D5.1 Market analysis report

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Dissemination Level

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| C | Confidential, only for members of the consortium and the Commission Services |

Abstract
This report provides a Market Opportunity Analysis of ImmersiaTV. To do so, it analyses how ImmersiaTV’s Value Chain, with 6 main categories of stakeholders identified. Then it provides a description of the main market trends for audiovisual immersive products. Finally, based on these analyses, it provides a set of recommendations regarding ImmersiaTV’s positioning in its Value Chain.
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### Disclaimer

The information, documentation and figures available in this deliverable, is written by the **ImmersiaTV** (Immersive Experiences around TV, an integrated toolset for the production and distribution of immersive and interactive content across devices) – project consortium under EC grant agreement H2020 - ICT15 688619 and does not necessarily reflect the views of the European Commission. The European Commission is not liable for any use that may be made of the information contained herein.

### Statement of originality:

This document contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.
EXECUTIVE SUMMARY

The main goal of ImmersiaTV is to demonstrate a novel approach for the recording, broadcast and display of omnidirectional video. In ImmersiaTV we fully embrace the need for high-quality omnidirectional video, but we recognize the need to create a novel AV language addressing the specifics of immersive displays, within the contemporary, and multi-display, living room.

Following the steps of the value chain that are directly crucial in ImmersiaTV’s activity, the report identifies 6 main categories of stakeholders in the market for AV immersive products:

(i) Omnidirectional camera producers and/or processing software providers. They should not be considered as competitors because their products are complementary to what ImmersiaTV is developing. However, several important players are present in this stage including players that are strong in other stages or traditional players in the camera sector;

(ii) Providers of editing software for omnidirectional video;

(iii) Producers of immersive AV content, who are on the one hand competitors and on the other hand supporting ImmersiaTV’s objectives in contributing to the overall development of the market for immersive experiences. They currently all rely on business-to-business activity;

(iv) Distributors;

(v) Providers of devices allowing to display immersive content. They constitute the part of the industry most well-known from consumers. They include the most important and most powerful companies in this whole industry, which have invested heavily in these technologies. Their success is key to have the whole market for immersive experiences succeed. There are no display device providers within ImmersiaTV;

(vi) End-to-end platforms are providers of immersive experiences and/or of solutions allowing to produce, distribute and sometimes display immersive AV content. Those that are active in the live production and distribution of live events appear as ImmersiaTV’s most direct competitors.

The report provides a general overview of market trends for Virtual Reality and raises important questions concerning how the sector could evolve in the coming years, thus informing the ImmersiaTV consortium partners of potential threats and opportunities. Main trends are:

- VR is a fast growing market;
- Next to games, video and user-generated content will drive the adoption of VR technology;
- Shipments and sales of display devices are the most visible feature of the market;
- Displays vary greatly in terms of price and quality, the underlying trade-off is the one between quality and accessibility;
- Consumers will adopt VR only if relevant, innovative content is developed.

Finally, based on the analysis, the report recommends:

(i) To further question the relevance of (a) developing tools to make it easier to produce immersive content that can be experienced on different devices in a synchronised way, and of (b) the importance of live production. ImmersiaTV needs to differentiate from other providers of editing softwares;

(ii) To explore business-to-business business models rather than business-to-consumers;

(iii) To sustain and develop links with traditional and online media;
(iv) To follow up how the identified end-to-end platforms evolve and to map other similar market players.
## CONTRIBUTORS

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**Revision History**

- Version 0.7, 29/06/2016

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**Executive Summary**

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1. INTRODUCTION

1.1. Market analysis in the context of ImmersiaTV

1.1.1. ImmersiaTV

The main goal of this project is to demonstrate a novel approach for the recording, broadcast and display of omnidirectional video. In ImmersiaTV we fully embrace the need for high-quality omnidirectional video, but we recognize the need to create a novel audiovisual language addressing the specifics of immersive displays, within the contemporary, and multi-display, living room.

1.1.2. WP5 and T5.1

The overall objective of WP5 is to ensure that project results – to be understood as the creation of an end-to-end system for novel immersive audiovisual experiences and its components – have a determining impact on the audiovisual market. To reach this objective, this WP will:

- Determine overall conditions for successful exploitation of the proposed solutions, such as productization, standardization, additional stakeholder involvement etc. and identify optimal go-to-market strategies for each of the stakeholders, to be translated in feasible and viable exploitation plans.
- Organise maximal visibility to the proposed solutions through presence at major relevant events and set up direct contacts with potential clients of the developed solutions.
- Implement a communication strategy aligned with the exploitation strategies of the consortium partners.

Within WP5, T5.1 performs an analysis of the current and expected future market for immersive audiovisual products by:

1) Shedding light on changing behaviours and associated expectations in audiovisual consumption;
2) Assessing the market potential of the solutions developed within ImmersiaTV both in terms of enhancing existing formats and in creating new types of content;
3) Identifying technological trends, potential competing platforms and solutions as well as complementary stakeholders.

This analysis will lead to a set of recommendations which will steer both the use cases to be prioritized by the project as well as the exploitation and innovation transfer activities developed further in this WP.

1.2. Objective

This report describes the market for audiovisual immersive products and provides a set of recommendations as input for the use cases and the exploitation and innovation transfer activities in T.5.2.

Following the steps of the value chain where ImmersiaTV is active or that are directly crucial in the project’s activity, this report provides lists of relevant stakeholders. Where relevant, these lists are further structured in order to put stress upon important aspects of the market. This leads to initial business recommendations regarding ImmersiaTV’s activities.
1.3. Overview of deliverable

Next section provides an overview of the methodology used in the report: Market Opportunity Analysis. It then briefly explains how data were gathered, which constitute the basis of the report.

Section 8 follows the steps of the Market Opportunity Analysis, providing (i) a definition of the relevant market(s); (ii) an analysis of ImmersiaTV’s Value Network; (iii) a description of potential competitors; and (iv) an analysis of main market trends.

Section 9 concludes and provides recommendations.
2. METHODOLOGY

2.1. Market Opportunity Analysis
Market Opportunity Analysis (MOA) is a step-wise method to assess the market potential of a product or service and to provide scenarios that can lead to market strategies. It consists of four steps: value network analysis, competitive analysis, market segmentation, and scenario development. It is a methodology designed to be a guide in a mostly qualitative research into the market potential(s) of a product or service. It describes the markets or ecosystem(s) in which the product or service can be placed, while providing insight into strategic choices that need to be made.

2.1.1. Value Chain/Value Network
Value networks correspond to the organization of actors in the provision of a product or a service, i.e. how roles, resources and capabilities are distributed among them and the relationships between them. Every value network will consist of the following building blocks:
   a) the business roles,
   b) the business actors that can potentially adopt these roles,
   c) the basic services that are exchanged between the actors

Value networks are described using the following codes:
   • White boxes indicate roles;
   • Light grey boxes indicate an actor that may have one or more role;
   • Arrows indicate a flow of service (e.g. providing a software) or content (e.g. stitched content)

![Figure 1: Illustration of the portrayal of Value networks](image)

This report provides a simple description of ImmersiaTV’s Value Network, used mainly to identify potential competitors, and position ImmersiaTV in comparison to them.

2.1.2. Competitive Analysis
Competitive analysis is inspired by the competitive-forces model by Porter. This consists of following sub-analyses:
   • Current competitors
   • Complements and substitutes. While this analysis is suitable for new entrants in developed markets, immersive experience is still in its infancy: important players have emerged but market positions are far from stable (to start with consumer adoption). Thus, it cannot always be divided rigorously whether other providers are current or future competitors or whether their offers will be complements or substitutes, etc.

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A related question is whether the immersive solutions developed within ImmersiaTV are complementary or substitute to current user practices, and therefore to standard media products. For example, are ImmersiaTV services competing with what broadcasters are currently proposing?

- **Positioning.** This is analysed in particular in terms of the innovative aspects of ImmersiaTV. ImmersiaTV’s objectives are to innovate at various levels (cf. 2):
  - Content (inner form or core). ImmersiaTV aims to come up with innovative formats for e.g. documentaries and live events
  - Consumption & Media. ImmersiaTV aims at changing the user’s experience to AV content, e.g. in relation to the use of 2nd screen The specificity for creative content is that at the level of consumption it may prove difficult to disentangle what relates to product innovation and what relates to process innovation 3.
  - Production & Distribution. ImmersiaTV aims at proposing new ways of producing and distributing immersive AV content
  - Business Models. ImmersiaTV aims a defining the relevant business models associated to the solutions developed in the project

Furthermore, the innovative solutions developed within ImmersiaTV are based on previous innovations, and the combination thereof within an end-to-end solution. Therefore some aspects of it can be innovative, others will be more about imitating the current state-of-the-art while being able to integrate with others functionalities. For example, ImmersiaTv benefits from the arrival of the smartphone, a device that has helped proliferate and optimize vital VR components like sensors, gyroscopes, and small screens 4.

- **Future competitors.**

The report identifies the main types of actors being active in the VR industry, briefly qualifies them, and provides structured, non-exhaustive lists of companies (see 2.2). The competitive analysis follows the stages in the value network, to identify competing products or services at each step (and end-to-end solutions). A mapping is provided for each stage in the value network, with specific angle. Thus:
  - In the capture & processing stage, a distinction is made between the most important and other players.

2.1.3. Market segmentation

The market segmentation gives insights on the adoption potential of the innovation. The purpose of this exercise is to extend the competitive analysis and get certain indications on the possible market size.

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3 Ibid.

The market segmentation is an established method in marketing, although many variations exist. A segment can be calculated or assessed by narrowing down the market to segments that constitute realistic target groups for the purchase/adoptions of a good or service. This can be done as shown in Figure 2.

Due to the lack of consistent data on this rapidly evolving market, the aim of market segmentation is mainly to provide a general overview of market trends for Virtual Reality and to raise important questions concerning how the sector could evolve in the coming years, thus informing the ImmersiaTV consortium partners of potential threats and opportunities. Next iterations may provide a more detailed analysis, but only if relevant data are available.

2.2. Data gathering

This deliverable combines insights provided by consortium partners and literature review.

ImmersiaTV consortium partners have been asked to fill a list of stakeholders that were contacted or should be contacted. Based on their main domains of activities, they have been asked to ensure the main stakeholders had been correctly identified. More generally, they are supposed to provide information about market trends and latest industry developments.

Literature review was mainly performed online. It has relied mainly on:

- Recent reports, e.g.:
  - Wright, W., 2015. A Brief History of VR. WinWin.

Gannett Co., 2015. Bringing you into the news: the state of virtual reality in journalism, October.

- Data and information provided by the following websites/companies, e.g.:
  - Kzero (on kzero.co.uk)
  - Wearable (on wareable.com)
  - CCS Insight (on ccsinsight.com)
  - Digi-Capital (on digi-capital.com)
  - Digital Media Update (on digitalmediaupdate.blogspot.be)
  - Business Innovation Centre
  - Manatt digital media
  - Road to VR (on roadtovr.com)
  - The VR Fund 2016 VR industry landscape
  - Strategy Analytics

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3. IMMERSIATV’S MARKET POSITIONING

3.1. Relevant markets
ImmersiaTV aims at innovating for technologies producing immersive AV content, and this way to propose new forms of AV content. Therefore it touches upon three related fields: Virtual Reality (VR), interactive video and orchestration apps offering content for second screens.

Simulating one’s physical presence as if one were in a remote place has been a challenging issue in the Virtual Reality field. Hence the challenge with VR is to immerse the user in another experience. With the emergence of VR, we have seen a simultaneous surge into the development of augmented reality (AR) experiences. AR experiences focus on providing computer-generated artificial overlays into a user’s real-world environment. Some AR platforms and devices can provide a more immersive experience than others, but the basic premise is that AR experiences do not block out the real environment — contrarily to VR. Therefore, while ImmersiaTV touches slightly upon AR technologies (e.g. for the portals), AR and VR remain different and the report will only evoke AR.

Interactive video refers to all forms of audiovisual content that include some of interaction on behalf of viewers with the content. Therefore it blends interaction with linear video. Interactions include:10
- Annotation (e.g. annotations in YouTube videos);
- Content Browsing (e.g., through keyframes) when there are means for undirected search;
- Collaborative Use when it is possible to perform the interaction together with other users in a synchronized way;
- Direct Content Manipulation when users have the option to interact with individual objects in the video;
- Content Navigation (e.g., fast forward/rewind, random access, etc.).
- Querying and Filtering when video content can be filtered for different features (e.g., color, faces, etc.).
- Content Summarization/Abstraction when the system supports generation of a digested or summarized view of the content.

Second screen denotes the use of handheld devices such as smartphones and tablets in close connection with TV watching. While still a new behaviour among television audiences, they offer promising perspectives, notably in the field of advertising. Second screen applications require synchronisation between the first (TV) and the second screens.

9 Ibid.
12 http://www.bbc.co.uk/rd/projects/companion-screens
13 http://wywy.com/research/second-screen-study/
3.2. Value Network

This section provides a description of ImmersiaTV’s Value Network. Three main Value Chains can be distinguished: Components, Hardware & Software, and Content. Immersive AV content production is first captured. Captured content needs to be stitched and produced. The outcome is distributed before being displayed. Every step of this content chain relies on hardware and software:

- Cameras for capture
- Software to ensure the processing (i.e. stitching) of the captured content
- Software allowing to edit the processed content (e.g. by adding subtitles)
- Content delivery networks to ensure distribution
- Various devices for display and control the experience

Each of these hardware or software rely on components, some of which being specifically designed for producing and displaying immersive AV content. In this report, we will not focus on component producers (e.g. motion sensor, CPU) since ImmersiaTV partners are no component producers.

The focus is on the production and distribution of immersive content, including the hardware and software needed to produce and distribute such content, hence the following figure:

![Figure 3: ImmersiaTV – Value Network](image)

We have identified 6 main categories of stakeholders (sometimes with subcategories), in relation to their situation in the Value Chain and names for each type.

3.3. ImmersiaTV’s Competitors

3.3.1. Capture & Processing

At capture level, (omnidirectional) camera producers are producers of 360 cameras and/or rigs for multiple cameras, aimed at professional or amateur users. At pre-production level, processing software providers propose software solutions that notably allow to stitch audiovisual content that has been captured by omnidirectional cameras. They need to ensure

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14 It can be also softwares, e.g. the Opera TV Browser (source: [http://www.operasoftware.com/products/tv/tv-browser](http://www.operasoftware.com/products/tv/tv-browser))

15 These softwares might also help users to set up a 360 world or to add interactions that will enable different storytellings (e.g. concerning transitions).
encoding of omnidirectional video sequences, which represent time-varying 360° environments.\textsuperscript{16}

Both categories are presented together because of the strong trend towards the integration of both activities. Cameras not only capture but also captured content is directly stitched (and sometimes edited although this seems to remain quite basic). Furthermore, there is an integration towards the role of displaying. Just like with standard cameras, it is possible to visualise what has just been captured. However not all display devices allow to capture, hence display remains a separate role (see after).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{camera_producer_value_network.png}
\caption{Camera producer – Value Network}
\end{figure}

There are three basic types of omnidirectional cameras on the market.\textsuperscript{17}

- There are several relatively inexpensive single-lens 360° camera devices, which are able to produce omnidirectional video for consumer and stream it over wireless network interfaces. The quality of video coming from such compact devices is usually sufficient for mobile applications, but cameras are not able of producing high resolution or high frame rate video for more demanding users and immersive entertainment.\textsuperscript{18}

- Custom rigs for multiple (inexpensive) cameras. They provide high resolution and a good frame rate, in a light-weight, compact, untethered and affordable package, but they lack inter-camera synchronisation and central exposure and white balancing control.\textsuperscript{19} More advanced rigs are usually still custom-build rigs, with high end cinema cameras or based on machine vision cameras, high end to very low cost board level depending on budget, skills and desired image quality.\textsuperscript{20}

- Some companies are working on more advanced, professional omnidirectional camera systems constructed using multiple high-resolution cameras places on specialized rigs. Cameras are perfectly synchronised and sensors are consistently controlled, but often frame rate and/or resolution are not adequate.\textsuperscript{21}

\begin{flushright}
\textsuperscript{16} ImmersiaTV. Immersive Experiences around TV, an integrated toolset for the production and distribution of immersive and interactive content across devices. Part B, technical annex. Project proposal.
\textsuperscript{17} Ibid.
\textsuperscript{18} Ibid.
\textsuperscript{19} Ibid.
\textsuperscript{20} Ibid.
\textsuperscript{21} Ibid.
\end{flushright}
Important players in this sector include:

- **Facebook** is developing the Facebook Surround 360, to be released in summer. It includes a design for camera hardware and the accompanying stitching code.\(^{22}\)
- The **Google Jump Assembler** is an open-source VR platform consisting of three main components: the 16-camera rig, an assembler that takes raw footage and compiles it into stereoscopic VR video, and a player, which will live inside Google-owned YouTube.\(^ {23}\)
- **Kodak** notably provides the Kodak SP360 camera\(^ {24}\). Furthermore, Kodak proposes all kinds of software downloads for free (e.g. PIXPRO 360 Stitch)\(^ {25}\)
- **LG 360 Cam**
- **Nikon** with the Nikon KeyMission 360\(^ {26}\)
- **Nokia** with e.g. Nokia OZO\(^ {27}\)
- **Ricoh** notably provides the Ricoh Theta\(^ {28}\). Its software also allows to edit immersive content
- **Project Beyond** is a 360 stereoscopic camera with live streaming from **Samsung**. The camera was unveiled at the Samsung Developer Conference 2014. The Project Beyond camera is designed specifically for compatibility with the Samsung Gear VR.\(^ {29}\)
- **Video Stitch**, an ImmersiaTV consortium partner (see also Orah,\(^ {30}\) a 360 live camera, launched on April 6, 2016)
- **GoPro** notably provides the GoPro Odyssey. Furthermore, and to illustrate the trend towards integration of capture and processing, in 2015 GoPro acquired **Kolor**, a provider of software products to stitch static pictures and videos.\(^ {31}\) Founded in 2004, Kolor was the first company to perceive the potential of SIFT technology in the identification of interest points in an image, and created Autopano, an image stitching software. Kolor has since provided panoramic imagery solutions, including panorama software, virtual tour software, video-stitching software and a full range of hardware products. Furthermore, a few systems are based on GoPro cameras, e.g. rigs designed to hold and synchronize a few GoPro cameras. This includes
  - Developed by **VFX Studio Hive Division** and **InVRsion**, PanoptikonVR is a 360° stereoscopic camera system designed to shoot immersive, live action video content to be experienced with the new generation of virtual reality devices.\(^ {32}\)
  - The **Freedom360** mount.\(^ {33}\) They also own the Koncept VR virtual reality production agency.
  - **360Heros**\(^ {34}\)

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\(^ {22}\) https://code.facebook.com/posts/1755691291326688/introducing-facebook-surround-360-an-open-high-quality-3d-360-video-capture-system
\(^ {23}\) https://www.google.com/get/cardboard/jump/
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\(^ {30}\) http://www.engadget.com/2016/04/06/orah-live-360/
\(^ {31}\) http://www.kolor.com/about-us/
\(^ {32}\) http://www.panoptikonvr.com/en/
\(^ {33}\) http://freedom360.us/
Other players include:
- **360 Designs Mini Eye**[^35]
- **360Fly**[^36]
- **Argon360** is an IP core for chip or FPGA offering video stitching in real time, enabling live streaming and live preview of 360° panoramic videos.[^37]
- **Bublcam**[^38]
- **CENTR Camera**[^39]
- Based in Lille (France) and San Francisco (USA), **Giroptic**[^40] specializes in 360° imaging technology. Powered by the GIROPTIC 360 Virtual Sensor Technology, the Giroptic 360cam is the first and only 360 camera able to record full spherical photos and videos as a .jpg or .mp4 file, without any software or post-processing.[^41]
- The Vuze virtual reality camera was created by **HumanEyes Technologies**. It is a Consumer 3D 360 Video camera.[^42]
- The new Allie camera from **IC Real Tech** can turn two 360-degree camera feeds into an “all-D” image that lets users look in any direction they want.[^43]
- **Insta360 4k**[^44]
- **Kogeto** Joey 360, a versatile 4K full motion 360° desktop video camera providing capture, live webcast, and two-way panoramic teleconferencing.[^45] They also make the Dot, a $49 iPhone attachment for 360 video.
- **LucidCam** is a stereoscopic 3D camera with 180° wide-angle lenses and spacial audio.[^46]
- **Matterport** Pro 3D
- **Moovr** produces rigs using Samyang and Canon cameras for professional 360 video shoots.[^47]
- **MULTICAM**[^48]
- **Narvaro**, A 3D camera on a robotic rig that moves based on input from the HMD[^49]
- **Panono Ball Camera**[^50]
- **Panocam 3D**[^51]
- **Camargus by Qamira**[^52]

[^34]: http://www.360heros.com/
[^35]: https://360designs.io/product/mini-eye/
[^36]: http://www.360fly.com/
[^37]: http://www.argondesign.com/products/argon360/
[^38]: http://www.bublcam.com/
[^39]: http://www.centrcam.com/
[^40]: http://www.giroptic.com/
[^41]: http://eu.360.tv/en/
[^42]: http://vuze.camera/
[^43]: http://techcrunch.com/2015/01/04/allie/
[^44]: http://www.insta360.com/
[^45]: http://kogeto.com/
[^46]: http://lucidcam.com/
[^47]: http://moovr.com/
[^48]: http://cinfo.es/our-products/synthetrick/multicam
[^49]: http://www.narvaro3d.com/
[^50]: http://jonaspfeil.de/ballcamera
[^51]: http://www.panocam3d.com/camera.html
[^52]: http://qamira.com/
- **Radiant Images** provides custom professional rigs. Customized 2D and 3D solutions are specific and appropriate to each client and cover the whole workflow from pre- to post-production.\(^{53}\)
- **Sphericam**
- **Triggar VR**
- **VSN Mobil V.360**\(^{54}\)

ImmersiaTV will not focus on building its own rigs, or stitching algorithms, but rather on developing a video capture, replay and processing distributed architecture that is ground up designed for omni-directional video.\(^{55}\) Therefore, the players active in providing hardware and software for capture and/or processing should not be considered as competitors. Their products are complementary to what ImmersiaTV is developing.

However several companies listed here are also developing hardware of software in other steps of the Value Network, which makes them more likely competitors for ImmersiaTV (see also section 3.3.6. on end-to-end platforms).

Finally, the mapping shows that several important players are present in this stage including players that are strong in other stages (e.g. HMD for Samsung or Facebook) or traditional players in the camera sector (e.g. Nikon, Kodak).

A next iteration of the report may analyse targets for the omnidirectional cameras mentioned here, to assess whether they are mainly targeted at professional or amateur users. A related question is the revenue model for omnidirectional cameras: are they sold? Or rented?

### 3.3.2. Production

At production level are editing software providers for omnidirectional video.

![Diagram of Value Network](image)

The creative editing of omnidirectional video is still a quite challenging undertaking. Off the shelf software to edit offline video, such as Adobe Premiere, or Final Cut X, offer limited support for these although plug-ins exist (e.g. Mettle Skybox, see after). It is possible to edit omnidirectional video through post-production software suites but this process remains very

---

\(^{53}\) [http://www.radiantimages.com/](http://www.radiantimages.com/)

\(^{54}\) [http://www.vsnmobil.com/cameras/v360](http://www.vsnmobil.com/cameras/v360)

\(^{55}\) ImmersiaTV. Immersive Experiences around TV, an integrated toolset for the production and distribution of immersive and interactive content across devices. Part B, technical annex. Project proposal.
time-consuming, and unpractical to use. Producers of editing software for omnidirectional video include:

- Adobe has announced, during the NAB Show in April 2016, full support for VR video workflows for its two software applications Premiere Pro and After Effects. This would include a new VR Video mode to preview and control pan and tilt in the non-linear editing system, and new metadata flags to ensure support on VR-capable sites like YouTube and Facebook (see 3.3.4)

- Mettle SkyBox products for 360/VR are plug-ins for Adobe softwares, which include: SkyBox 360 Post FX for After Effects: described by Mettle as the most complete set of tools available for 360/VR Production in After Effects. Mettle 360/VR Plugin for Premiere Pro: the toolset allows users to add text, logos, and layer 2D footage on 360 footage. Editors can also correct the horizon line, denoise, blur, and sharpen footage. Mettle’s Skybox 360/VR Transitions for Adobe Premiere Pro is the latest addition for Premiere Pro provides 360 gradient wipe, 360 random blocks, 360 iris wipe and 360 mobius. Many of the 360 Transitions will have X,Y start points to help storytellers direct the viewer’s gaze.

- Dashwood provides the 360VR Toolbox (Public Beta), enabling real-time 360 degree VR headset monitoring (support for Oculus DK2, other headsets planned) while editing, and a full-featured plugin suite for Adobe Premiere Pro, After Effects and Final Cut Pro.

- Foundry NUKE offers toolkits covering VFX, editorial and finishing.

- Im360 Entertainment

- Pixvana

- Point Grey Research Inc

- Video Stitch, an ImmersiaTV consortium partner

- Worldviz provides the Vizard VR Toolkit, a platform designed specifically for authoring VR/AR experiences. It is aimed at professional users.

It is crucial for ImmersiaTV to follow the latest developments regarding edition of omnidirectional AV content, and in particular to propose something different from what competitors are currently developing, notably Mettle. This in a context of a particularly innovative market.

In a next iteration of this report, we may check target users for production tools (e.g. professionals vs amateurs), or sound production tools.

56 ImmersiaTV. Immersive Experiences around TV, an integrated toolset for the production and distribution of immersive and interactive content across devices. Part B, technical annex. Project proposal.


58 http://www.mettle.com/product/skybox-studio/

59 Plug-in functionalities: plugins for 360° XYZ-axis re-orientation, projection of 2D logos or video on 360VR, pan and scan output of “flat” video from 360VR sources, output of stereographic “little planet” or cubic “skyboxes” from 360VR sources, and spherical 360 blur, sharpen, glow and noise reduction filters. Source: www.dashwood3D.com

60 https://www.thefoundry.co.uk/products/nuke/

61 https://www.im360.com/

62 http://www.pixvana.com/

63 https://www.ptgrey.com/

64 http://www.worldviz.com/products/vizard
3.3.3. Content production

At the level of content production are producers of immersive audiovisual content, i.e. compatible with immersive displays.

Companies active in immersive technologies are looking to provide immersive content as they know digital entertainment will certainly drive the market further. This content may span traditional film, music applications, or live sporting events. One core objective of ImmersiaTV is to demonstrate a novel kind of audiovisual content format, compatible with immersive displays, coherent across devices, and ready for broadcast distribution. Immersive content producers are therefore on the one hand competitors (since they provide content that can directly compete with content produced by ImmersiaTV consortium partners) and on the other hand supporting ImmersiaTV's objectives in contributing to the overall development of the market for immersive experiences. This also seems to be the type of industry stakeholders with most players active (similar to other media markets). All the more so that traditional media players (notably film studios) have started developing immersive AV content.

There are different types of content. Some may be more interesting for ImmersiaTV to know about. Hence the description is more detailed for, on the one hand, VR Film Studios and, on the other hand, documentaries and informative immersive content. The focus here is on on-demand content. Live events, which suppose integration of all activities from capture to production or even distribution, are analysed in the section on end-to-end platforms (see 3.3.6).

3.3.3.1. VR Film Studios (360 video)

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>AlchemyVR</td>
<td>UK</td>
<td>Born out of a collaboration between Atlantic Productions and Zoo VFX</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Has partnerships with museums</td>
</tr>
<tr>
<td>Exozet</td>
<td>Germany &amp; Austria</td>
<td>Communication agency</td>
</tr>
<tr>
<td>Fisheye</td>
<td>Belgium</td>
<td></td>
</tr>
</tbody>
</table>

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66 We roughly follow the VR Industry 2016’s typology, see https://trello.com/b/srhdQF14/virtual-reality-industry-2016
67 http://www.alchemyvr.com
68 http://global.exozet.com/
<table>
<thead>
<tr>
<th>Company</th>
<th>Country</th>
<th>Industry/Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Happy Finish</td>
<td>UK, USA, China &amp; India</td>
<td>Communication agency</td>
</tr>
<tr>
<td>Lightbox</td>
<td>Portugal</td>
<td>ImmersiTV consortium partner</td>
</tr>
<tr>
<td>Scopic</td>
<td>Netherlands</td>
<td></td>
</tr>
<tr>
<td>Vehicle VR</td>
<td>USA &amp; UK</td>
<td>Uprising Creative’s VR content studio.</td>
</tr>
<tr>
<td>Visualise</td>
<td>UK, USA &amp; UAE</td>
<td>Communication agency</td>
</tr>
<tr>
<td>WeMakeVR</td>
<td>Netherlands</td>
<td>They are also specialised in journalism</td>
</tr>
<tr>
<td>Yondr</td>
<td>Belgium &amp; USA</td>
<td>Media agency</td>
</tr>
<tr>
<td>Zakato</td>
<td>Spain</td>
<td>They also propose immersive advertising</td>
</tr>
<tr>
<td><strong>Non-European</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 Ninjas</td>
<td>USA</td>
<td>Founder is film director Doug Liman</td>
</tr>
<tr>
<td>Bipolar Id</td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>Cryworks</td>
<td>USA</td>
<td>Strong links with the film industry</td>
</tr>
<tr>
<td>Dimension Gate</td>
<td>Canada</td>
<td></td>
</tr>
<tr>
<td>Experius</td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>Felix &amp; Paul</td>
<td>Canada</td>
<td></td>
</tr>
<tr>
<td>Framestore VR</td>
<td>Division of Framestore, a major visual effect studio</td>
<td></td>
</tr>
<tr>
<td>Studio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Google Spotlight</td>
<td>USA</td>
<td>Linked to Google</td>
</tr>
<tr>
<td>Stories</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GoPro</td>
<td></td>
<td>Linked to GoPro (see section 3.3.1)</td>
</tr>
<tr>
<td>Headcase VR</td>
<td>USA</td>
<td>Strong links with the film industry</td>
</tr>
<tr>
<td>Honey VR</td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>Jaunt Studios</td>
<td>USA</td>
<td>Linked to Jaunt (see section 3.3.6)</td>
</tr>
<tr>
<td>Matter VR</td>
<td>USA</td>
<td>Media professionals (beyond VR)</td>
</tr>
</tbody>
</table>

69 http://www.fisheye.eu  
70 http://www.happyfinish.com/en/  
71 http://www.scopic.nl/  
72 http://vehicle-vr.com/  
73 http://visualise.com/  
74 http://wemakevr.com/company/wemakevr/. They have been creating Virtual Reality experiences since 2013. They aim at exploring new ways of storytelling, developing best practices, new technologies and workflows. They produce reasonably big productions, with custom cameras and software.  
75 http://web.zakato.com/?page_id=12. They are specialised in the capture of immersive 360° images (photo and video), and in their interactive visualisation in all kind of devices: desktop, mobile, tablets, HMD, fulldome cinemas. One of their projects is #3in360, an experimental project on immersive journalism in which by means of short and simple 360° video capsules they are trying to develop new concepts to document reality  
76 http://www.30ninjas.com/  
77 http://bipolarid.com/  
78 http://cryworks.com/  
79 http://www.dimensiongate.com/  
80 http://experius.com/?mc_cid=c2a29104d9&mc_eid=6fb3b6b9b6  
81 http://www.felixandpaul.com/  
82 http://framestorevr.com/about/  
83 http://www.headcasevr.com/  
85 http://www.honeyvr.com/about/  
86 http://www.jauntvr.com/jaunt-studios/
### 3.3.3.2. Documentaries and informative immersive content

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>European</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BBC News</td>
<td>UK</td>
<td>Related to traditional media</td>
</tr>
<tr>
<td>Digivision</td>
<td>Spain</td>
<td>They produce documentaries with VR effects. They did the Tarraco series for RTVE.</td>
</tr>
<tr>
<td>Immersive Journalism Lab</td>
<td>Spain</td>
<td></td>
</tr>
<tr>
<td>VRT</td>
<td>Belgium</td>
<td>ImmersiaTV consortium partner</td>
</tr>
<tr>
<td><strong>Non-European</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABC News VR</td>
<td>USA</td>
<td>Related to traditional media</td>
</tr>
<tr>
<td>Emblematic Group</td>
<td>USA</td>
<td>Their activities include journalism pieces (e.g. Project Syria)</td>
</tr>
<tr>
<td>Gannet</td>
<td>USA</td>
<td>Belongs to USA Today</td>
</tr>
<tr>
<td>National Geographic</td>
<td>USA</td>
<td>They announced in May 2016 that they will be launching NG VR Studio, which will offer a mix of original and franchise experiences</td>
</tr>
<tr>
<td>The New York Times</td>
<td>USA</td>
<td>They shipped 2M cardboard in 2015 and constantly release new VR journalism pieces</td>
</tr>
</tbody>
</table>

---

86 http://mattervr.com/web/
87 http://mirada.com
88 https://newdealstudios.com/
89 www.panogramma.com
90 http://thesecretlocation.com
91 http://www.thevrcompany.com/
92 http://www.unit9.com/
93 http://www.vrplayhouse.com/
94 http://vrse.com/ & http://with.in/
95 http://www.e-digivision.net/
96 http://www.immersivejournalism.es/
97 http://abcnews.go.com/Video/fullpage/abc-news-vr-inside-syria-33768357
98 http://www.emblematicgroup.com/#/project-syria/
99 http://realscreen.com/2016/05/09/nat-geo-to-launch-virtual-reality-studio/#ixzz48DmiM00u

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D5.1 Market analysis report 23 Version 0.7, 29/06/2016
3.3.3.3. Immersive animation

- **apelab**, from Switzerland
- **Artanim interactive**, from Switzerland
- **Baobab Studios**
- **IG Port**
- **Illusion Ray Studio**
- **Innerspace VR**
- **Kite & Lightning**
- **Oculus Story Studio** (see section 8.4.3)
- **Penrose**
- **Reel FX**
- **Skullmapping** is a boutique animation (VR-CGI based content) studio based in Belgium. They create projection mapping projects, VR experiences and holograms. One example is *The Styx*, an immersive multi sensory virtual reality experience, that can be adapted to any location or venue. It relies on the use of an Oculus Rift, headphones (3D sound), but also other sensoric experiences such as smell and touch.
- **Survios**
- **Weta Workshop**
- **WeVR**
- **Xiola** Producers of animated content with good character animations skills.

3.3.3.4. Audio creatives

Finally, among immersive content producers are **audio creatives**, i.e. creators focused on 3D audio creation. These include:
- **Abbey Road studios**, who have an interest in R&D, in particular on immersive environments
- **Queen Mary University of London**, in particular its sound department
- **two big ears**. They have developed 3Dception, an in-house spatial audio production software for developing fast, efficient and scalable virtual and augmented reality experiences. They have been acquired in May 2016 by Facebook.114
3.3.3.5. Findings

Considering the density of information available on immersive AV content producers, this intermediate conclusion summarises the findings of this mapping. Four types of content have been emphasized: VR films, documentaries and immersive informative content, immersive animation and audio. In particular the 2 first categories have been mapped since they are closer to the type of content ImmersiaTV aims at developing (by directly producing content and by providing tools thereto). All following statements concern these 2 first categories.

Most content producers are based in the USA, or have an office there. We have however identified a number of European content producers.

All content producers rely on Business-to-Business activity. This means they do not have revenues directly from consumers but get their works commissioned, e.g. by brands (notably for communication agencies), or media (notably for producers of immersive informative content). This is likely to change when a sufficient amount of consumers get access to HMD.

Immersive content producers are usually linked to bigger entities, e.g. Oculus Story Studio to Facebook or Google Spotlight Stories to Google. In particular producers of documentaries and informative immersive content are related to traditional or online media.

3.3.4. Distribution

**Distributors** are providers of solutions allowing to deliver and receive immersive audiovisual content. Although stakeholders can provide both services, this section focuses on their ability to deliver content to end-users.¹¹⁵ More precisely it focuses on providers of platforms giving access to immersive content for Internet users.

![Figure 7: Distributor – Value Network](image)

Some platforms are **app stores**, they include:

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¹¹¹ https://twobigears.com/

¹¹² http://techcrunch.com/2016/05/23/facebook-just-bought-vr-audio-company-two-big-ears-and-is-making-their-tech-free-to-developers/

¹¹³ Hence this section does not describe Content Delivery Network (CDN) providers (e.g. Microsoft Azure CDN, Amazon CloudFront, Google Cloud CDN) Although CDNs are crucial to ensure the delivery of very large files, like VR files CDN providers are not specialised in VR or interactive video. Furthermore, business models are quite different, with CDN providers relying on B2B activities while platforms address end-users.
- Next Galaxy Corp is developing CEEK – a fully immersive social content hub and distribution platform for accessing virtual reality experiences, 3D and 360 videos with the Oculus Rift and other VR Displays. They are also creating headphones and a controller for VR\footnote{http://www.nextgalaxycorp.com/}
- Facebook’s Oculus Home\footnote{https://share.oculus.com/}
- Valve with SteamVR\footnote{http://store.steampowered.com/universe/vr}
- WEARVR\footnote{https://www.wearvr.com/}

Some platforms give access to video, they include:
- Bitmovin\footnote{https://bitmovin.com/tutorials/vr-360-video-encoding-playout/}
- Deepoon’s dedicated mobile app 3DBoBo
- EEVO\footnote{https://eevo.com/}
- Google’s YouTube supports uploading and playback of 360 degree spherical videos on desktop Chrome. One can also watch 360 degree videos on YouTube apps for Android and iOS.
- GoPro VR
- Jaunt
- Littlestar\footnote{http://littlstar.com/}
- NextVR
- Samsung Milk VR\footnote{http://www.sphereplay.com/}
- Sony Pictures Television’s Crackle
- SpherePlay\footnote{http://www.sphereplay.com/}
- VRideo\footnote{https://www.vrideo.com/}
- VRSE\footnote{http://vrse.com}
- WEVR Transport

It is only now that the confluence of affordable hardware for immersive display, improvements in IP-based video distribution and in omnidirectional video capture enable the live delivery of video-based omnidirectional content. **ImmersiaTV benefits from the latest developments in the field of distribution.**

A question relates to how ImmersiaTV should approach both types of platforms. **Their evolutions should be scrutinized to check whether tools and content developed within the project could be made available, and how.** In the longer term, an issue is how to use these platforms to generate revenues from ImmersiaTV’s contents and products.
3.3.5. Display

Display devices providers are providers of hardware (and related software) allowing to experience (watch, interact, etc.) immersive audiovisual content. They can be integrated, or working with other devices.

Devices allowing to display immersive content constitute the part of the industry most well-known from consumers. They include the most important and most powerful companies in this whole industry (Microsoft, Google, Facebook, etc.), which have invested heavily in these technologies. As main points of entry to consumers, they are also expected to pull the whole market for immersive experiences. In other words, their success is key to have the whole market for immersive experiences succeed. A key question is therefore: what is the impact of not having them in the consortium?

The VR Hardware Radar plots companies developing a range of different hardware peripherals and equipment into one of the following categories: HMD – Integrated, HMD – With Mobile Device, Controller – Hand Device / Glove / Body Unit, Controller – Treadmill / Foot Control, Controller – Haptics, 3D Camera, End-to-End Platform. For the purpose of this deliverable, the Controllers categories were grouped; 3D Cameras were analysed in a previous subsection, while end-to-end platforms are analysed in the next subsection.

3.3.5.1. Head-Mounted Displays – Integrated

HMD – Integrated are displays with the screen integrated into the unit. Therefore they do not require the connection of a mobile device as the screen. However they may require the connection to hardware, e.g. Sony PSVR requires connection to a PlayStation 4. They include

- AntVR
- Avegant Glyph
- DotLab DoVision
- Facebook Oculus (aka Oculus Rift) (desktop/console). Emerging out of an initial $250,000 Kickstarter campaign in 2012 that ended up raising nearly 10 times that target, Oculus has developed a fully immersive tethered VR HMD that will likely be the most heavily used and most capable headset in the consumer market, the Oculus Rift. The company was acquired by Facebook in a $2 billion deal in 2014. Oculus has also invested to build out a complete VR platform spanning control inputs (acquisition in

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128 http://www.kzero.co.uk/blog/q2-2015-update-of-the-vr-hardware-radar/
129 http://www.kzero.co.uk/blog/q2-2015-update-of-the-vr-hardware-radar/
130 http://www.antvr.com/
131 https://www.avegant.com/
2014 of the makers of the Xbox controller), content creation (Oculus Story Studio in 2015) and partnerships, along with its own proprietary headset. On the partnerships front, Samsung’s Gear VR, a mobile and untethered HMD, is powered by Oculus. Oculus has also maintained a relatively open platform from the beginning and sold over 175,000 software developer kits.

- **Fove**
- HTC-Valve’s Vive (desktop/console). The Vive is an HMD developed in conjunction with game developer Valve and consumer electronics manufacturer HTC. The device is powered by Valve’s SteamVR, a full-featured, 360-degree, room-scale VR experience. The collaboration links the hardware expertise of HTC with the content creation expertise of Valve. The two are also already working with a wide range of partners such as HBO, Lionsgate and Google to develop Vive-specific experiences. With over 125 million active accounts on the company’s traditional Steam entertainment and gaming platform, SteamVR will look to leverage a pipeline direct to its customers to allow them to enjoy VR applications on the Vive.

- **Immersion Neo VR**
- **MindMaze**
- Razer OSVR powered by Sensics
- **Sony** PlayStation VR (console), aka Project Morpheus. It is expected to be launched in October 2016. The HMD is designed to be fully functional with the PlayStation 4 video game console.
- **Starbreeze** StarVR
- **Survios** (console)
- **Virtual Reality (VR) Technology Limited** has introduced in June 2015 the first mass-produced 2K Virtual Reality headset: 3Glasses D2.
- **VR Union Claire**
- **VRvana Totem**
- **Vuzix** iWear

Recent figures show that **Facebook’s Oculus Rift, HTC-Valve’s Vive and Sony PlayStation VR are currently the most important integrated HMD in the global market**. They are expected to represent 77% of global virtual reality headset revenues (see section 3.4.3 for more details about market trends).

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133 http://www.fove-inc.com/
136 http://www.mindmaze.ch/
137 http://www.razerzone.com/osvr
138 http://www.wearable.com/project-morpheus/sony-project-morpheus-release-date-price-games
139 http://fortune.com/2016/04/15/gamestop-playstation-vr-demos-key-to-sony-marketing/
140 http://www.starvr.com/
141 http://survios.com/
142 http://the3glasses.com/
143 http://www.vrvana.com/
3.3.5.2. Head-Mounted Displays – with mobile device

HMD – with mobile device are displays that use a third-party mobile device as the screen\(^ {145}\) (e.g. a mobile phone placed inserted in the HMD, thus in front of the eyes of the user). They include:

- AlterGaze\(^ {146}\)
- Archos\(^ {147}\)
- AuraVisor\(^ {148}\)
- Baofeng
- Cordon Pinc VR\(^ {149}\)
- DéePoon Virglass\(^ {150}\)
- DODOcase DIYVR\(^ {151}\)
- Durovis Dive\(^ {152}\)
- Fibrum\(^ {153}\)
- FiresVR JiDome-1\(^ {154}\)
- GameFace\(^ {155}\)
- Google Cardboard\(^ {156}\)
- Homido\(^ {157}\)
- Immersion VRRelia\(^ {158}\)
- Ion VR
- LeTV LeVR Cool 1\(^ {159}\)
- LG Vortex VRTX One\(^ {160}\) and LG 360 VR\(^ {161}\)
- Mattel View-Master (powered by Google)\(^ {162}\)
- MergeVR\(^ {163}\)
- Metatecture AirVR\(^ {164}\)
- Pico VR\(^ {165}\)
- Quantum Bakery Figment VR\(^ {166}\)

\(^{145}\) http://www.kzero.co.uk/blog/q2-2015-update-of-the-vr-hardware-radar/

\(^{146}\) http://www.altergaze.com/


\(^{148}\) http://www.aurvisor.com/

\(^{149}\) http://hellopinc.com/

\(^{150}\) http://www.virglass.com/

\(^{151}\) http://www.dodocase.com/

\(^{152}\) http://www.durovis.com/index.html

\(^{153}\) http://www.fibrum.com/

\(^{154}\) http://www.firesvr.com/

\(^{155}\) http://gamefacelabs.com/

\(^{156}\) https://cardboard.withgoogle.com/

\(^{157}\) http://homido.com/

\(^{158}\) http://immersionvrelia.com/

\(^{159}\) http://technode.com/2015/12/27/letv-edges-into-virtual-reality-with-levr/

\(^{160}\) http://VRTX.io/


\(^{162}\) http://www.view-master.com/en-us

\(^{163}\) http://www.mergevr.com/

\(^{164}\) http://getairvr.com/

\(^{165}\) http://www.picovr.com/

\(^{166}\) http://figmentvr.com/
- Samsung Gear VR is a HMD based on Samsung’s smartphones. It relies on a partnership between Samsung Mobile & Oculus. It has provided the first VR appstore 167. Samsung 360 Camera.168
- Seebright169
- Stooksy170
- Sulon Cortex171
- Tencent172
- Visus VR173
- vrAse174
- Vrizzmo
- Wearality Sky
- Yay3D VR Viewer175
- Zeiss VR One176

Samsung Gear VR seems to be the most important market player in this segment. In April 2016, more than one million people used it, according to Oculus.177

3.3.5.3. Controllers

Controllers are input devices using hands and/or leg and/or foot and/or body movements. Tracking is done using sensors. They can also provide tactile feedback by force or vibration.178 They enable users to input control, in order to navigate within the immersive experience – although it can partly be done by moving the head in the case of HMD. They are complementary to HMD. Such devices include hand devices, Gloves, body units, treadmills, foot control, haptics, etc. Companies/brands include:
- Control VR
- Cyberith Virtualizer
- iMotion
- InfinAdeck
- KOR-FX Gaming Vest
- Leap Motion
- PrioVR
- Reactive Grip
- STEM
- Stompz

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169 http://seebright.com/
170 http://www.stooksy.com/VR-Spektiv/
171 http://sulontechnologies.com/
172 http://vr.tencent.com/
173 https://www.visusvr.com/
174 http://www.vrase.com/
175 http://yay3d.com/
176 http://zeissvrone.tumblr.com/
178 http://www.kzero.co.uk/blog/q2-2015-update-of-the-vr-hardware-radar/
Virtuix Omni provides a VR interface and treadmill (and dedicated shoes) that allows users to move freely and naturally while in a virtual environment. Other products include IMU-based tracking devices named Omni PODs that attach to the Omni Shoes and aim to track the movement of each foot without noticeable latency.\(^{179}\)

### 3.3.5.4. Second screen software solutions

ImmersiaTV’s solutions will to some extent rely on second screens, with the related challenge of ensuring multi-device synchronisation. Such providers include:

- **Ares Interactive Media**
- **Companion Screens by BBC R&D\(^{180}\)** This research explored the technologies that could be used to control and synchronise a TV programme across a number of devices, and experimented with the kind of programme formats that might work across more than one screen. They have developed a new protocol, Universal Control, which provides a standard for devices on the home network, such as a mobile phone or tablet, to access and control network-connected set-top boxes.
- **Dish Network’s Dish Anywhere Mobile App**
- **Disney Second Screen**
- **Mufin\(^{181}\)** provides software solutions (audioid) for second screen applications, which enable to connect and synchronise the second screen such as a smartphone, tablet or laptop with the TV, VoD and movie. This notably allows to create new ways of storytelling by considering new formats, multiple screens or interfaces from the beginning and to measure viewers interests and participation.
- **SmallTownHeroes**, a spin-off of VRT-medialab

There also several apps that allow social consumption of TV content, such as GetGlue, SocialGuide, Miso or Tunerfish.\(^{182}\)

There are no display device providers within ImmersiaTV. This is not an issue since the innovations (products and content) developed within ImmersiaTV should be **watchable on any device**. The objective is to avoid lock-in. However next iterations should consider the potential additional costs related to compatibility.

### 3.3.6. End-to-end platforms

End-to-end platforms are providers of immersive experiences and/or of solutions allowing to produce, distribute and sometimes display immersive audiovisual content.\(^{183}\) This includes platforms giving access to live events since this implies an integration of activities from capture to production or distribution.

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\(^{180}\) [http://www.bbc.co.uk/rd/projects/companion-screens](http://www.bbc.co.uk/rd/projects/companion-screens)

\(^{181}\) [https://www.mufin.com/usecase/second-screen/](https://www.mufin.com/usecase/second-screen/)


\(^{183}\) This definition is slightly more restrictive than the VR hardware radar’s, i.e. a company that provides HMD systems coupled with input devices and motion capture. This category brings together companies that are creating VR experiences encompassing HMDs, input devices, games and other elements. Survios and VRCade are two examples. ([http://www.kzero.co.uk/blog/q2-2015-update-of-the-vr-hardware-radar/](http://www.kzero.co.uk/blog/q2-2015-update-of-the-vr-hardware-radar/)).
Platforms proposing live production include:

- **EVS**\(^{184}\) claim to be the technology leader for video production.\(^{185}\) They cover various steps: live production, broadcast centers\(^{186}\), multicam studio production, multimedia distribution\(^{187}\).

- Focused on cinematic virtual reality, **Jaunt** has created an end-to-end solution for creating and distributing premium live-action VR. They aim at delivering content to the wide array of mobile devices and VR hardware in the industry. Jaunt recently announced the launch of a series of professional-grade camera systems specifically designed for capturing fully immersive, 360-degree cinematic VR experiences codenamed “NEO.” The company looks to supplement this hardware with its own content arm, Jaunt Studios, which seeks to develop professional-grade VR content.\(^{188}\) They also produce content

- **LiveLike**\(^{189}\) is a VR platform that enables broadcasters and sports teams to deliver immersive, live sports viewing experiences. This US company with European offices in France insists on (i) being the first to offer an experience with strong connection through social networks; (ii) the easiness for broadcasters to adopt LiveLike’s technology.

- **LiveSphere** provides a turnkey solution that allows broadcasters to create and deliver a high-quality live 360° television experience for their viewers. It includes 360° Video Capture (up to 500 Megapixels per second, using multiple cameras with overlapping fields), 360° Video Stitching, Encoding & Streaming, and Decoding & Displaying (real-time decoding and dynamic display - one field of view on the end-user's second screen)\(^{190}\).

- **NextVR** aims to enable the transmission of live, long-form virtual reality content in broadcast quality, seeking to transform live and on-demand VR into a mainstream experience for sporting events, concerts, cinematic productions and more. NextVR’s platform allows for immersive content to be streamed using current home and mobile internet connections. They also seeking to offer content via all major consumer HMDs, including the Oculus Rift, Samsung Gear and HTC-Valve’s Vive.\(^{191}\) They also provide 3D cameras.

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\(^{184}\) [https://evs.com/en](https://evs.com/en)

\(^{185}\) [https://evs.com/en](https://evs.com/en)


\(^{189}\) [http://www.livelikevr.com/](http://www.livelikevr.com/)


- Specular Theory is a technology company and full service production facility for virtual reality content. They have developed proprietary content creation tools for recording, uploading and sharing live-action VR content.\(^{192}\)
- Reality Lab\(^{193}\)
- VantageTV\(^{194}\)
- Voke VR\(^{195}\) Their fields include sport and entertainment (e.g. live concerts).

Other platforms include:
- Condition One\(^{196}\) provides cameras with proprietary stitching software, video player and mobile apps for Samsung Gear VR and Google Cardboard. It also develops content, e.g. in partnership with The New York Times or the Utah Office of Tourism.
- Immersive Media introduced the first 360° full digital camera system in 2004, were the driving technology behind Google street view (cameras and drivers), and developed the world’s first viewer for 360° content that worked over the web.\(^{197}\) They have recently created a wireless 4G 360° camera system, and propose integration with innovative products like the Samsung GearVR and Oculus Rift. Their products allow to capture, production, distribution and playback. They provide a 360° video platform to create immersive content, which can be deliver to various displays.\(^{198}\) They have been acquired by Digital Domain.
- Total Cinema 360\(^{199}\) is a full-service production studio and software development company (including content distribution software) specializing in virtual reality and spherical 360 audio-video content.
- VRCade\(^{200}\)
- Vrtify\(^{201}\) defines itself as the first VR music platform.

The end-to-end platforms that are active in the live production and distribution of live events appear as ImmersiaTV's most direct competitors, especially if one considers that the most important innovation for the project derives from the integration of its various components. There is a need to follow up how the identified platforms evolve (activities, market presence, targets, etc.) and map other similar market players.

\(^{192}\) http://www.speculartheory.com/
\(^{194}\) https://vantage.tv/
\(^{195}\) http://vokevr.com/
\(^{196}\) http://www.conditionone.com/
\(^{197}\) http://immersivemedia.com/?page_id=71
\(^{198}\) http://immersivemedia.com/?page_id=60
\(^{199}\) http://totalcinema360.com/
\(^{200}\) http://vrcade.com/
\(^{201}\) http://www.vrtify.com/
3.4. Immersive AV: state of the market / Market segmentation

3.4.1. VR: a fast-growing market
VR and AR have the potential to become the next big computing platform, as we saw with the PC and smartphone.\(^\text{202}\)

This is visible in investments made. $3.5bn is the value of the 225 VR/AR VC investments made in 2014-2015 – although this includes Facebook paying $2bn to acquire Oculus in May 2014.\(^\text{203}\) Several technology giants are making huge investments.\(^\text{204}\) Other firms pursuing projects in the area include Google, Sony, HTC, Samsung (see section 8.3.6).

Goldman Sachs estimates a market in 2025 of $35bn for software and $45bn for hardware, including:
- $11.6bn for video games, 216mn users
- $4.1bn for, with 95mn users.
- $3.2bn for video entertainment, 79mn users.

Digi-Capital predicts AR/VR revenues to reach $120bn by 2020, respectively 90 for AR and 30 for VR.\(^\text{205}\)

In Units, CCS Insight expects 24 million VR and AR devices to be sold in 2018 (vs. 2.5 mln in 2015).\(^\text{206}\) The analysts estimate that more than 12 million virtual reality headsets will be sold in 2017, with sales of augmented reality smart glasses expected to be worth $1.2 billion in the same year. CCS Insight forecasts shipments of AR and VR headsets forecast to grow to 96 million units by 2020, at a value of $14.5 billion.\(^\text{207}\)

Virtual reality has the most potential with consumers in the near term.\(^\text{208}\) Beyond sales of HMD (see section 3.4.3), many significant VR-focused companies are widely known.\(^\text{209}\) However it is expected that the ultimate market potential for AR will dwarf the VR market, because AR’s semi-immersive (rather than fully-immersive) nature means that AR applications are much broader in scope.\(^\text{210}\) Several advances in technology over the past five years have made the

\(^\text{203}\) Ibid.
\(^\text{209}\) http://digitalmediaupdate.blogspot.be/2015/10/vr-in-2016-several-million-headsets.html
\(^\text{210}\) http://digitalmediaupdate.blogspot.be/2015/10/vr-in-2016-several-million-headsets.html
prospect of widespread adoption of virtual reality seem more possible, if not inevitable, than ever before 211:
- The development of low-cost high-quality mobile components, thanks to the pervasive adoption of smartphones
- An extremely low-latency technology in order to create an experience free of motion sickness

3.4.2. The place for AV content in VR experience
Video entertainment is far from being the only field in which VR (and AR) technologies will be applied. For Goldman and Sachs 212, live events and video entertainment are only 2 of the 9 use cases envisioned.

Currently **gaming is considered the leading application of VR**.213 At the center stage 214, it is the low-hanging fruit for virtual reality devices.215

However **video and user-generated content will also drive adoption of this technology**.216 Immersive AV notably has potentially positive impact on viewers engagement, e.g. towards advertising. Viewers watch immersive 360° video longer than other online or mobile videos.217 Due to the interactive nature of 360° video, viewers tend to re-watch the content much more frequently than they would do with a normal video. This can be combined with the possibility of game-like elements such as hot-spots and personalization.218 Such impact may also be due to the character of novelty, and therefore may not last when VR has become mainstream.

Besides, the technology is evolving into a medium to deliver social experiences. For example, Samsung is teaming up with one of the world’s largest amusement park operators, Six Flags, to launch a series of VR roller coasters equipped with Samsung's Oculus-powered Gear VR headset.219

3.4.3. Display and content are crucial for growth
The crucial challenge for immersive experience technologies is to ensure their adoption. Of all the steps of the VC for immersive experiences, display and content appear as crucial for the

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213 http://www.ccsinsight.com/blog/vr-movie-revolution-goes-dutch
216 http://www.ccsinsight.com/press/company-news/2251-augmented-and-virtual-reality-devices-to-become-a-4-billion-plus-business-in-three-years. Amateur users are currently outside of the scope of ImmersiaTV but it could be that tools developed within the project are of interest also for end-users, thus opening a new market niche, especially if the project succeeds in making the edition of synchronized content user-friendly enough.
217 http://immersivemedia.com/?page_id=60
218 http://immersivemedia.com/?page_id=60
219 http://www.ccsinsight.com/blog/vr-movie-revolution-goes-dutch
success of this industry. They are B2C activities while other steps are for the moment mainly B2B activities (e.g. CDN providers, softwares allowing to edit immersive AV content, and even omnidirectional cameras).

Currently display providers act as platforms mediating between two types of users: consumers and content makers. In a typical setting of two-sided markets, for their platform (their display and the related ecosystem: their app store, related hardware e.g. PlayStation or Samsung smart phones) to succeed they need as many consumers and content makers as possible adopting them. Content makers are hesitant to develop immersive content without an installed base while consumers are reluctant to buy devices without content to experience

Displays sales and shipment are the most impressive feature in this market. For example, a great amount of Google cardboards have been distributed although figures vary between 2mn distributed since its launch in June 2014 and sales of almost 5 mln low-cost designs based on Google Cardboard in 2015. VR devices sales are expected to increase from 2.2mln (2015) to 20mln (2020). In 2016, 12.8 mln unit VR headset are expected to be sold for revenues of $895 mln, according to Strategy Analytics. 77% of that value is accounted for by newly launched premium devices from Oculus, HTC and Sony, which however will only account for 13% of volumes in 2016. Actually, HMD – with mobile should represent 87% of units shipped in 2016. Related are control input, which will be vital in the growth of the VR ecosystem.

Displays vary greatly in terms of price and quality, the underlying trade-off is the one between quality and accessibility. This trade-off is exemplified by Facebook and Google's opposite strategies. Facebook, owner of Oculus, represents quality. Proponents of this approach argue that the most important factor in popularizing VR is to provide the highest quality experience possible (low latency, high resolution, etc.). Quality, the argument goes, is paramount because at this early stage of the game, one or two low-quality apps might convince people that today's VR is no different from the disappointing efforts of the 1990s. Quality however has a price. Oculus was launched at a price of $599 (including two

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221 Ibid.
227 Wright, “A Brief History of VR.”
228 Ibid.
videogames and an Xbox controller), and it was estimated that a PC meeting Oculus’ requirements would cost $1,000 229.

Proponents of the accessibility approach argue that the key factor in creating demand is to make VR devices as cheap and easy-to-get as possible 230. Google represents accessibility. Cardboard’s (a fold-up headset into which users slip their smart phones) first iteration can be bought for less than $5 online. Google says that a least a million units have sold. Another 1 mln were distributed for free via The New York Times 231. Another example is the Samsung Gear VR that was launched at $99 and which has seen strong shipments in 2015. In April 2016, more than 1 million people used the Samsung Gear VR. 232

Importantly neither approach precludes the other; both may actually represent a market segment 234.

Consumers will however adopt VR only if relevant, innovative content is developed. The challenge (for video entertainment and video games) is to create new forms of content 235. Even more than in the case of 3D, it is not possible to simple port a film over. Immersive AV content requires new storytelling with different writing and producing techniques 236, e.g. with more long takes, since cutting may make give nausea to users. For live events, Goldman Sachs argues that the challenges are a bit different. VR comes, after radio and TV, as a convenient solution to remedy the by nature limited number of seats available for each event. There are however challenges in acquiring rights and on the user adoption side since the experience with a HMD is more individual and less social 237.

Possibly cost for content production may become lower since 360 degree camera reduces the need for multiple cameras and editing work typical to 2D video 238.

Stakeholders in these markets are aware of such challenge, and try to produce content and attract content producers. For example, 200k developers have registered to create games on Oculus’ VR platform (as of Sept 2015). Oculus says 100 games will be available in 2016 (including 20 developed internally) 239. CCS Insight believes that although augmented reality and virtual reality are two very different technologies, they each have the potential to deliver transformative experiences. 240

230 Wright, “A Brief History of VR.”
234 Wright, “A Brief History of VR.”
236 Ibid.
237 Ibid.
238 Ibid.
239 Ibid.
CCS Insight expects user-generated 360-degree pictures and films will be an important source of viewing material for VR headsets.\(^\text{241}\) This will trigger greater interest in 360-degree wearable cameras, with sales of 250,000 units expected in 2016. Sales will rise to 3.3 million in 2020, accounting for 13 percent of the entire wearable camera market of 25 million units.

4. CONCLUSION AND RECOMMENDATIONS

Following the methodology of Market Opportunity Analysis, this report has provided a simple description of ImmersiaTV’s Value Network, used mainly to identify potential competitors, and position ImmersiaTV in comparison to them. The report has then identified the main types of actors being active in the VR industry, briefly qualifies them, and provides structured, non-exhaustive lists of companies. Finally it has provided a general overview of market trends for Virtual Reality and raised important questions concerning how the sector could evolve in the coming years.

4.1. Market trends

ImmersiaTV touches upon three related fields: Virtual Reality (VR), interactive video and orchestration apps offering content for second screens. The analysis of market trends has focused on VR. Main trends are:

- VR is a fast growing market. Following the PC and smartphone VR (together with AR) has the potential to become the next big computing platform. This is particularly visible in the amounts invested in VR (and AR).
- Next to games, video and user-generated content will drive the adoption of VR technology
- Shipments and sales of display devices are the most visible feature of the market, notably for consumers. HMD – with mobile represent most of the market in volume.
- Displays vary greatly in terms of price and quality, the underlying trade-off is the one between quality and accessibility. Proponents of the quality approach argue that the most important factor in popularizing VR is to provide the highest quality experience possible. Proponents of the accessibility approach argue that the key factor in creating demand is to make VR devices as cheap and easy-to-get as possible
- Consumers will adopt VR only if relevant, innovative content is developed. Stakeholders in these markets are aware of such challenge, and try to produce content and attract content producers.

4.2. ImmersiaTV’s positioning - recommendations

The following figure represents ImmersiaTV’s positioning in the Value Network. **ImmersiaTV’s first specificity** is to cover the whole value chain from capture to production, i.e. to provide an end-to-end tool. The project itself and/or its consortium partners will provide solutions in terms of capture, stitching, editing, and distributing immersive AV content. Other stakeholders are providing end-to-end tools, though (see 3.3.6). However **ImmersiaTV’s second specificity** is the focus on the synchronisation. Developed tools will allow to have different experiences for the same content on a TV set, a HMD and a mobile device (e.g. smartphone or tablet). This in particular will be applied to live production and distribution of content (e.g. sport events). Finally **ImmersiaTV** will develop innovative immersive content notably aimed at demonstrating the project’s Value Proposition.
This allows to position ImmersiaTV towards the six types of stakeholders that have been identified.

**Capture** and **pre-production** stages have been presented together because of the strong trend towards the integration of both activities (including also the role of displaying), the players active in providing hardware and software for capture and/or processing should not be considered as competitors. Their products are complementary to what ImmersiaTV is developing. However several companies listed here are also developing hardware of software in other steps of the Value Network, which makes them more likely competitors for ImmersiaTV. Finally, the mapping shows that several important players are present in this stage including players that are strong in other stages.

In the **production** stage it is crucial for ImmersiaTV to propose something different from what competitors are currently developing. A **first differentiator** in this respect is that tools developed within ImmersiaTV will make it **easier to produce** immersive content that can be experienced on **different devices** (i.e. one edits once for various platforms). A **second differentiator** concerns the importance of **live** (vs. offline) **production**, as developed in Pilot 2. This report therefore **recommends** in a next iteration to **further question the relevance in the value proposition of both differentiators**.

**Immersive content producers** can be competitors. However they also support ImmersiaTV’s objectives in contributing to the overall development of the market for immersive experiences. The mapping on films and documentaries shows that most of them are based in the USA; they rely on business-to-business activity, and a significant proportion of them are related to traditional or online media. While being in the USA is not a must, from this comparison, this report **recommends** (i) to **explore business-to-business business models** rather than business-to-consumers; (ii) to **sustain and develop links with traditional and online media**.

Regarding **distribution**, online platform’s evolution should be scrutinized to check whether tools and content developed within ImmersiaTV could be made available, and how. In the longer term, an issue is how to use these platforms to generate revenues from ImmersiaTV’s contents and products. For example 360 AV content that will be developed could be made available through platforms such a YouTube or Bitmovin. However, synchronicity between devices is currently not ensured by those platforms, which would limit the experience for viewers.

Devices allowing to **display** immersive content constitute the part of the industry most well-known from consumers. They include the most important and most powerful companies in this whole industry. Facebook’s Oculus Rift, HTC-Valve’s Vive and Sony PlayStation VR are...
currently the most important integrated HMD in the global market, while Samsung Gear VR seems to be the most important market player in the “HMD – with mobile device” segment. These devices’ success is key to have the whole market for immersive experiences succeed. **There are no display device providers within ImmersiaTV.** This should **not** be an issue since the innovations (products and content) developed within ImmersiaTV should be watchable on any device. The objective is to avoid lock-in. However next iterations should consider the potential additional costs related to compatibility.

Finally, **end-to-end platforms** appear as **ImmersiaTV’s most direct competitors, especially those that are active in the live production and distribution of live events**, especially if one considers that the most important innovation for the project derives from the integration of its various components. The report **recommends to follow up how the identified platforms evolve** (activities, market presence, targets, etc.) and to map other similar market players.

### 4.3. Next steps

This report is intended to be a living document, to be updated at least twice (December 2016, September 2017). The next iteration will update this document, aiming at gathering more statistics.

It will further address questions and findings in this document, also based on the project consortium’s needs and identified gaps in the analysis.

Finally It will provide a first analysis of **strategies for successful exploitation**, i.e. the conditions for successful exploitation of the proposed immersive audiovisual solutions, and the best strategies to address these.
5. REFERENCES


