowledge assures the reliability of the results, and end users' lesser knowledge will provide the SmartSet project very valuable information as the project goes forward to the demo stage (i.e. is the solution easy to use for the so called beginners).

The answers concerning technical and creative knowledge acquired from the personnel in order to use SmartSet revealed that the need for technical and creative knowledge are vital to the successful deployment of the SmartSet solution, as selling and/or using any equipment successfully relies on knowing the product and all its possibilities. Overall, it was seen as an asset if the company's personnel have previous experience in TV and media productions. The research shows that it is clear that one shouldn't forget the need for creative knowledge while concentrating only on the technical requirements.

Also, while planning the training of the SmartSet software and hardware, the developers must take into account both aspects; technical and creative design. The

need for instructional videos/webinars/courses in how to create and use graphics in the most complex way possible came up in order to understand the full potential of the SmartSet technology and how to adapt SmartSet technology in everyday work. However, many of the respondents were of the opinion that basic usage training and familiarising with the software specifics are sufficient and online training and/or reading the manuals can give the needed information of operating the SmartSet.

The price has a great importance when creating a new market for a SmartSet solution. Based on the CIAG member and end user interviews there were very different points of view: even though low-cost pricing could be appealing for small enterprises with a lesser need for the virtual studio solution, for larger broadcast companies cheap pricing could even cause negative response because they might think that product and the quality are not good; the virtual studio market has become used to high prices. On the other hand, the price could also have a lesser importance if the customer, e.g. small TV stations, newspapers and radio channels with online streaming etc., is willing to make a strategic choice and invest in the SmartSet solution to be able to challenge bigger studios and other competitors in their businesses and to provide new services. However, in general, the lower the price is, the more customers there will be. Based on all the data, the starting price for SmartSet solution, both hardware and software, should be estimated at 9,000-10,000 euros. Another important factor, and in many cases the most important factor, in the pricing are the personnel costs in addition to SmartSet product costs: how much a customer has to and is willing to invest in personnel using the SmartSet virtual studio. So called “normal” studios usually need lots of personnel to operate the set: electricians, gaffers, camera operators, sound department, director, editor etc. Based on the open questions, it’s easy to summarise that SmartSet should be simply and easy to operate by one or maximum two persons when set on location and functional.

It would a good idea marketwise to provide some sort of a basic package for beginner users and companies with only basic needs for the standard starting price and then if the customer needs more advanced features or specific personalised templates they can buy such packages from “SmartSet Online Store”. With this kind of marketing strategy it would be easier for customers to make the important first step towards a virtual studio user.

The respondents were asked to contemplate the reasons why their company would buy or use SmartSet and, on the other hand, why they would not buy or use the solution. The reasons for acquiring the SmartSet solution can be summarised in two main qualities: lower production costs and ease of operation. Therefore, the keyword seems to be cost-effectiveness, not to forget the quality of the production: producing impressive output with less input. Cost-effectiveness includes the costs to own and the costs to operate. The main issues that could prevent the respondents from buying or using the SmartSet solution are price and functionality problems. It’s safe to assume that the pricing is a very important factor for the possible buyers. Instability and problems with functionality are also mentioned in several answers, so it’s important to make sure to provide a package that offers easy usage and a stable operation system.

Concerning the importance of certain characteristics' effect on the decision to buy SmartSet, the stakeholders appreciate the most the possibility to create their own virtual sets, user-friendliness of the product, potential new markets and target groups for the company and profits, and the end users emphasise user-friendliness, the possibility to create their own virtual sets, price and the availability of support. These differences between the answers show that as the end users aren't necessarily targeting new markets, the stakeholders value the profitability and new target groups very highly. In the end users' answers, however, profit is the least important factor. Although the end users are piloting in the project and testing the product, the stakeholders represent the demand of the industry in general. Therefore, the developers must also take into consideration how the SmartSet solution can be marketed as a tool to reach new markets.

The research also pursued finding what could be the asset of the SmartSet solution as a virtual set in comparison with the existing real sets. A few important issues were raised. First of all, it was mainly agreed that a virtual set requires much less space than a real set. It appears that the less space needed could serve as a valid marketing point for the SmartSet solution. Secondly, almost all the respondents totally agreed that virtual sets allow for using the same studio for different scenarios. This must be the key factor in marketing SmartSet as it's a fact that makes the virtual set unique and different from the traditional real set solution. However, it was mostly agreed that a real set offers more natural images but virtual sets can offer more compelling final. It needs to be considered whether there's a need for making the virtual set outcome more natural and realistic looking or should the "virtual look" be considered as an asset.

While thinking about the possible marketing channels that could serve to best reach the right target groups, for both, the end users and stakeholders, presentation videos online is the main promotional channel they'd prefer. The secondary way to reach the target audiences is, according to the results, personal contact. Although there were clearly two main marketing channels that the respondents prefer, all of the other given options (webinars, seminars, handouts and brochures) were also chosen many times. This implies that the versatile usage of different marketing channels is important in order to best reach the possible target groups. The SmartSet project can offer a platform to further test the most suitable marketing channels for the SmartSet solution.

According to the end users, their companies' current target groups are expected to be the main consumers of the material produced with the SmartSet technology. However, they could also see some potential in reaching totally new target groups with the help of SmartSet productions. The answers also revealed that the online or live production possibility is the key point in reaching new target groups (e.g. video presentations, online lectures in virtual classrooms). In addition, all of the end users shared the opinion that the solution is marketable for both genders. The respondents felt that the SmartSet solution is gender-neutral and should be designed to be user-friendly and not complicated to use once set in the site.

The SWOT analysis of the SmartSet content (made by the end users) show that “simple, fast, cheap” outlines the main points on how the solution could be marketed content-wise. However, the content includes much more, and as was raised in the answers from the end users, innovativeness, visuality and variability can also be the main key points in developing and marketing the product. In opportunities, the respondents see the possibilities to find new customer groups. Also, the simplification of studios (small space needed) and transportability play a vital role in the usage of SmartSet. The issues raised concerning the content (weaknesses) that the developers must address include the Windows-based system, the lack of user-friendliness and the idea of the solution being technology dependent. It’s also important to be aware that the potential end users are not accustomed to utilising virtual sets. Therefore, it’s essential to provide technical support on site if problems or a need for instant maintenance arise. A threat concerning the content could be that the SmartSet solution could easily become too technical and hard to achieve the know-how competence. The end users also raised the point of the low usage of the virtual studio; under-exploiting can cause deprivation in the company. In conclusion, the developers have to think about how to market this new solution in a way that that it offers something new as well as offering a solution for the current needs of the companies.

The stakeholders and end users also considered what kind of content their organisation could produce by using SmartSet. Potential ways to use can be roughly divided into few categories: live productions (TV shows, news, magazines), presentation videos (for own company or for clients), music videos and movies (or parts of these) and educational productions. The answers reveal that at this point the target groups see the usage of SmartSet in somewhat traditional ways. As the SmartSet project goes forward into the demo phase, it offers an opportunity to test different ways to utilise the SmartSet solution.

Even though SmartSet is more of a software-based than hardware based solution, at least from the developer’s point of view, SmartSet is set to be a complete virtual studio solution including as well the necessary hardware: desktop computer with competent video and audio embedding cards, green screen, camera, microphones, audio delay and media recorder. Hardware should have a very basic setup without too specific hardware elements to make SmartSet more user-friendly, reliable and stable production solution. Hardware should also be able to be set up in small spaces, which is one of key advantages when comparing a virtual studio set to real studio sets. Most end users had a need for 4K standard compatibility which makes it with wide angle view possible to simulate a real set’s camera pan, tilt and zoom without suffering low resolution artefacts. Most end users also had a need for third party hardware solutions e.g. teleprompter and gesture recognition devices like Myo or Kinect. Hardware issues are very case-sensitive, meaning that different users have different technical needs. Therefore, the best solution for the hardware question would be to offer not only standard set but also optional, more personalised hardware set for customers in need. But then there should be some precautions: it is difficult to create functional maintenance and support for the SmartSet solution, if there are too many variables in

need of specific drivers, settings etc. If the hardware would have not so many different sets of components, replacing malfunctioning hardware could be also much easier, faster, simpler and cheaper. It is important to make the product as problem-free as possible to not lose customers when they have grown tired of problems and started negative word of mouth.

There was already a clear vision on the strengths and opportunities of the SmartSet solution: user-friendliness, reliability and simplicity are keywords. Specific functions end users needed were an internal chromakeying in the software, some basic special effects to enhance quality of the sets and integration of the talent to the virtual environment by using shadows, lights, bump mapping etc. End users also needed augmented reality (AR) which means inserting tracked talent over the recorded tracked footage. Software has to be compatible with most 3DMax and Maya models and animation. The interface for the production stage also had a clear importance for end users and based also on both the end user and stakeholder interviews, the interface should be developed as user-friendly and simplified as possible where the design of patterns and integrated video clips could be triggered easily. Therefore, the system should have both “plug and play” -and “drag and drop” - based functions combined into a simple and clear user interface which makes it possible for the customer to get the benefit of the virtual studio system from the very beginning. This way, SmartSet would also be appealing for a wider not-so-experienced general audience to wipe out technophobia concerning virtual studio systems and to create good word of mouth for the SmartSet solution. With this kind of simplified interface and more user-friendly approach, the developer could also make a difference between their high-end products. Template-based system also received very positive feedback in CIAG and end user interviews. The main idea in templates is that customers will receive in the SmartSet solution ready-made functional set-templates with some minor adjustment possibilities and if they need some new, more personalised and specific templates they could purchase them from “SmartSet Online Store”. This kind of thinking would support the user-friendly and marketwise “plug and play” – ideology behind the product and customers would not have a need for specific person to provide 3D sets for their organisation which is quite time-consuming and expensive.

The research also set out to find if there are some geographical issues that should be considered while developing and marketing the SmartSet solution. The questions included country specific requirements, possibilities for international cooperation and mobility of the virtual studio. For the most part, the respondents didn't see any country specific requirements that should be taken into consideration. Several answers revealed that the Internet connections are not (or could not be) in all areas fast enough or reliable enough for online streaming. Other answers pointed out that unfamiliarity might be an issue as there is not a large amount of virtual studio content produced in some countries and also low cost is a huge requirement. A few laws were also mentioned, but for the most part there are no country specific laws that restrain the development work of the SmartSet solution.

In addition, it was seen that the SmartSet solution could also offer a possibility for the company's internationalisation, for instance new business and cooperation, as well as new clientele. The mobility of the SmartSet software and hardware was also seen as an important asset. The locations needed varied as one respondent said "in our facilities and in different countries" and another "inside the country". Concerning the mobility, the marketing point was also raised up as one of the respondents said that for example they would like to advertise their online eLearning services in seminars and conferences and, therefore, to set the studio in such occasions.

After purchasing something, the customer needs maintenance for the hardware and updates for the software to get the most out of the product and even for years to come. Both end users and stakeholders were willing to invest an estimated 2,825 euros in a year for maintenance, support and updates. This is very much in line with the normal maintenance costs of 10-15% of retail prices for a virtual studio solution. Most importantly online-based maintenance, support and software updating was seen to be the best solution to able SmartSet solution to become both functional and low-cost; if the solution would need personal maintenance on location the maintenance costs (technician salary, travel cost etc.) would have impact on product's pricing. Therefore, there must be well-organised and updated tutorials-website to explain step-by-step all the possible problems situation. Once again, if average customer would be satisfied with online-based maintenance, support and software updates, there could be also an optional possibility to buy training courses, if needed.

Finally, one of the SmartSet project's main goals is to figure out how to make the SmartSet solution a game changer. All the respondents were asked if they feel, at this point, that the solution we are developing could be a game changer, and 16 answered yes, 6 answered no. The reasons behind these answers give more insight concerning where the development of the solution should be targeted.

It seems to be essential that the low price doesn't mean bad quality. In addition, the ease of use is a key point as well as portability. These factors can be the reasons why SmartSet could become a game changer. It's also important to notice a few answers that state that it would give a huge marketing value if the "main players" of the field start using the SmartSet. By giving an example, they could lead the way for others to start using the same technology.

Why SmartSet isn't a game changer is mostly based on the fact that there are other similar virtual set creators in the market. Therefore, to make SmartSet a game changer, the developers must figure out a way for this solution to differ from other similar kinds of products. It's also important to understand the statement that "the SmartSet is only a tool and the story is the main game changer". This addresses the issue that it's not enough to just educate people on how to use the SmartSet solution (software and hardware) but also to let them know to which kind of material it's best suited for (content). By figuring this out, it's possible to create a totally new market to which SmartSet is an answer for.

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Authors

Timo Puukko is Senior Lecturer in cultural and media arts at Lapland University of Applied Sciences. He has an MA degree in film and TV-directing. In the SmartSet project, Puukko is responsible for consulting, collecting and analyzing stakeholder's needs and SmartSet solution's functionality requirements; this process will make it possible to critically evaluate the SmartSet solution. He is also responsible for Lapland UAS's test sessions in SmartSet. In this report, his main research focus areas have been pricing, hardware and software specifications and user-friendliness of the final product to satisfy needs of SME's in creative and educational sectors.

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The vision in the **SmartSet project** is to develop a low cost virtual studio solution that, despite being ten times less than the cost of comparable solutions on the market, will have the same quality of high cost solutions currently used by larger broadcast media companies, but with a simple and limited functionality. The project will increase the competitiveness of the European creative industries, particularly in the broadcast media sector.

The SmartSet project objectives include mapping and prioritising the user requirements for the virtual studio solution to be developed. This report is based on the user consultation process with the end users and stakeholders of the SmartSet project to determine the functionality requirements for product development and integration. The research set out to detail a range of user requirements which will feed into the virtual studio specification.



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