



Virtual and augmented reality

Science fiction is becoming fact as Augmented and Virtual Reality (AR/VR) enters our daily lives. The arrival and disappearance of 3D television was a false dawn, but signalled the beginning of a new era that is resulting in consumers and businesses around the world engaging with AR and VR in combination with smart devices.

Despite the still emerging nature of the technology, companies and investors are already identifying potential industries that could benefit from integration with AR/VR. Manufacturing healthcare are two vertical industries that have made significant headway in applying AR/VR technologies to their day-to-day work processes. The result has been greater efficiency, productivity and employee satisfaction. In addition, investment flows reveal a preference for AR over VR. This may correlated to prioritising industries as commercialisation takes hold. The aim of this white paper is to highlight recent developments unfolding across industries, companies and sub-sectors in AR/VR.



Hampleton director, Jonathan Simnett, predicts that as the sector develops there will be a reallocation of interest amongst the tech giants to more software-based companies as the market for hardware production stabilises. "This shift will see an overall increase in M&A, as companies begin to fully commercialise their VR/AR offerings at speed and look for opportunities to leverage hardware investments."



Jonathan Simnett Director



New players in an old game

Amongst the tech heavyweights and hot start-ups, global companies Cisco, HP and Accenture entered enterprise VR in 2H 2017. Cisco Spark is testing how people can start to collaborate in the real world and has launched the Cisco Spark app available in the Oculus store. As one of the largest professional services and digital agencies in the world, Accenture's entrance into extended reality is a large leap in the right direction. While consumer adoption has been slow, enterprise solutions is driving the adoption of AR/VR. Enterprises will choose to invest thousands of dollars on a Microsoft HoloLens headset which could result in saving them millions of dollars in costs of training employees. Other enterprises may also choose to use Dell's \$400 Windows mixed reality headset, for example, to train someone to drive a forklift. The majority of VR growth is likely to be driven by start-ups building revenue-generating businesses for specific industry sectors. This trend is likely to continue as enterprises embrace the new Microsoft Windows Mixed Reality headsets, which offer lower prices and easier setup. Advancements in display technology are largely responsible for the 47% growth in the tethered head-mounted display category. Finally, the recent announcements of new all-in-one, standalone devices, such as Oculus Go and HTC Vive Focus, bodes well for VR this year.





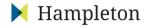














Sub-sector breakdown

Distribution Services

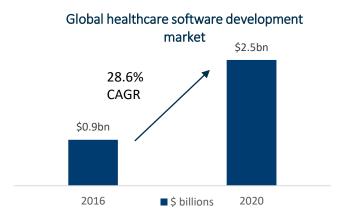
Tech and entertainment companies alike are pushing ahead to encourage consumers to experience and adopt AR/VR products.



Software Development

One of AR/VR software development biggest markets is global healthcare.

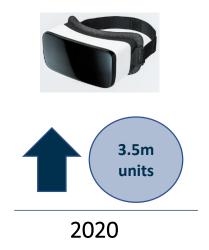
• Triple in size from 2015 to 2020.



Hardware

The global market for smart augmented reality glasses is expected to reach 3.5 million units by 2020.

- Driven by workflow transforming applications in the enterprise and industrial sectors.
- Enterprise sector: smart glasses along with smart phones and tablet PCs will evolve into the modern worker's second brain and help enterprise AR to bring in rapid improvements to employee productivity.





Vertical industry applications

The majority of VR's growth has been driven by start-ups building revenue-generating businesses for specific industry sectors. This trend is likely to continue in 2018 as enterprises embrace the new Microsoft Windows Mixed Reality headsets, which offer lower prices and easier set up.

Entertainment

Hollywood is embracing AR, VR and mixed reality, with accelerating investment by the entertainment sector. Stars Wars augmented reality app, stickers and posters is a testament to the rising use of AR/VR experiences that will help drive consumer interest in AR/VR. Major Hollywood players adopting the technology include AMC, Disney, DreamWorks Animation, HBO, Netflix, Sony Pictures, and Viacom.

Retail

Amazon is pursuing augmented reality tech to fuel a new focus on auto parts. The e-commerce giant already uses AR tech for its retail business through its iOS and Android apps, allowing customers to project renderings of furniture and electronics into their homes.

Healthcare

When it comes to start-ups in AR/VR, healthcare is the hottest new sector in 2018. From genetic research and emergency room management to clinical trials, virtual nurses and drug discovery, these new technologies are already creating new applications in healthcare. Users of medical VR have said that hospital experience can be improved, but also lower the cost of care.

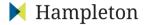
Manufacturing

Using augmented reality in the manufacturing industry can help companies solve the most complex challenges. Boeing's case of bringing Google Glass to the wire assembly process of their 787-8 Freighter is the top highlight.

Before AR technology, Boeing's employees needed to continuously consult a laptop to ensure that numerous wires were correctly assembled. The process caused fatigue in employees and was time-consuming in general.

With AR headsets, the company's employees now have the same information right before their eyes, making Boeing's wire assembly process faster and more comfortable. They can also issue voice commands conveniently and ask a colleague to join the headset's video stream to assist with complex tasks.

As a result, augmented reality manufacturing reduced Boeing's wire assembly process time by 25 percent and lowered errors to nearly zero percent. More so, the solution significantly improved employee satisfaction and, consequently, employee retention.



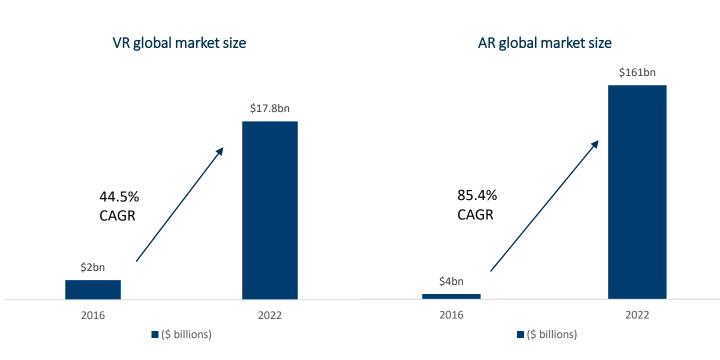


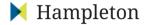
Global market trends

Key attributes

The accelerating growth of the global AR and VR markets can be attributable to key underlying factors:

- Definitive presence of smart phones and tablet computers
- High mobility and versatility
- Increasing interest of large tech corporations and technological advancement.
- Increase in the awareness about AR and VR technologies among consumers
- Mass scale adoption of AR/VR in various industry verticals
- Integration of AR/VR to create mixed reality for future applications.







Geographical breakdown



North America APAC

USA still champions #1 as the world's largest AR/VR market, driven by huge R&D investments

Hardware segment: most prominent companies are USA-based, cultivating further AR/VR growth in the North American region

Non-USA based companies have significant presence in USA due to manufacturing facilities and R&D bases

USA delivered more AR/VR revenue than China in 2017, but in the next 5 years Chinese growth could dominate the market long-term by a significant margin.

Fastest growing regional market, by their increasing adoption of smartphone-based AR/VR games

Growth in this space has been facilitated by:

- Digitalizing lifestyles
- Low-cost smartphones
- Commercialisation of AR/VR head-mounted displays
- Expanding middle class population demanding a more engaging virtual experience of the digital world

Presence of big players in APAC e.g. Samsung Electronics, Sony Corporation, HTC Corporation, expected to push growth in this region

China expected to play an important role due to well- established manufacturing and engineering sector

Europe: a rising star

Amongst all the action in the world's battleground, Europe is set to become a global VR leader. A recent study by Ecorys, a European research firm, projects that by 2020 the production value of AV/VR will increase between EUR 15-34bn in Europe and will create up to 480,000 jobs across the continent. This economic up-scale will place Europe's AR/VR market first-in-class. This is supported by Europe's long-standing foundations of VR research and manufacturing, highly-skilled workforce, strong creative industry and cultural diversity, creating a clear competitive advantage and marking its position as an important player in the global VR industry.



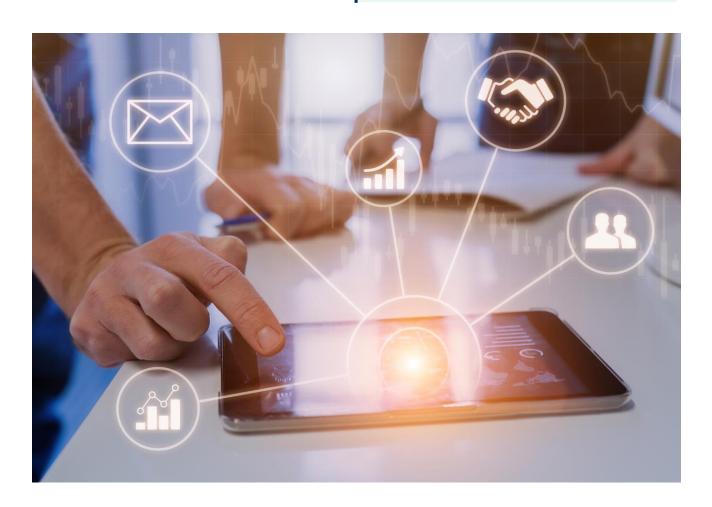


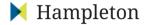
AR/VR Investment overview

Fundraising trends

- **1.** Investment has seen a significant rise as the industry begins to gain traction
- **2.** Start-ups raised a record \$3.6 billion from VCs and corporates in last 12 months to the end of Q1 2018.
- 3. Over \$750m was invested in Q1 2018 alone
- 4. There has been a fundamental transition in the fundraising market from VR to AR, specifically into very-early stage dynamics of mobile AR. As anticipated at the start of 2018, this has been driving an acceleration of fundraising trends

- **5.** 2018 is a transitional year and, as expected, overall deal volumes declined slightly in the short-term as VCs and corporates look to medium-term mobile AR and long-term smart- glasses growth
- **6.** Early-stage tech markets' mega-rounds take the lion's share of dollars invested
- 7. Q1 2018 provided further big rounds for Magic Leaps (\$461m), Improbable (\$502m), Niantic (\$200m), and Unity.
- **8.** Investors favour AR over VR. VR start-ups have found the fundraising environment challenging since mid-2017. This is possibly due to high friction on uptake from consumers, delaying VR's mainstream adoption.







Top investors

Investors	Investments 2012-2018 YTD	AR/VR Funding
ROTHENBERG VENTURES	37	Meta AR hardware and software developers Jaunt VR Cinema developers Emergent VR software developers
bostVC	24	Mindshow Realities VR software engineering TheWaveVr Music festival VR SculptrVR VR architecture design
△ VIVE×	24	Limitless Cloud-based VR software The Rogue Initiative VR Cinema developers Mindesk VR software developers
THE VENTURE REALITY FUND	13	InstaVR VR software developers Vizor VR hardware and software developers Immersv VR hardware and software developers
PRESENCE CAPITAL	11	VREAL VR software developers Scope AR AR software developers Simbe Robotics development
tech stars	11	Applied VR Healthcare VR software developers IrisVR VR software developers Fantasmo Studios 3D AR developers
colopl next	10	Fishbowl VR VR software testing Fove Eye-tracking VR hardware developers Psychic VR Lab VR and AI software developers



Source: CB Insights

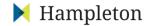




Top funded AR & VR start-ups

Company	Total funding (\$m)	Abstract
magic leap	1,888	Wearable cinematic VR technology
unity	689	VR/AR game development
∽ DAQRI	275	Enterprise augmented reality
NIANTIC	225	AR games for mobile
LYTZO	216	Imaging technology for VR
♥ NEXT VR	115	VR broadcasts for live events
6 NantMobile	110	Image recognition for AR
mındmaze	109	VR technology for neurorehabilitation and gaming
• sphero	107	Cinematic VR technology
JAUN1—	100	Connected toys

Source: CB Insights





Top Players – Augmented Reality

Magic Leap

One of the most funded start-ups is Magic Leap, based in Florida. They specialise in the development of a 'photonic chip' which uses digitally rendered photons to supplement reality. Despite Magic Leap's secrecy in its product, it has received an impressive \$1.4 billion total funding after its series C round, with significant investments from Google in 2014 and Alibaba in 2016. The company is expected to enter its series D round in the coming months with a possible valuation of \$6-8 billion. However, the increased pressure from competitors and investors to see a final product have been noted, with Magic Leap reportedly aiming to have a prototype product released by late 2017 to early 2018.

Niantic

Google's spin-off project Niantic has evolved as an independent and innovative company focused on creating augmented reality games. Niantic is the creator of Pokémon Go, which will be followed this year by a Harry Potter-themed AR game, Wizards Unite. The key characteristic of their AR games is that it makes people go outside, explore the real world and discover augmented reality interactions in select locations.

Microsoft

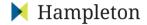
One of the most renowned software development companies joined the race to become one of the leaders in AR/VR. Microsoft developed a headset, HoloLens, describing its approach as a mixed reality. It incorporates both AR and VR in its philosophy and works on games, apps including developing a demo AR version for their messaging service Skype for HoloLens.

INDE

A UK-based company that holds several patents and awards in AR technology. INDE develops a range of AR solutions for smartphones and large screen, with a blue chip customer base including National Geographic, 20th Century Fox, Universal Studios, Smithsonian Museum, and WWF.

Vuforia

Vuforia is the mastermind behind the most frequently used software development kit for the development of AR reality games and apps. It allows developers to create marker-less and location-based AR interactions and experiences. In addition, its APIs work with a range of common programming languages such as C++, Java and .Net. It can be used to create both hybrid and Android/iOS native apps.





Top Players – Virtual Reality

Google

Google has been one of the first movers in this space and has made ground-breaking progress in both AR and VR. In 2013, it developed the first commercial model of smartglasses, Google Glass. Despite failing to gather momentum in the sale of Google Glass, Google nevertheless hold a dominant position in the hardware market. Its next product, Google Daydream headset, helps smartphone users experience VR games and movies and is the cheapest VR headset which works with Android smartphones, originally priced at \$15.

Oculus

The Oculus Rift is one of the best known VR headsets available on the market. The PC-tethered headset is capable of offering highly immersive and realistic VR experiences. Their official Rift Experiences includes a varied catalogue of products, both free and premium, categorized into games, movies sports, music, travel, documentaries and history, entertainment and apps. Oculus joined up with Facebook to launch a new product this year, Oculus Go, which allows people to experience virtual reality without a computer. They hope their new product launch will facilitate a mass adoption of VR amongst consumers.

HTC VIVE

HTC VIVE support and develop this space in many forms. Their most visible efforts to encourage development in VR technology is their VR headset. However, they have also created an AR/VR accelerator programme, VIVE X, through which it invests in start-ups that have the potential to add value and innovation to this technology field. VIVE Studios is a platform for talented developers who gain access to the full know-how of the company to create valuable and useful VR apps and experiences.

Samsung Gear VR

Samsung's headset was created in collaboration with Oculus, but the company best known for their smartphone manufacturing has launched its own platform where headset owners can discover a variety of content, create their own with the Samsung 360 camera and share it with other users.

Space VR

Space VR started an ambitious project, consisting of astronauts and ex-NASA employees, to install 4K 360-degree cameras on satellites and deliver high-quality VR images of the Universe to users down on Earth.





Notable Acquisitions

Top acquirers	Target	Target abstract
Ć	SensoMotoric Instruments GmbH FlyBy Media Emotient Inc.	Sensor-based eye tracking systems Mobile virtual reality software Facial recognition & analytics SaaS
Google	Owlchemy Labs Eyefluence Inc. Thrive Audio	Virtual reality-based online video games Sensor-based eye tracking systems Virtual reality headphone system
	SimplyGon Mojang	3D optimisation software & SaaS Swedish video game developer
f	TheEyeTribe.com Two Big Ears Ltd. Surreal Vision	Sensor-based eye tracking systems VR audio software & SDKs 3D virtual reality software
SABOREM!	Enterspace AB ePawn InfinitEye VR SAS	Location-based VR software development AR software developers French virtual reality headset
MEDIATECHNIC SOLUTIONS	TGT Studios Shooterboy Entertainment Into the VR World	Australian mobile game asset VR mobile video game asset VR online retailer
magic leap	FuzzyCube Software Dacuda NorthBit Ltd.	Mobile game development studio 3D software division Mobile application test & development





Conclusions & contacts



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AR/VR has come a long way and even though there not has been an 'iPhone moment' yet, confidence in both the technology as well as the use cases is growing stronger. Since AR/VR has its technical roots in the gaming industry it was foreseeable that it would get more social (in addition to the very successful multiplayer games). Therefore, rather than one person entering a virtual world, consumers can now share virtual experiences, addressing previous apprehension to the market.

Furthermore, whilst AR/VR was predominantly used to support sales and marketing, more and more effort now flows towards AR/VR in supporting industry and manufacturing processes. Progress is slower than the optimists had hoped, yet it seems to be stronger and more sustainable than the pessimists predicted.

Hampleton produces regular reports on M&A activity in the following sectors:

- AR/VR
- Artificial Intelligence
- Automotive Technology
- Cybersecurity
- Digital Marketing
- E-Commerce
- Enterprise Software

- Fintech
- Healthtech
- Industry 4.0
- Internet of Things
- IT Services
- SaaS and Cloud

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