



MARKET PULSE REPORT, AR & VR

UK

**DISCOVER KEY TRENDS &
INSIGHTS ON DISRUPTIVE
TECHNOLOGY SECTORS
AND INNOVATIVE STARTUPS**

Research Methodology:

GrowthEnabler's Analyst team used a first of its kind proprietary research methodology to assess the AR and VR startup landscape and compile this report. The main pillars of this methodology comprises of in-depth secondary data and syndicated data synthesis.

Secondary data and syndicated data synthesis: GrowthEnabler's analyst team conducted detailed data collection, analysis and synthesis of the UK and global AR and VR market via web-based databases, syndicated data sources, research houses and other miscellaneous sources. All these sources of information and analysis have been duly cited in the report.

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About GrowthEnabler

GrowthEnabler delivers data & intelligence on disruptive technologies & digital innovations from the startup economy, to global brands, business leaders, startups and entrepreneurs, to gain insights, get connected and grow faster.

► **Augmented Reality (AR)** is virtual reality combined into real life. It enables developers to create images within applications that augment the elements of the real world. With AR, users can interact with virtual contents in their normal reality, and also distinguish between the two.

► **Virtual Reality (VR)** is all about creating a virtual world that users can interact with using computer-generated simulation of a three-dimensional environment through headsets with screens inside and sensor gloves. This virtual world, that the user experiences, should be designed in such a way that identifying the reality would be a real challenge for the users.

INTRODUCTION

Globally, the revenue for Augmented Reality (AR) and Virtual Reality (VR) technologies is expected to touch US\$5.2 billion in 2016 and continue to grow by over 100% annually for the next 4 to 5 years¹. Additionally, in 2015, 864 million mobile phones were capable of running AR programmes and content indicating a large market opportunity for AR companies². However, the main challenge facing AR and VR technologies is the ability to go further mainstream with affordable and user-friendly industry-specific use cases for the benefit of end-users and the companies they represent. This research report by GrowthEnabler details the overall state of the

AR and VR market with a special reference to UK market conditions. Included in this report is an insightful overview of the leading UK-based startup companies that are on the path of AR and VR innovation.

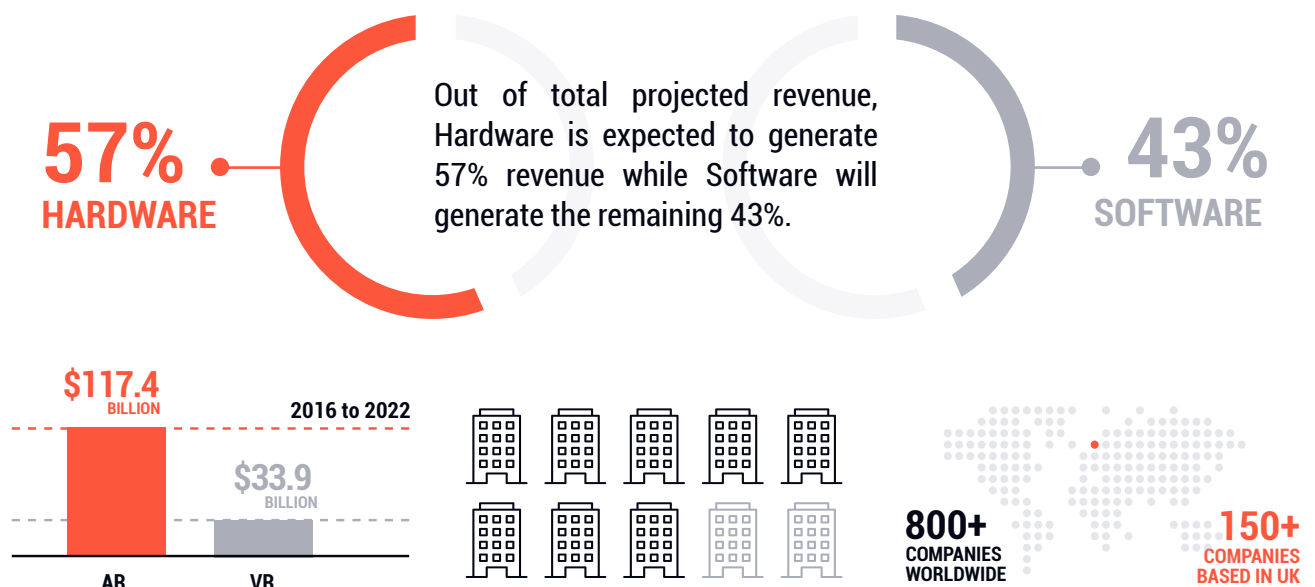
What marked the beginning of computerised reality? Was it the introduction of the Google Glass? Or was it when Facebook acquired Oculus Rift? Companies are aggressively working on making these technologies more mainstream to transform the way we perceive the functionality of industries ranging from defence to gaming. As technologies in AR and VR unravel in front

of our eyes, understanding their purpose and functionality is essential.

With AR, users continue to be in touch with the real world while interacting with virtual objects around them. However, with other VR technologies such as Oculus Rift and others, the user is isolated from the real world while being immersed in a world that is completely fabricated.

Several technologies like Eyefluence incorporate both AR and VR technologies into its functions. It offers eye-tracking technology that can be applied to both AR and VR systems.

Market Overview



AR market to reach \$117.4 billion at CAGR of 75.72% between 2016 and 2022. VR market to reach \$33.9 billion at CAGR of 57.84% between 2016 and 2022.

8 out of 10, top tech companies have already invested in AR and VR. These companies include Apple, Google, Microsoft, Facebook, Samsung and IBM.

Currently there are 800+ companies are in AR/VR segment around the world out of which 150+ are based out of the UK.

Source: Goldman Sachs, Markets and Markets

¹ IDC, Goldman Sachs, 2016 / ² Augmented Reality Trends, 2015

Applications

Industries have been incorporating AR and VR into their regular products and services to enhance customer experience, simulated learning, and other forms of demonstration. However, the use and extent of industry-ready applications vary across industries and/or sectors. Outlined on the left are examples of a few applications and use-cases that have been adopted by varied industries or sectors.

Education	California recently opened a VR learning centre for medical students where, they can use an Oculus DK2 to travel inside the human body instead of just reading about red blood cells. ³
Healthcare	VR has been in use in healthcare for years. Recently, a doctor in Miami used Google Cardboard to plan for a surgery on a baby who was born with half a heart and only one lung. The Cardboard helped him see the 3D images of the baby's heart in a way he otherwise could not. ⁴
Aerospace	NASA has been using VR at the Johnson Space Center in Houston, Texas to train astronauts for spacewalks since 1992. ⁵
Automobile	Ford Motor Company uses VR to design cars before it makes a physical prototype. Companies are even creating driving simulators. ⁶
Real Estate	These technologies enable customers to stand inside a house or apartment without visiting that place physically. Many companies like YouVisit offer the ability to view 360° videos and pictures of property listings. ⁷
Tourism	Getting to visit a location in virtual reality could help potential travellers make decisions. Marriott has been testing out VRoom Service. Guests staying at specific locations can use a GearVR to virtually visit places like Chile, Rwanda, and Beijing. ⁸
Gaming	Over 20% of gaming companies were developing AR/VR based games in 2015, up from 7% in 2014. Recently Pokémon Go , which uses AR, was termed the most successful and famous game to date. ⁹
Defence	Use of AR and VR in the defence sector consists of 'Flight Simulations', 'Battlefield Simulations' and 'Virtual Bootcamps'. This provides real-life experiences without actual danger to a soldier's life.
Sports	Sports has always been on the leading edge of AR and VR. Baseball teams like the Dallas Cowboys and Tampa Bay Rays are already using AR/VR systems to aid in training. ¹⁰
Manufacturing	UK based Virtalis uses VR to allow manufacturers to give staff a real feel for the new constructions, be it a submarine or an apartment block. ¹¹
Media & Entertainment	From the New York Times and ABC News to "Star Wars" and the Lowe's Holoroom, big media, entertainment and retail brands are testing the limits of AR and VR.

³ <http://www.techrepublic.com/article/digital-cadavers-how-virtual-reality-and-augmented-reality-can-change-anatomy-class/>

⁴ <http://www.techrepublic.com/article/10-ways-virtual-reality-is-revolutionizing-medicine-and-healthcare/>

⁵ <http://www.techrepublic.com/article/nasa-shows-the-world-its-20-year-vr-experiment-to-train-astronauts/>

⁶ <http://www.euroforum.de/augmented-reality/>

⁷ <http://www.techrepublic.com/article/virtual-reality-in-2016-the-10-biggest-trends-to-watch/>

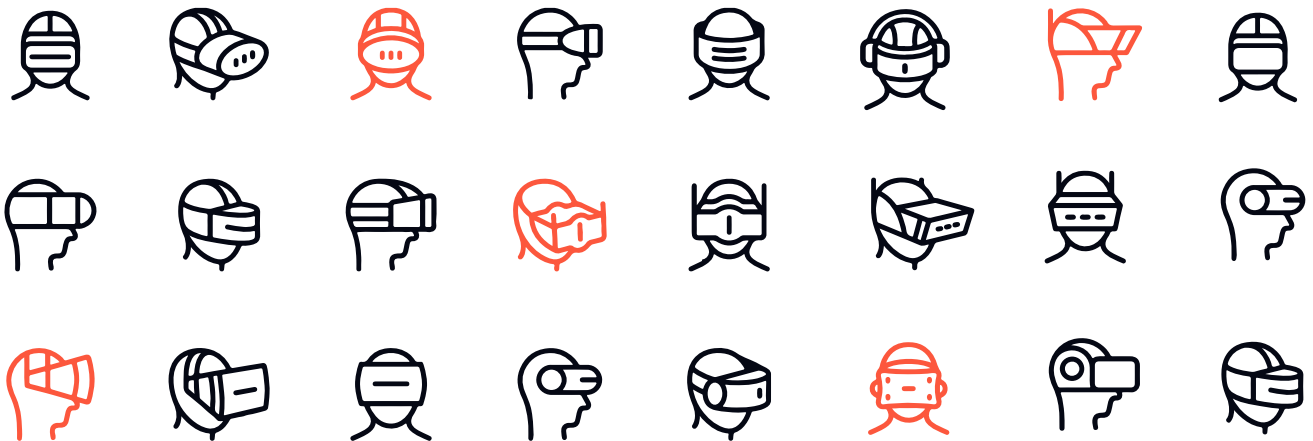
⁸ <http://news.marriott.com/2015/09/marriott-hotels-introduces-the-first-ever-in-room-virtual-reality-travel-experience/>

⁹ GDC (Game Developers Conference), 2016

¹⁰ <http://www.digitaltrends.com/virtual-reality/tampa-bay-rays-virtual-reality-mlb/>

¹¹ <https://www.virtalis.com/>

INDUSTRY CHALLENGES



“ Less than 1% of the PCs expected to be in use globally in 2016 will be powerful enough to run the best virtual reality technology¹² - Nvidia. - ”

Computing power

Due to the nascency of the AR and VR market, the key barriers to market adoption are primarily related to lack of uniform cross-platform technical standards, and high cost of technology.

Despite the growing excitement around AR and VR products and services, users are far from 'AR and VR ready' due to:

/ Limited computing power. Low levels of computing power inhibits market adoption at a wider level. High levels of computing

power are required to operate VR technology. Although VR environments can be experienced on smart phone and consoles devices, sophisticated, high end headsets including Oculus Rift, and HTC Vive, require the support of high spec PC's, with powerful processors (CPU/GPU), and high capacities.

/ Head mounted displays: These displays require high energy consumption batteries to perform and deliver the desired experience, restricting access to a broader audience.

Motion Sickness

The sold out pre-orders of some solutions such as Oculus Rift and HTC Vive, reflect the hype and demand to experience real life simulations and the illusion of virtual worlds. In spite of advanced research, development and investment, issues have arisen in relation to VR motion sickness.¹³ These low latency headsets are designed with embedded

motion sensors and cameras to enhance the virtual world experience. However these features must work in unison to stabilize the virtual view, and minimize motion sickness. The importance of visual stabilization and the elimination of feelings of nausea is integral to the AR/VR user experience.

¹² <http://www.bbc.co.uk/news/technology-35220974> / ¹³ <http://phys.org/news/2016-03-virtual-reality-creators-motion-sickness.html> and Markets



Optical

User experience related issues have also been identified with the hardware and optics features in Smartglasses. Unlike TV or PC screens, Smartglasses must blend visual information coming in naturally with that generated by the computer and project it in a user's field of view to augment reality,

without being distracting¹⁴. The challenge is in striking the balance between the visuals, (i.e. colours, sharpness) delivered from the natural world, and the augmented visuals delivered from the device. Large or heavy glasses will lessen product enjoyment, and limit geographies of product use.

“ Bristol & Bath are emerging as UK's major centers for VR development

- Richard Chapman, Invest Bristol and Bath - ”

Haptic Solutions

VR in healthcare has assisted in medical training. Medical practitioners can perform an operating procedure via VR. The limitation lies in the 'feel' of the operation scenario. The absence of 'touch' significantly reduces

the sensory experience of the surgery. Although the practitioner may see, or hear, the lack of a synthetic haptic input, in the form of pressure, signals huge scope for improvement.

¹⁴ Sumanta Talukdar, CEO of WaveOptics. <http://www.pwc.com/us/en/technology-forecast/augmented-reality/optic-breakthroughs-resaping-augmented-reality.html>



Software

The increase of AR/VR players provides a broader variety of product choice and options for users. Currently, however many known platforms use applications without cross-platform capabilities and varied development standards, cocooning their products into independent ecosystems.

Consequently, software developers are forced to design apps, and platforms that may not be compatible with one or each of these ecosystems. With the rise of new entrants into the industry, comes the increased risk of a fragmented software ecosystems.

The lack of platform standardization, or open / cross-platform development across AR/VR hardware, poses a sizeable challenge for software developers. Software developers prefer to leverage open source platforms that can support a range of apps built on standardized templates and code.



Security

Whilst software developers favour open source platforms, such platforms bring along security vulnerabilities, resulting in data and privacy breaches, and exposing consumers to real threats in the physical world from hackers.

/ Vast amounts of data is being shared through AR/VR devices in real time. This, coupled with the easy access to social profile and personal information, leaves individuals exposed and vulnerable to cyber bullying or stalking in ordinary social settings.

/ On demand sharing of data leaves Individuals exposed to an increased risk of cybercrime including identity theft and fraud.

/ The sharing of private data conflicts with data protection legislation and raises a debate on the ethics of privacy versus data sharing.

/ Hackers and cyber criminals pose a threat those immersed in their virtual world. Players of AR game Pokémon GO¹⁵ were targeted by robbers who introduced gameplay into the app to lure players to isolated locations and rob them at gunpoint.



Cost

Purchasing, upgrading, and even switching present economic barriers to user adoption and market penetration.

/ Although VR environments can be experienced on smartphones and console devices, sophisticated, high end headsets including Oculus Rift, and HTC Vive come at a significantly higher purchase cost.

/ Personal comfort and user experience are critical to wearables like Smart Glasses. Buyers will be reluctant to invest in a premium device which compromises user comfort over a sustained period, or leaves a user feeling nauseated.

/ To enjoy a fully immersive experience at home or work, requires ample computing power and the right technology infrastructure, i.e. advanced graphics cards, and CPU capacity to prevent lag. This comes at a cost, which not everyone can afford.

/ The debate of software ecosystems originated from Apple-designed exclusive technology and Android's inclusive operating systems. As new devices emerge, their unique software operating systems and coding principles, leaves the average user facing high switching costs, or risk AR/VR hardware incompatibility with the default software ecosystem.

¹⁵ <http://www.theverge.com/2016/7/10/12142434/pokemon-go-armed-robberies-missouri>

AUGMENTED REALITY TECHNOLOGY DEVELOPMENT & GROWTH



Much of the investment in AR has been focused on display medium (e.g. touchscreens) manufacturers and mobile applications. Unlike VR devices, which are predominantly wearable devices, AR does

not necessarily rely on hardware devices for users to experience the benefits. Pokémon Go, a popular and recent gaming app, demonstrated an AR experience via the use of a smartphone.

Gaming and Entertainment

Similar to VR, the gaming and media/entertainment industries have enjoyed the highest adoption of this technology, particularly in the consumer market. Pokémon GO has reached 21 million + daily active users in only a few weeks, post release. The success of AR gaming will spearhead lifestyle brands to partner with viral AR games to engage with the millennial consumers (aged 18 – 24 years).¹⁶ Gamers searching for a Pokémon may be exposed to an AR image of relevant branded store, or product, in order to drive brand engagement and appeal.

Education

AR can enhance learning environments, stimulating higher levels of engagement, focus, and benefit visual learners. Skills training in industrial environments, inspection/quality assurance, work instruction, workflow management, or operations/safety can be delivered using AR. In traditional classroom environments, tutorials can be made more compelling and engaging through AR integrated content.¹⁷ AR's ability to motion capture and reposition objects in a virtual environment broadens its usage and appeal to academic exhibitions and learning classrooms enabling interactive learning, e.g. physics experiments.¹⁸

Military

Integration of maps, weapon control systems and projection of satellite information, are just some of the features utilised by the military using AR goggles. Augmented Immersive Team Trainer (AITT) facilitates the training of military troops at Quantico to call in airstrikes and artillery barrages - enabling the recreation of one of the challenging types of live training. AR technology helps to substitute all the costly components of such military training,¹⁹ making the military amongst the leading adopters of AR technology.

Healthcare

Healthcare is the leading sector for enterprise adoption. Use cases include patient care management, medical training, and also prescription management.²⁰ Medical applications like AccuVein help medical staff to find a patient's veins through an AR projection.

Digi-Capital released a report in April that projected AR and VR would be a \$150 billion

market by 2020, and only \$30 billion of that will be VR. A survey by TechProResearch, stated 67% of respondents are considering adopting AR for future use in their enterprise, 20% plan to use it within next 12 months.²¹ Companies such as furniture retailer Ikea are testing AR solutions so customers can determine whether a desired piece of furniture will fit in their own living room, thus

alleviating the need to manually measure the dimensions of the sofa and showcasing the 'look and feel' of the new interior design. Logistics organisation, DHL are also testing AR glasses in their warehouses in a bid to reduce errors, and increase productivity. Both, AR and VR have a definite future in the enterprise, but AR has a stronger projectile.

¹⁶ <https://www.marketingweek.com/2016/07/18/why-pokemon-go-is-a-game-changer-for-augmented-reality-and-marketers/>

¹⁷ <https://www.edsurge.com/news/2015-11-02-how-to-transform-your-classroom-with-augmented-reality>

¹⁸ <https://elearningindustry.com/virtual-reality-augmented-reality-education>

¹⁹ <http://breakingdefense.com/2015/09/marines-explore-augmented-reality-training/>

²⁰ <https://blog.catavolt.com/2015/10/3-ways-augmented-reality-is-changing-the-healthcare-industry-2/>

²¹ 67% considering adoption of Augmented Reality in the enterprise (<http://www.zdnet.com/article/research-67-percent-considering-adoption-of-augmented-reality-in-the-enterprise/>)

AR DEVICE FORECAST

Main uses



Logistics



Support



Design

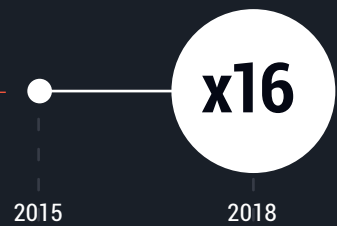


Medicine

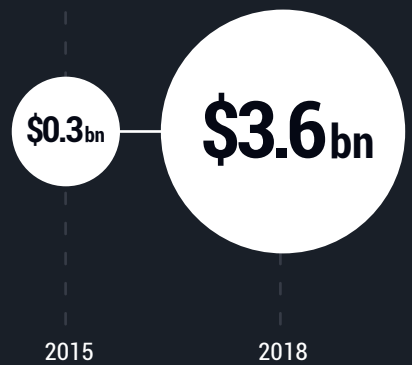


Education

Shipments



Market value

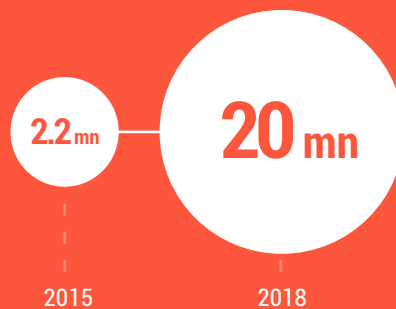


Smartphone VR

of VR device sales in 2018



Shipments



Main uses



Games



Videos



Travel



Marketing



Social

VR DEVICE FORECAST

VIRTUAL REALITY TECHNOLOGY DEVELOPMENT & GROWTH



Over 2.5 million VR and AR devices were estimated to have been sold in 2015. Sales projections forecast more than 25 million device sales by 2018²²

According to CCS Insight, Software & VR-friendly content creation will drive mass market adoption. The growth, adoption and expansion of VR, span across multiple industries, including Gaming, Real Estate,

Automotive, Healthcare, Sport, Manufacturing and the Military. Companies, such as Audi are using VR technology to offer potential customers a detailed virtual viewing experience of their cars, including the interiors,

and electronics features,²³ whilst gamers actively seek to transform 2D gaming, into a 3D interactive gaming experience. The growth and evolution of hardware components have made VR what we see today.

Gaming and Entertainment

Gamers are the key drivers of consumer level interest in VR. The community comprises of early adopters and enthusiasts, eager to explore 'immersive' experiences by interacting with the enhanced virtual environment, allowing them to become fully immersed and a part of the game. Content creation for traditional fields such as film, music videos and live concerts are attracting additional interest from non-gamers, fuelling the fast adoption of VR technology.

Fast adoption of AR and VR in the gaming and entertainment sector has fuelled Chinese VR device manufacturer HTC, to outrun their competitors by devoting \$100 million²⁴ to a build a new VR accelerator program (Beijing, San Francisco and Taipei) for developers called Vive X, VR. The virtual accelerator will allow investors, developers and VR mentors to network, share best practises, enabling global talent to create interesting and engaging content to help shape the future of this industry.

Medical Training

Conducting VR invasive surgery eliminates risk, and brings significant cost savings in medical training. Medics can:

/ Practice and perfect procedure techniques in virtual theatres.

/ Aid and facilitate patient psychological phobia management.

/ Offer solutions to homebound or disabled patients.

Introducing the haptic element will further strengthen, and boost VR adoption in the healthcare industry.²⁵

Sporting

With the use of VR, sports fans can be transported to live games, with an enhanced view from the heart of a sporting arena - anywhere in the world. Professional sports leagues and associations have expressed interest in the use VR in the streaming of live games. Such an immersive experience is likely to generate an additional source of revenue from sporting association and ardent fans, passionate about the game, their team or sport.

Military and Defence

The military and defence sector has embraced VR for virtual combat training along with military applications akin to

immersive flight simulations, and battlefield medical training. Virtual training, fighting and scenario planning grant cost savings, making the military and defence space keen adopters of VR technology.

Automobile, Manufacturing and Real Estate

Business adoption in the automobile and architectural sectors have revolutionised the way potential clients interact with high value assets such as cars or properties in situations such as:

/ Removing the need for on-site travel and viewings

/ Scheduling appointments with prospects/ clients

/ Reducing dedicated sales staff

VR enables a greater number of potential customers to 'walk' through buildings, inspecting the layouts or interior design of apartments. Similarly, both mechanics or car designs such as Audi and car buyers can delve under the hood, and examine the car engine, from their preferred location. VR will empower businesses to save capital, and build better business-customer relationships permitting an increase in business use-cases.

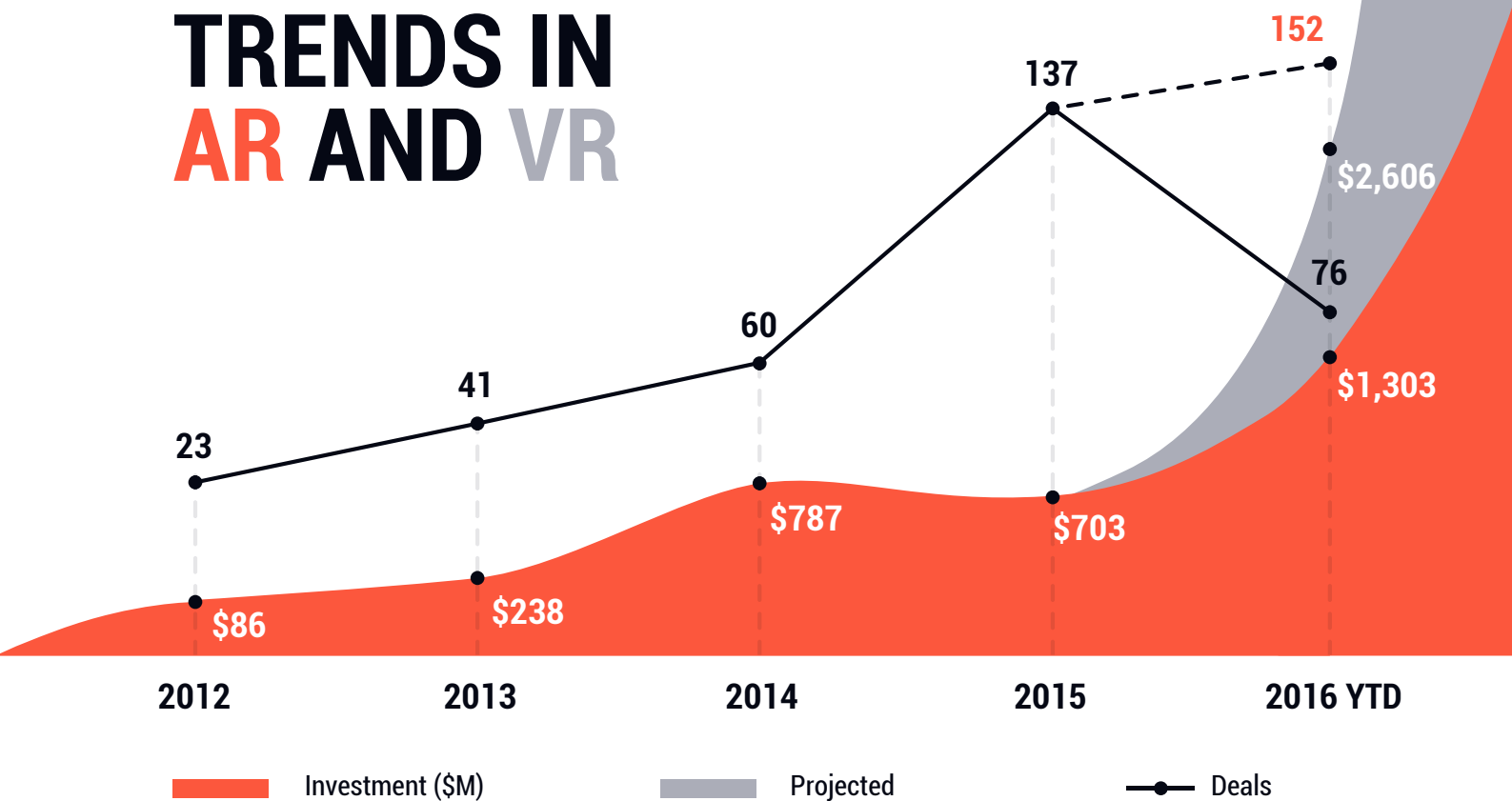
²² <http://www.ccsinsight.com/press/companynews/2251-augmented-and-virtual-reality-devices-to-become-a-4-billion-plus-business-in-three-years>

²³ <http://www.techrepublic.com/article/9-industries-using-virtual-reality/>

²⁴ <https://techcrunch.com/2016/04/26/htc-announces-100m-vive-x-virtual-reality-accelerator-program/>

²⁵ Virtual Reality is revolutionizing medicine & healthcare [<http://www.techrepublic.com/article/10-ways-virtual-reality-is-revolutionizing-medicine-and-healthcare>]

INDUSTRY TRENDS IN AR AND VR



2016 has already witnessed a cumulative rise in AR/VR funding by 85% from 2015.²⁶ At the current run rate, deal volume this year will grow by 11% over last year's total. Of the total funding of approximately US\$2.9 billion raised globally, the US grabs the highest share at 70%, and the UK comes in a distant second at 5%.

Among the AR/VR companies that raised

the highest amount of funding to date, UK-based Blippar, raised the 4th highest level of funding, at a total of US\$99 million. Over US\$103 million has been pumped into the UK AR market and Blippar is responsible for 96% of that.²⁷

Approximately US\$43 million has been invested in the UK VR market and the top funded companies include Improbable and nDreams.²⁸

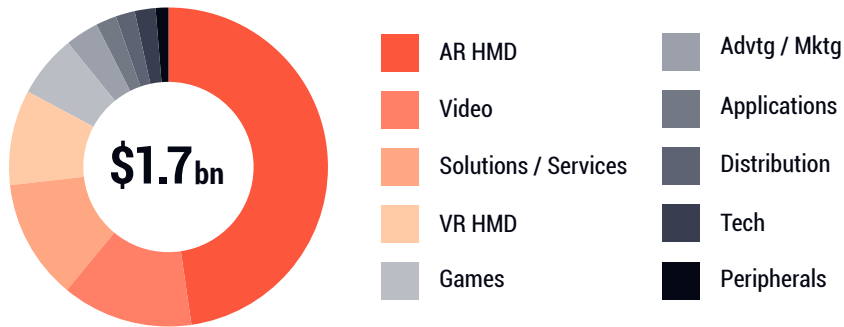
In the financial year 2015-16 total investment in AR/VR worldwide stood at \$1.7 billion.²⁹

Globally, AR/VR hardware companies received the highest amount of funding as yet at US\$1211 million. The top categories that saw the most number of deals are

AR/VR companies focusing on commercial and industrial applications, infrastructure and tools, and the content.³⁰

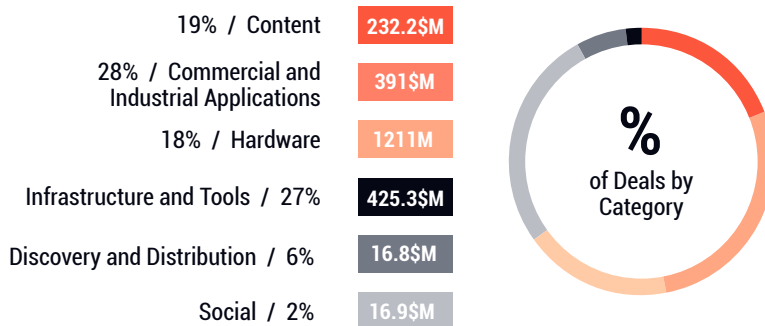
²⁶ CB Insights, 2016 / ²⁷ Ibid / ²⁸ Ibid / ²⁹ Digi-Capital, 2016 / ³⁰ CBI Insights, 2016

Worldwide Investment in AR/VR. 2015-16



Funding raised by companies functioning under different wings of AR and VR.
Source: Digi-Capital

AR/VR Funding by Category



Deals by category of AR/VR companies.
Source: CB Insights, 2016

AR and VR companies are venturing into new arenas to capture the ever-growing addressable market, and to seize the many opportunities the technology presents.

AR/VR companies in content, commercial and industrial applications, hardware, infrastructure and tools, discovery and distribution, and social, have witnessed close to 350 deals till date.³¹

/ Content is key and emergence of affordable VR alternatives like Google Cardboard, companies are increasing their focus towards creating content that suits the technology like 360° videos, VR videos and movies. Education and Gaming companies are also major providers of AR and VR content. A number of companies are introducing apps like Waking App as a platform to create AR and VR content.

/ Commercial and Industrial applications of AR and VR include marketing technology, retail, real estate, defence, manufacturing, logistics, healthcare, and data analytics.

/ Infrastructure and Tools companies are solving the technology limitations for great

AR and VR experiences by creating developer tools, gaming engines, software development kits, gesture and motion tracking, and haptic feedback technology, among others.

/ Hardware includes head mounted displays (HMDs), mobile HMDs, other mixed reality displays, cameras and capture technology

/ Discovery and Distribution companies provide a destination to search and discover AR and VR content and apps

/ Social media companies allow for collaboration and communication within the medium. Virtual meeting environments and chat rooms are prominent examples in this arena.

There are 3 types of VR headsets currently in the market:

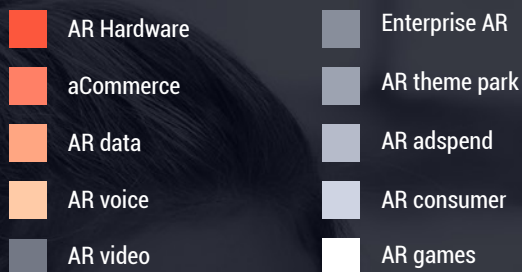
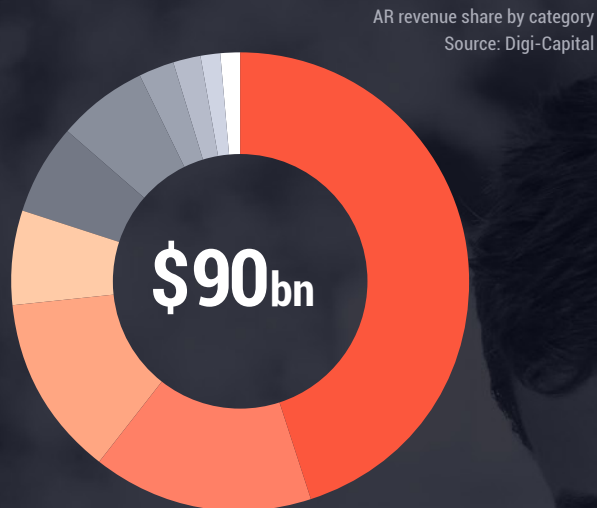
► **Mobile VR HMDs [Head Mounted Display]:** Google Cardboard is the most popular HMD in this category. These offer rotational tracking, variable frames per second (maximum of 60 FPS) and variable field of view (~90 degrees). This kind of HMD requires lenses, a sheet of cardboard, a magnet, and an android phone with a gyroscope.

► **Premium mobile VR HMDs:** The "Oculus powered Samsung Gear VR" (Oculus software, Samsung hardware) headset comes under this category. It offers positional tracking, 60 consistent frames per second and a field of view of 96 degrees. FreeflyVR also falls under this category.

► **Tethered HMDs:** Oculus Rift and HTC Vive fall under this category. They are priced much higher than the previous two categories. The Oculus Rift is priced at \$599 and the HTC Vive at \$799. Both the Vive and Rift need to be connected or tethered to a PC with a reasonably competent GPU.

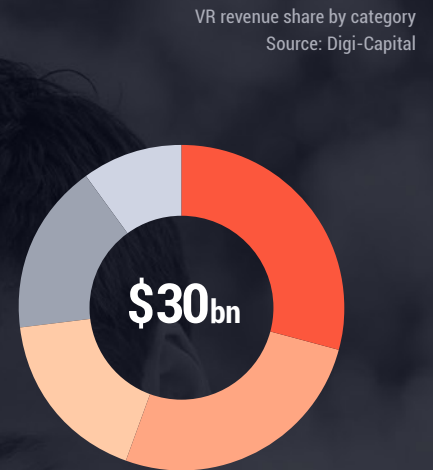
³¹ CB Insights, 2016

AR Revenue trend



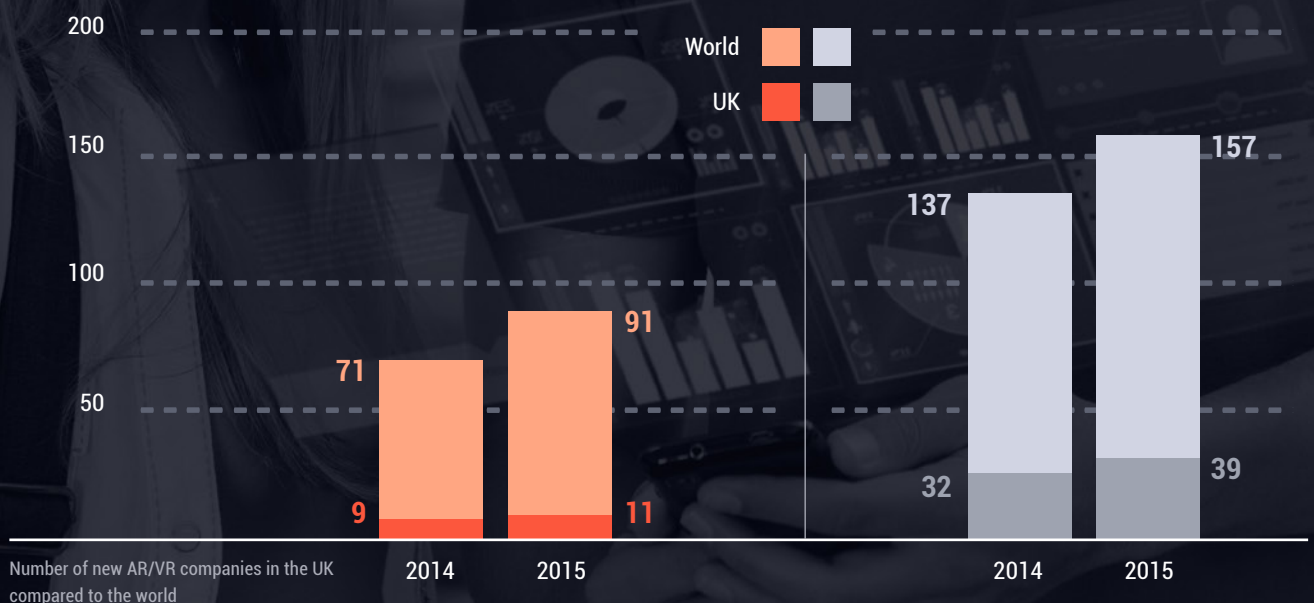
As per the above figure, the AR market is at a much higher trajectory than the VR market and the former is very likely to outrun the latter by US\$60 billion in the next 4 years. This is attributable to the tangible value that AR offers when compared to VR. It is more accessible and is significantly more affordable than VR.³²

VR Revenue trend



Gaming is a hot application space for VR. In 2015, the revenue from VR video games was \$660 million and this number is projected to reach \$6.9 billion by 2020 and \$11.6 billion by 2025.³³

Most of the revenue in AR is expected to come through the sale of Hardware. AR hardware revenue is expected to reach \$42 billion by 2020.³⁴



³² Digi-Capital, 2016 / ³³ IDC, Goldman Sachs, 2016 / ³⁴ Ibid

KEY TAKEAWAYS

Growth	VR is the hare, AR is the tortoise and we all know who wins the race. Market for AR in 2022 is expected to reach US\$117 billion as compared to US\$34 billion of VR
Revenue	AR/VR hardware (57%) will generate more revenue than software (43%)
Marketshare	US (70%) is expected to lead the market, UK (5%) and China (3%) to follow
Funding	Industry is at a nascent stage and we have seen 75% of the total investment in Seed and Series A rounds. This trend is expected to change as more companies will be reaching to mature stage and raising significant amount
Market Maturity	More Unicorns will emerge out of the US, UK and China. This number is expected to grow significantly from the current baseline of 4; Oculus Rift (US), Magic Leap (US), Blippar (UK), and MindMaze (Switzerland)
Advertising	Commercial advertising will have the best use-case adoption from an enterprise point-of-view alongside the Gaming sector
Adoption	Adoption of AR and VR units will be far slower than smartphones but as the technology advances, price points decline and adoption increases, AR and VR unit adoption will be as game changing as the advent of the PC
Cost	Major hardware devices (desktop, smartphones, tablets, LCD TVs) have experienced pricing declines by 5-10% annually over the last 20 years. HMD price decline is expected to follow a similar trajectory
Integration	Integration of AR and VR technologies will create a unified technology environment known as MR (mixed reality). Companies like Eyefluence and Sketchfab are already seizing this opportunity and in the future we'll be seeing more such technologies



RECOMME

FOR AR/VR COMPANIES, INNOVATORS AND TECHNOLOGISTS

1

Product usability drives investment and growth

AR and VR technology products that are ultra 'cool', visually stunning and beautifully designed, also need to have market appeal and should be easy-to-use. Investors favour products that have a blend of both 'cool factor' status and a strong usability score. AR and VR startups should build products using Lean six sigma techniques, creating a Minimum Viable Product that is continually user-tested and part of an iterative feedback process.

2

Product innovation and R&D is essential

AR and VR technologies are an early stage of development vs established mainstream technologies. For innovators, there is a need for at least 60% of investment funds to be focused on R&D, product innovation, roadmap development and user-centric design to drive mass market adoption. New technology advancements, coupled with the ever lowering cost of hardware, courtesy, Moores Law, should make this process easier to manage.

3

Master an industry

AR and VR startups need to focus on designing and marketing products to address opportunities and challenges specific to an industry. In some cases, it makes sense to select a primary and secondary industry focus. Having core specialisation in an industry helps to establish brand expertise, competitive differentiation and both customer mind and market share.

“ Being able to attract continuous app usage and giving great AR experience to consumers while helping businesses will be the most important factor for AR growth ”

INDICATIONS

4

Create immersive and interactive products

User experience design that is mobile-ready creates immersive and interactive engagement drives brand value and product stickiness. PokémonGo applied these design principles to create a highly engaging and addictive experience, that results in mass adoption and virality.

5

Build a seamless & personalised user experience

Personalisation and cross-device usability through multi-platform development standards ensure users spend more time engaging with the product wherever or whenever across platforms. Understanding the flow of the end-to-end user journey and diverse user personas can be useful in user centric design and product development. For example, a user who adds items to a shopping cart in a VR e-commerce experience should be able to continue the same experience seamlessly on a smartphone or tablet, with the same level of personalisation.

6

Focusing on and going beyond the gaming industry

The gaming industry has cemented itself as the clear industry leader and early adopter of AR & VR technologies and products. AR and VR startups should build and design products to meet the growing demand of this fast growing sector.

Besides, gaming, it is important to diversify products and services and develop use cases that can help real estate, automotive, retail, automotive and healthcare segments.

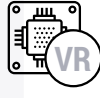
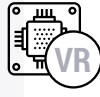


**“ Change is inevitable,
and the disruption it
causes often brings
both inconvenience
and opportunity. ”**

Robert Scoble

Age of Context: Mobile, Sensors,
Data and the Future of Privacy

UK TOP AR & VR STARTUPS

COMPANY	CORE STRENGTHS	GROWTH OPPORTUNITIES
 WAVEOPTICS Using a patented holographic technology, builds display materials to enhance the quality of AR products and devices such as AR glasses.	/ Team has expertise in AR, design and systems engineering / Partners include Blippar, thinkable studio, Tick Tock / Raised funds from Imperial Innovations Group, RBVC, Octopus Ventures, Blippar	/ Limited competition in UK market. Opportunity to accelerate growth and market adoption / Opportunity to lead and define industry standards in AR hardware manufacturing waveoptics.co.uk
 IGLOO Developer of 360 degree VR technology. Provides software tools that projects images to produce 360-degree digital projection using graphics, live feed, video and animated audio visuals.	/ Providing Igloo installations globally across Asia, UK, USA, Europe, and the Middle East - with clients such as Vodafone, BP, Toyota / Successful use cases at events, festivals, roadshows, and visitor attractions	/ Scope to drive new partnerships and growth in the Education industry - creating immersive learning experiences for students; and in the virtual and physical business coaching and training industry to enhance interactivity and recall igloovision.com
 INFINITY (ACQUIRED) Provider of VR A1:F16 to film, concert, theatre and television production houses. Acquired by Gate Ventures for \$1.4M in 2016.	/ Founders are successful television producers. / Infinity content is being distributed by major television networks like SkyTV. / A content supplier for Oculus Rift who were acquired by Facebook for \$2B³⁵	/ VR and 360 degree content will be dominant in the Real Estate and Tourism industry. / Infinity operates in the UK and China, 2 of the top three VR markets globally. / Major growth opportunity for Infinity360 to provide virtual tour experiences to the global Tourism industry. infinite360.co.uk
 ADS REALITY (ACQUIRED) Developer of product recognition software. Enables the recognition of 3D products via mobile phones, by overlaying digital information, videos or animation using AR	/ Acquisition by GAME provides greater access to new markets, technology capabilities, R&D and clients / Strong team background with 15+ years of experience in retail industry / Large Retail clients : Tesco, Sainsbury's	/ Ads Reality can gain significant market share in the Retail AR industry to become a dominant player - thanks to its current client brands / Opportunity to create partnerships with brand advertising agencies such as Publicis, WPP Group of companies to enter the offline retail industry adsreality.com
 ZEROLIGHT Provider of display services. Designs, builds and powers engaging interactive services ranging from virtual showrooms and VR experiences to AR and visualisation applications.	/ Recognition as the tech business of the year in the UK and its real-time 3D car configuration technology shortlisted for the SMMT's 2015 Automotive Award for Innovation³⁶	/ Leverage major growth opportunity to automate and modernise quality analysis applications processes, using AR and VR, in heavy machinery industries such as Military and Aerospace / Build partnerships with global automotive manufacturers to set up virtual showrooms to enhance customer buying experience zerolight.com
 FREEFLY VR (PROTEUS LABS) Engages in the designing, manufacturing and sale of wireless VR headsets for mobile phones. It adapts smartphones into a wearable VR experience Patent: EU Registered Design	/ Major advantage on price point, \$110 against VR headsets like Oculus and HTC and even ships worldwide / Compatible with over 200 apps on Google Cardboard / Part of Startup Chile incubator / Partnered with Gamebench enabling developers to test their VR experiences on multiple devices³⁷ / Top clients include Best Buy, John Lewis and Argos	/ Freefly's competitive product pricing strategy has strong potential to drive brand awareness and fast market adoption / VR headset shipment volume was at 0.14 million in 2015 and this number is expected to hit 6.31 million by 2017. (Statista, 2016) freeflyvr.com
 IMPROBABLE Developer of an operating system to build simulated worlds or complex simulation systems for Gaming, Defence and Infrastructure.	/ Backed by Andreessen Horowitz in Series A of \$21.55M / Simplifies and optimises the development process for 3D environments / Strong leadership team consisting of marquee names including Nick Button-Brown from Crytek, and Sam Kalnins, Google Hangouts / Limited competition in the VR Operating Systems market	/ Significant partnership opportunities with VR companies to scale spatial OS in 3D environments / Opportunity to gain market share as a VR software development platform across Defence, Energy, and Health sectors improbable.io
 NDREAMS Developer and publisher of VR games and experiences. Specialise in developing and publishing online games and operate a VR gaming website.	/ Teamed up with U.K. based VR entertainment firm, Virtual View Productions, to explore the crossover between filmed and game content in VR / Owner of VRFocus, a leading global VR gaming website / Nominated for develop awards'12 & Kemp Little award for business innovation; finalists in Inspire 11 awards and Smarta 100 / Develop content for Oculus Rift, Samsung Gear and Sony Morpheus	/ nDreams will benefit from the growth in the VR Gaming market (refer back to the graph- forecasted to reach US\$6.9 billion by 2020) / Significant opportunity to drive consumer market share as VR headsets become more affordable (Estimated to reduce 5-10% YoY - Goldman Sachs, 2015) ndreams.com

³⁵ <https://techcrunch.com/2014/07/21/facebook-acquisition-of-oculus-closes-now-official/>

³⁶ <http://zerolight.com/news/press-releases/zerolight-shortlisted-for-prestigious-smm-t-automotive-award-for-innovation-2015>

³⁷ <https://www.freeflyvr.com/developers/turbo-status/>

COMPANY	CORE STRENGTHS	GROWTH OPPORTUNITIES
 ZAPPAR Specialists in short form AR experiences made for mobile and headsets of the future to help capture the value in augmented reality. Uses patented image recognition technology and platform for a range of products including Retail, Gaming, Education and other segments	/ Clients and partners include Hasbro, Warner Brothers, Rovio, Sony, ASDA, McDonald's, Disney, Marvel / Reached over million mobile downloads by 2011. Recently partnered with Rovio to create "Angry Birds" augmented reality experience / Releasing additional Zappar powered picture books and their apps e.g One Direction picture book / Has developed an application for smartphones which provides an AR visual interaction experience. Businesses & publishers can create their own Zappar code for \$40/mo and license the app	/ Leverage existing global client list to build fast market credibility and drive new business opportunities and partnerships / Scope to gain brand coverage and market share in Media & Entertainment, and consumer goods industries by creating customised 'Zapcodes' to gamify and enrich content / Opportunity to democratise the creation of AR/VR content for the next generation of digital creative and developers through ZapWorks zappar.com
 BLIPPAR Provider of AR software through the Blippar app. Enables users to turn images into interactive Web experiences, via image recognition technology.	/ 1000+ brands onboard using their technology / Acquired 2 smaller competitor companies to strengthen its position in the market / High investor interest and secured investments of US\$99 million till date / Unique differentiation through proprietary Blip technology for brands, advertisers, and publishers to create interactive mobile content	/ Significant opportunity to dominate the AR mobile market as a brand leader and first mover / Unique differentiator - Building first ever AR search engine similar to Google search / Attractive joint venture and/or acquisition opportunity for global technology and media brands / Blippar's presence in consumer led industries including Fashion, Entertainment, and Music positions them as a strategic 'goto' company, as more global brands seek to enhance the customer user experience journey blippar.com
 MATTERPORT / VIRTUAL WALKTHROUGH (ACQUIRED) Provider of 360 virtual technology. Showcases commercial and residential properties via its 360° online virtual tour and immersive videos.	/ Virtual Walkthrough has a clear brand leadership and first mover advantage in the UK VR Real Estate market validated by early client wins and partnerships with CBRE (UK's largest commercial real estate services company), Hammerson and Keller Williams, including travel and hospitality brands such as Marriott and Intercontinental hotels / Over 200 clients including Sotheby's International Realty, Redfin, and Costar / Acquired by US-based, Matterport as a strategic acquisition to gain access to the UK AR Real Estate market	/ Virtual Walkthrough will gain significant market expansion leverage through the global distribution and financial strength of its acquirer, Matterport / Opportunity to gain brand leadership and market share as a first mover in the UK VR Real Estate market, and expand quickly into the Media and Entertainment Industry virtualwalkthrough.com
 TRILLENIUM Trillanium provides a platform for VR experiences by uniting 3D gaming and online shopping. Their software is compatible with existing VR devices. Has development headquarters in Croatia.	/ Founder, Hrvoje Prpic, is one of Europe's most successful retail entrepreneurs. His previous exit was one of the biggest domestic IPOs in Croatia and the Central Europe region. / Merger with ASOS led to growth in market opportunities and access and injected new capital to drive technology development, R&D, and expand partnerships / Winner of Pioneers of the Balkans	/ Trillanium is seeking to grow and scale in high potential VR content markets, such as, Real Estate, Automotive and Aeronautics / Significant opportunity to drive adoption through accelerated growth strategy; launching 150 virtual pop-up stores for major brands, by 2019 trillanium.com
 WIZDISH Developer of a VR treadmill platform. The company develops a locomotion platform which allows users to walk or run in VR worlds.	/ Limited market competition giving WizDish a front-runner position in transforming the traditional health and fitness treadmill experience - gamification and virtual worlds - Portable and compact product design and easy to maintain versus existing competitors / Supported by TechStars Accelerator / Early client wins: Samsung, Liberty Global, Wells Fargo, British Army / Global Brand Partnerships: Virgin Media" / Venture Beat top 100 most notable start-ups in May '16, 1 of 10 Virgin Media Techstars program winners, Best IEEE paper on VR with UCL in 2010	/ US and GB patents are in motion / WizDish has a first mover advantage with its innovative product design, in an emerging market with limited competition in the health and fitness domain / Established client logos will drive domino effect and lead to speedy market adoption and brand awareness wizdish.com
 VIEWEET Provides AR technology for the Real Estate industry, using 3D modelling. (Similar to Google Cardboard)	/ Established client base of over 250 organizations in real-estate & home building; including Mitchel Graham, Thomas Morris, Preston Baker among other major brands / Selected for Barclays Techstars Accelerator Programme, June'14 / Multiple product lines like Vieweet360, Vieweet VR, Vieweet Scan helping to accelerate partnership opportunities and hedge growth risk / Sells products in 27 countries	/ Leverage established brand and presence in the Real Estate industry to grow and scale / Opportunity to attract further investor rounds; Series A+ to fund growth, new product development, and global market expansion vieweet.com
 HOLOLAMP Developer of a portable spatial AR projector. A portable device offering a glass free and hands free AR experience.	/ Provides a live, holographic AR experience without needing wearable technology like AR glasses / Successfully raised seed round	/ Opportunity to create a niche in the AR Gaming space / Opportunity to enhance learning and education experience in schools using Holographic AR to drive user interaction and immersion / Long term opportunity to transform virtual communication using holographic AR versus video and telephonic conferencing hololamp.io



Software Model Company



Hardware Model Company



Hybrid Model Company



Augmented Reality Company



Virtual Reality Company

“

**Here you leave today
and enter the world of
yesterday, tomorrow,
and fantasy.”**

Walt Disney Company



GrowthEnabler

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