Growth of **Immersive Media-** A Reality Check

NASSCOM® 2019

Table of Contents

1. Report Introduction & Methodology	3
2. Executive Summary	4
3. Overview & Evolution	6
4. Immersive Media Ecosystem	10
5. Global Market Analysis	16
6. Applications & Use Cases	21
7. Emerging Technology Innovations	31
8. The India Story	35
9. Recommendations	51
Profiles of Key Players	55
Appendix – Additional Case Studies	65
Acknowledgements	71
Glossary of Terms	72
About Nasscom	73
Disclaimer	74

1 Report Introduction & Methodology

Background, Scope and Objective

- This report aims to provide an assessment of the current market for Immersive Media both globally and in India.
- This report provides a summary view of the following with respect to Immersive Media: Brief Introduction & its Evolution, Ecosystem Players, Market Size and Growth Estimates, Key Applications and Use Cases, Analysis of the Indian Market, Key demand drivers, Factors limiting growth, along with the key recommendations that may propel the growth of the Immersive Media market in India.

Details of Research Tools and Methodology

- We conducted Primary and Secondary Research for our market analysis. Secondary research formed the initial phase of our study, where we conducted data mining, referring to verified data sources such as independent studies, technical journals, trade magazines, and paid data sources.
- As part of the Primary Research, we performed in-depth interviews with stakeholders from throughout the Immersive Media ecosystem to gain insights on market trends, demand & supply side drivers, regulatory scenarios, major technological trends, opportunities & challenges for future state analysis.
- Stakeholders from the ecosystem included industry bodies, hardware OEMs, platform developers, system integrators, application developers, content developers, consumer enterprises and Global experts.

2 Executive Summary

- Immersive Media is defined as the media output with the ability to experience standard media in a multi-dimensional realm achieved by combining reality with technology. With the evolution of technology it has become possible to combine three dimensions of human sensory capabilities i.e. Sound, Sight & Haptic Feedback to create an immersive experience.
- Technologies that propagate immersive media to users include Augmented Reality (AR), Virtual Reality (VR), Mixed Reality (MR) and 360^0 Video.
- Immersive Media supply side ecosystem comprises five key categories of players: Hardware, Technology & Platform Developers, Application Developers, Content Producers, and System Integrators.
- The evolution of Immersive Media has been in progress for over 50 years, but has picked pace only in the last decade, especially with evolution in hardware devices and growth of technology & platform development.

- The Global Immersive Media market is estimated at USD 18.4 Bn in 2018 and is projected to grow at 76% CAGR to reach USD 179 Bn by 2022.
- Currently, USA is the leading market with as much as ~1/3rd market share of the Global Immersive Media market. By 2022, while US is estimated to continue to garner 1/3rd share of Immersive Media spending; China, Japan, Germany and UK are projected to emerge as markets with significant Immersive Media spending.
- The industry has captured significant interest of investors over the last few years - Globally Immersive Media industry has attracted over USD 7.5 Bn funding during 2013-17.
- Enhancing experiences related to 'Connect', 'Know', 'Learn', 'Explore' and 'Play' are the key applications of Immersive Media.
- As per 2017 estimates, Enterprise contributes to 2/3^{rds} of the Immersive Media Spending, while Consumer spending contributes to the remaining 1/3rd.
- Automobile, Heavy Industries, Real Estate and Training are the key enterprise verticals driving the Immersive Media market.
- Camera & Image Capture (Multi-Lens Camera, 3D Sensing Camera, Smart Contact Lens), 'Mapping & Environment' (Simultaneous Location & Mapping), and 'Display' technologies (AMOLED-based Micro Display, High Angular Resolution FOV) are areas witnessing significant technology innovations, which is also aiding the growth of Immersive Media.

India Story

- Immersive Media Market in India is estimated at USD 0.55 Bn in 2018, but is expected to grow to USD ~6.5 Bn by 2022. Augmented Reality is estimated to grow to USD 5.9 Bn, while Virtual Reality is estimated to grow to USD 0.5 Bn by 2022
- Real Estate, Media & Entertainment, Automotive and Retail are expected to be the verticals with maximum adoption of Immersive Media
- Indian AR-VR supply landscape comprises of significant large and small players in the areas of 'Tech & Platform Development', 'App Development' and 'System Integration' – both the domestic and the global Immersive Media market provides a significant opportunity for these players to tap into
- Partnerships and collaborations are expected to be the key drivers of the ecosystem in India, with majors such as Facebook, Snapchat, Niantic forging relationships with Indian firms

Key Growth Challenges

- Prohibitive costs of AR and VR devices in India is acting as a deterrent to adoption across Consumer, Retail & Small & Medium Enterprise market segments
- Availability of relevant content due to diverse requirements and technology limitations is a significant challenge for immersive media growth
- Awareness about Immersive Media value proposition and return on investment lacking in quantitative and qualitative view

Recommendations

In addition to the growing domestic demand, India has the potential to emerge as a large supplier of the global AR-VR demand leveraging its stronghold in technical capabilities across engineering, app development and content creation. Some measures which may accelerate this growth are:

- The Indian Government plays a dual-role to enhance growth of Immersive Media in India – 1. Act as a consumer, and 2. Act as an Enabler/Catalyst. Initiatives to ensure affordability of devices through Government support and programs may be considered
- AR-VR players improve availability of skilled and competent talent leveraging both formal and vocational education ecosystem
- AR-VR players improve focus on creation of customized content in order to appeal to larger masses across age groups, cultures, regions and other demographics and for businesses

3 Overview & Evolution

Immersive Media is transforming the way users experience reality. This section provides an understanding of Immersive Media and its evolution over the years

1. Immersion is a combination of Visual, Sound and Haptic feedback, which in turn is experienced only through Augmented Reality, Virtual Reality, Mixed Reality and 360^0 Video – known commonly as Immersive Media

2. The Immersive Media industry has been in a nascent form for the last 50 years, and has started growing in the last decade

3. Applications of Immersive Media have increased significantly for Enterprise as well as Consumers across sectors such as Automobile, Retail, Real Estate, Education etc

4. Key Drivers for the growth of Immersive Media are incremental quality of the content available, enhanced connectivity and superior device capabilities

5. Immersive Media is no longer about an alternative display technology but is being looked at as a transformative way to consume content

3.1 | An Introduction to Immersive Media

Immersion, as a concept is the unity between three specific dimensions of human experience capabilities. Sound, Sight and Intuitive Interactions form the three pillars. These operate independently of each other to create experiences on their own, but a truly immersive experience is created when the three come together to form one unified experience.

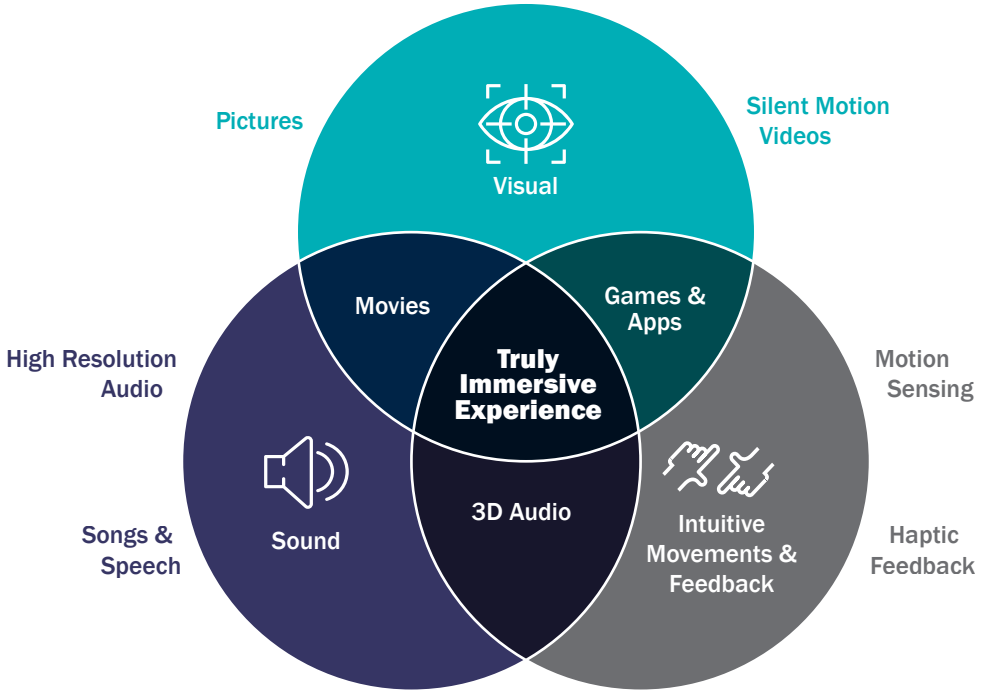


Figure 1: Dimensions of Immersive Media

Immersive Media is defined as the ability to experience standard media in a multi-dimensional realm combining reality with technology. Technologies that propagate immersive media to the users include Augmented Reality (AR), Virtual Reality (VR), Mixed Reality (MR) and 360^0 Video as illustrated in Figure 2.

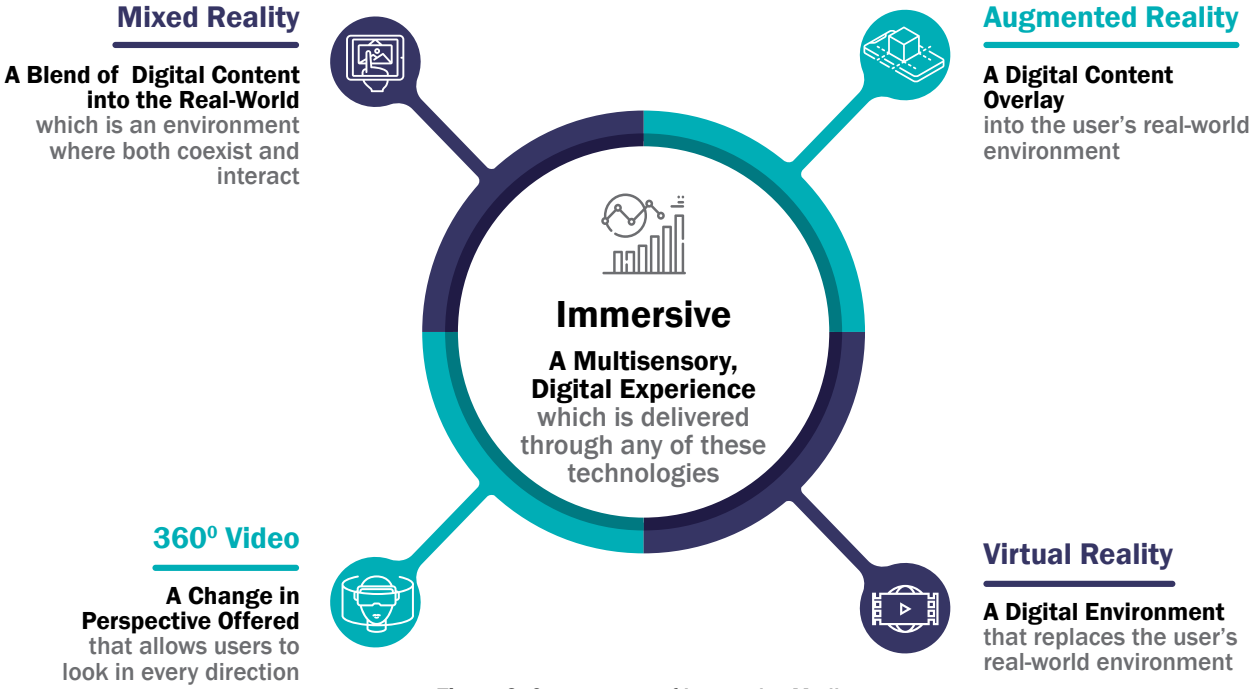


Figure 2: Components of Immersive Media

3.2 | Evolution of Immersive Media

The evolution of Immersive Media has been in progress for over 50 years, with Augmented Reality coming into existence in the year 1968. The term Augmented Reality came into existence only in 1990 and emergence of applications across Engineering, Media & Entertainment and uses in Industry have driven evolution of the technology as well as the ecosystem. With significant advancements in computing and display technologies, AR VR and MR applications will find greater number of applications with shortened product develoment cycles.

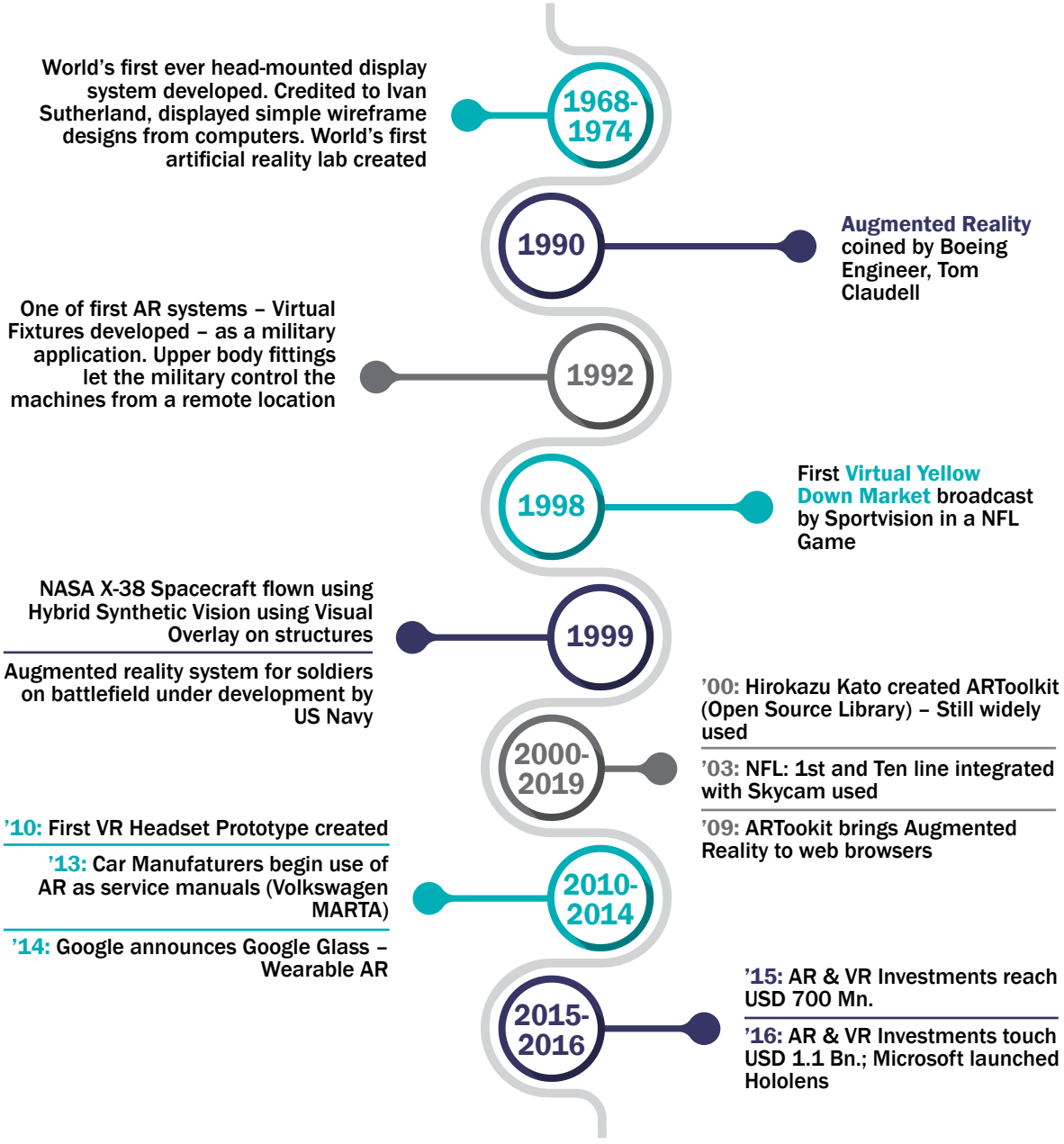


Figure 3: Evolution of Immersive Media

As depicted in Figure 3, the ecosystem of Immersive Media has evolved from simply being an alternative display technology to being a potential multi-sensory experience providing technology (Sound, Sight, Haptics etc.). It is currently being viewed as one of the drivers of the future of computing, entertainment and business as well.

The ecosystem is moving towards higher quality content created through advanced tools, platforms, devices as well as integration of multiple skills.

Key trends expected in the evolution of the ecosystem are as follows:

With increasing investment in R&D by various players, current device limitations will be overcome leading the way for better and first improved devices.

With technological advancement form factor of AR VR devices will further improve thus allowing seamless integration in daily lives across various use cases

The application ecosystem will get strong with focus on creation of applications and customized content. These developments will find multiple use cases across sectors e.g. Capital Goods, Heavy Manufacturing, Hospitality, Retail, Media & Advertising and Healthcare

4 Immersive Media Ecosystem

The Immersive Media Ecosystem consists of various players with unique roles to play in the value chain.

1. The immersive media ecosystem is made up of six key players - Hardware Producers, Technology & Platform Developers, Application Developers, Content Producers, System Integrators and Users

2. Hardware plays a significantly large role in the immersive media ecosystem, with hardware manufacturers increasing their focus on ergonomics, creation of untethered devices and potentially adding multi-sensory capabilities

3. Evolution of platforms and tools led by OS Developers such as Apple (ARKit 2) and Google (ARCore) have led to the mass availability of applications on both OS-powered smartphones leading to further proliferation of AR

4. Highly advanced hardware management protocols built into Software Development Kits (SDKs) has allowed focus to shift to UI & UX from the traditional performance management of smart devices

5. With increasing involvement of various data sources to create immersion experiences, there is an increased complexity for immersive solutions. Hence system integrators have a significant role to play in the future

4.1 | Immersive Media Ecosystem

The Immersive Media ecosystem is composed of 6-Key Players – Hardware Producers, Technology & Platform Developers, Application Developers, Content Producers, System Integrators and Users. Other than these, the Government in the form of Regulators and Policy Formulators play a critical role in the growth of the Immersive Media adoption in any country.

4.2 | Immersive Media Value Chain

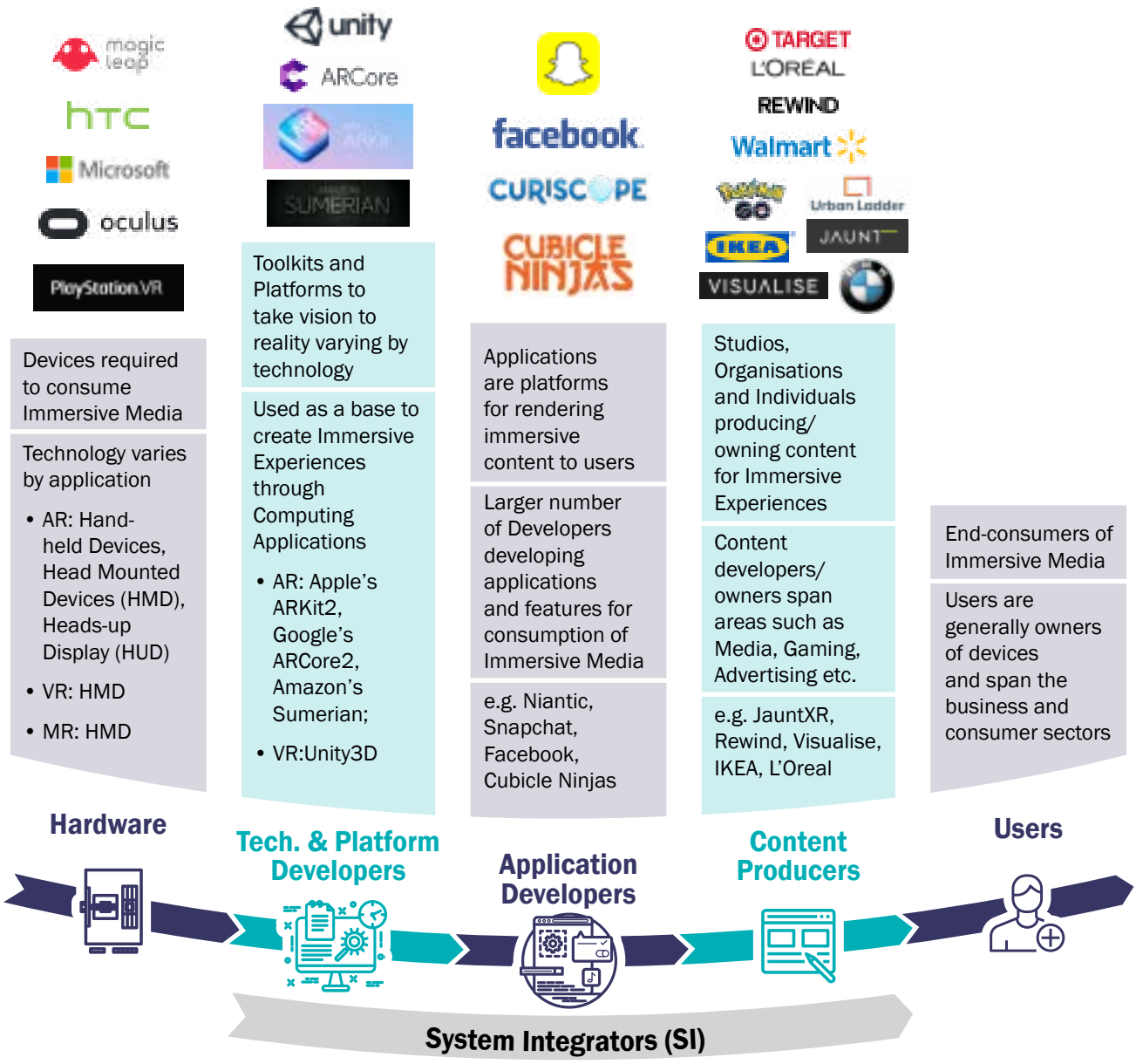


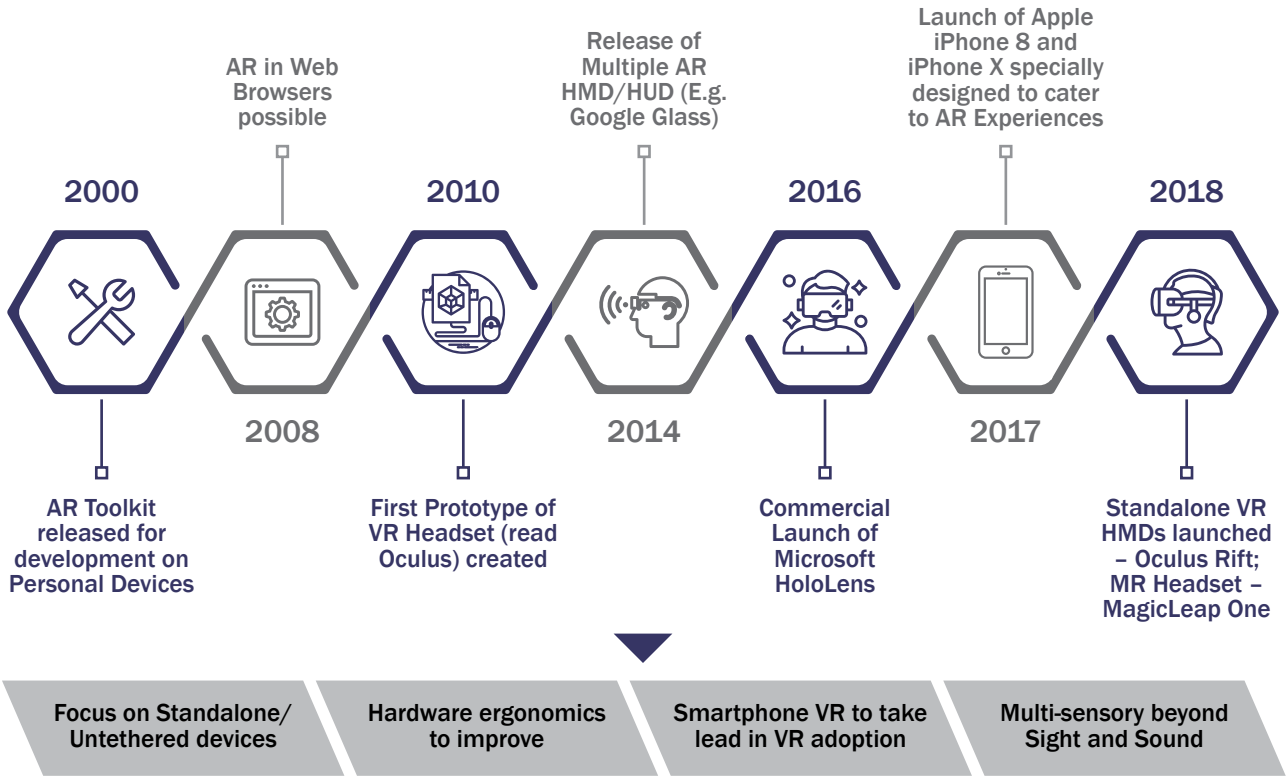
Figure 3: Value Chain of Immersive Media

Hardware

Physical devices that are used to consume content across the Immersive Media spectrum

Devices vary by type of Immersive Media e.g. Augmented Reality is consumed on Smartphones, HMD etc., while VR is consumed through VR- HMD only

Evolution & Trends



Focus on Standalone/ Untethered devices

Hardware ergonomics to improve

Smartphone VR to take lead in VR adoption

Multi-sensory beyond Sight and Sound

Impact on Growth of Immersive Media

Hardware advances in Handheld Smart Devices have led to potential for mass-adoption of Augmented Reality

Virtual reality has seen a positive shift with hardware ecosystem players producing devices with smartphone-based inserts, along with the more expensive tethered devices

Mixed reality has become a possibility with Microsoft's launch of Hololens, and Google-backed MagicLeap launching devices

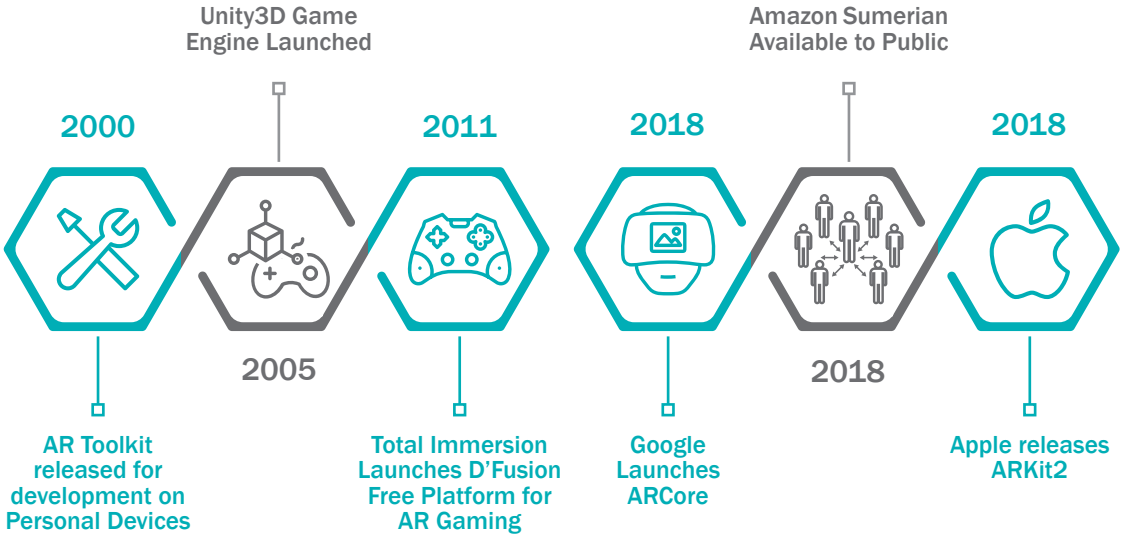
360^0 Cameras are improving in form factor, resolution and data transmission to ensure high quality image capture

Tech. & Platform Developers

Developers who create tools and platforms for the creation of immersive media applications and content

Platforms today have been developed by both Mobile OS developers, as well as stand-alone tool developers

Evolution & Trends



Launch of Major SDKs by Apple & Google

Focus shifting to UX from back-end performance

Impact on Growth of Immersive Media

Developers creating toolkits and platforms have played a significant role in driving mainstream adoption of Augmented Reality and Virtual Reality

Large investment driving SDK enhancents leading to better quality which will drive adoption

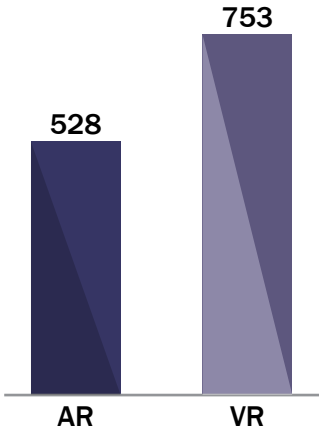
As SDKs are integrated to the device, uniquely built by the OS developer with advanced hardware performance management inbuilt, the larger focus is now on User Interface and User Experience and not device performance management such as Battery life, Processor Use etc.

Application Developers

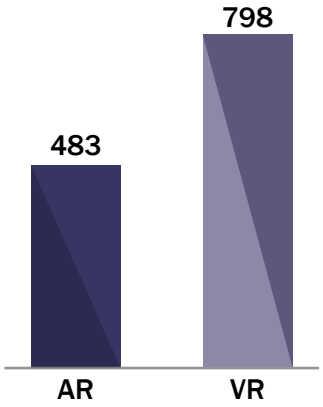
Developer Ecosystem that creates applications for Smart Devices, Computers, Consoles and other devices for rendering an immersive experience based on the technology of choice – AR, VR, MR, or 360^0 Video

Evolution & Trends

No. of Companies Founded (2013-2018*)



Total Funding (USD Mn.) (2013-2018*)



Applications of AR to grow faster due to non-requirement of additional hardware

Immersive applications to grow beyond Gaming, Real Estate, Media & Advertising, Social Media

Enterprise Sectors will begin development of highly specialized immersive apps

Impact on Growth of Immersive Media

Applications for Immersive Media have been centered around Gaming, Real Estate, Media & Advertising and Social Media

Social Media organizations such as Snap Inc. (Snapchat) and Facebook's recent strides in AR and VR to render content for consumption and sharing have led to exponential growth in the number of consumers

*:July 2018 Source: Traxcn

Content Developers

Producers of content that is consumed by the end-user across the Enterprise and Consumer ecosystems

Content can be in the form of Video, Audio, Graphics, Animations, Images etc. and can transcend any of the immersive technologies

Trends

- Content studios focusing on developing content for MR and VR
- Media & Entertainment sector showing most potential for content consumption in VR
- Virtual Presence for Enterprises, Training & Employee Development on VR

Impact on Growth of Immersive Media

Growth of quality content with greater contextualization has led to the growth of Immersive Media

Increasing adoption of VR in Media & Entertainment will enable its larger role in Film & Broadcasting

Content Producers and Owners are delivering various applications across Gaming, Retail, Education, Learning, Social Media etc. leading to a larger uptake

System Integrators

Responsible for delivering and rolling out complex solutions

Capabilities span Content Development, Application Development and Technology Integrations

Trends

- Augmenting capabilities in Content Development
- Working closely with Device Manufacturers carrying design feedback from Enterprise Clients
- Increasing investments in acquisition of tools and technologies to enhance overall delivery capabilities

Impact on Growth of Immersive Media

Enterprise interest in Immersive Media has increased in the last 5-7 years, with System Integrators designing and deploying these complex solutions for large corporations

Developing internal capabilities across multiple functional areas has led to the growth of reliance on the System Integrators

5 Global Market Analysis

Immersive Media globally has witnessed low adoption, but is on the cusp of growth - estimated to grow at 76% (CAGR) over the next 5 years

1. The Global Immersive Media market is estimated at USD 18.4 Bn in 2018 and is projected to grow at 76% CAGR to reach USD 179 Bn by 2022

2. Currently, USA is the leading market with as much as ~1/3rd market share of the Global Immersive Media market. By 2022, while US is estimated to continue to garner 1/3rd share of Immersive Media spending; China, Japan, Germany and UK are projected to emerge as markets with significant Immersive Media spending

3. The industry has captured significant interest of investors over the last few years - Globally Immersive Media industry has attracted over USD 7.5 Bn funding during 2013-17

4. As per 2017 estimates, Enterprise contributes to 2/3^{rds} of the Immersive Media Spending, while Consumer spending contributes to the remaining 1/3rd, with Automobile, Heavy Industries, Real Estate and Training are the key enterprise verticals driving the Immersive Media market

5. Camera & Image Capture, Mapping & Environment, and Display technologies are areas witnessing significant technology innovations, which is also aiding the growth of Immersive Media

5.1 | Global AR & VR Spending Estimates

Global AR & VR Spending Estimates – 2015-22 (USD Bn.)[3]

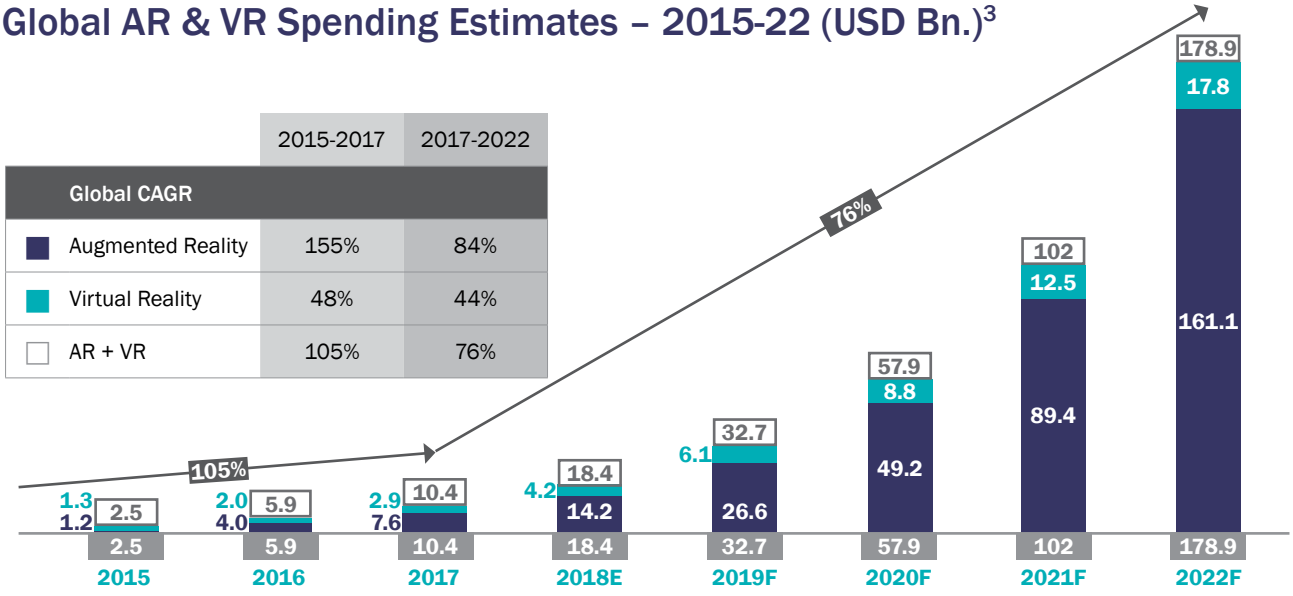


Chart 1: Global AR and VR spending (2015-2022)

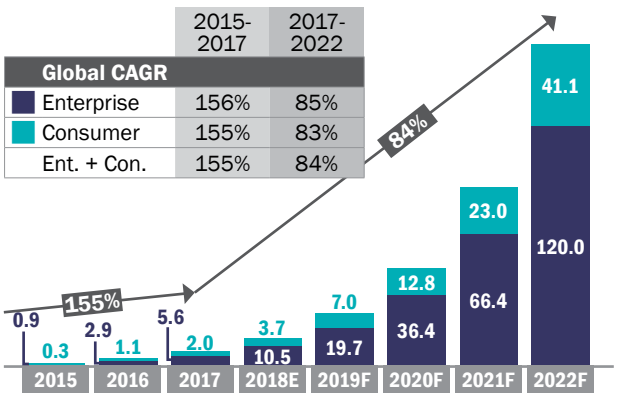
The global Immersive Media market has grown from USD 5.9 Bn in 2016 to USD 18.4 Bn in 2018 and is expected to reach USD 178.9 Bn by 2022. Gaming, Media, Entertainment, Retail, Medical and Healthcare, Digital marketing, Industry training and support are some of key Industries expected to drive the market

5.2 | Immersive Media Market: Enterprise vs. Consumer, Geographical split

As per 2017 estimates, Enterprise contributes to 2/3rds of the Immersive Media Spending, while Consumer spending contributes to the remaining 1/3rd. Both Enterprise and Consumer spending are estimated to grow at a significant pace (as shown in the Figure below) and the contribution percentage of the two segments is estimated to stay within the same range.

Enterprise Market vs Consumer Market Growth for Immersive Media[4]

Global Augmented Reality Market
(Consumer vs. Enterprise) (USD Bn.)



Global Virtual Reality Market
(Consumer vs. Enterprise) (USD Bn.)

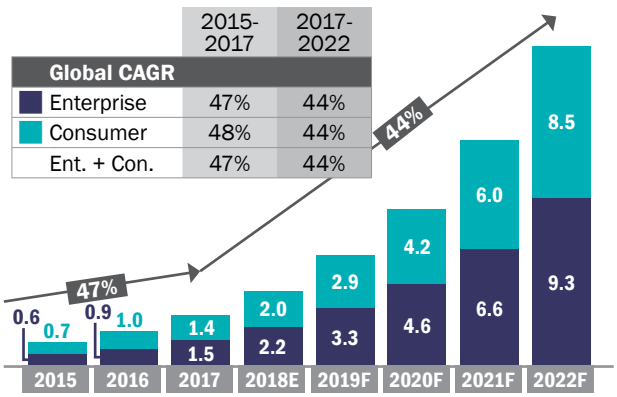
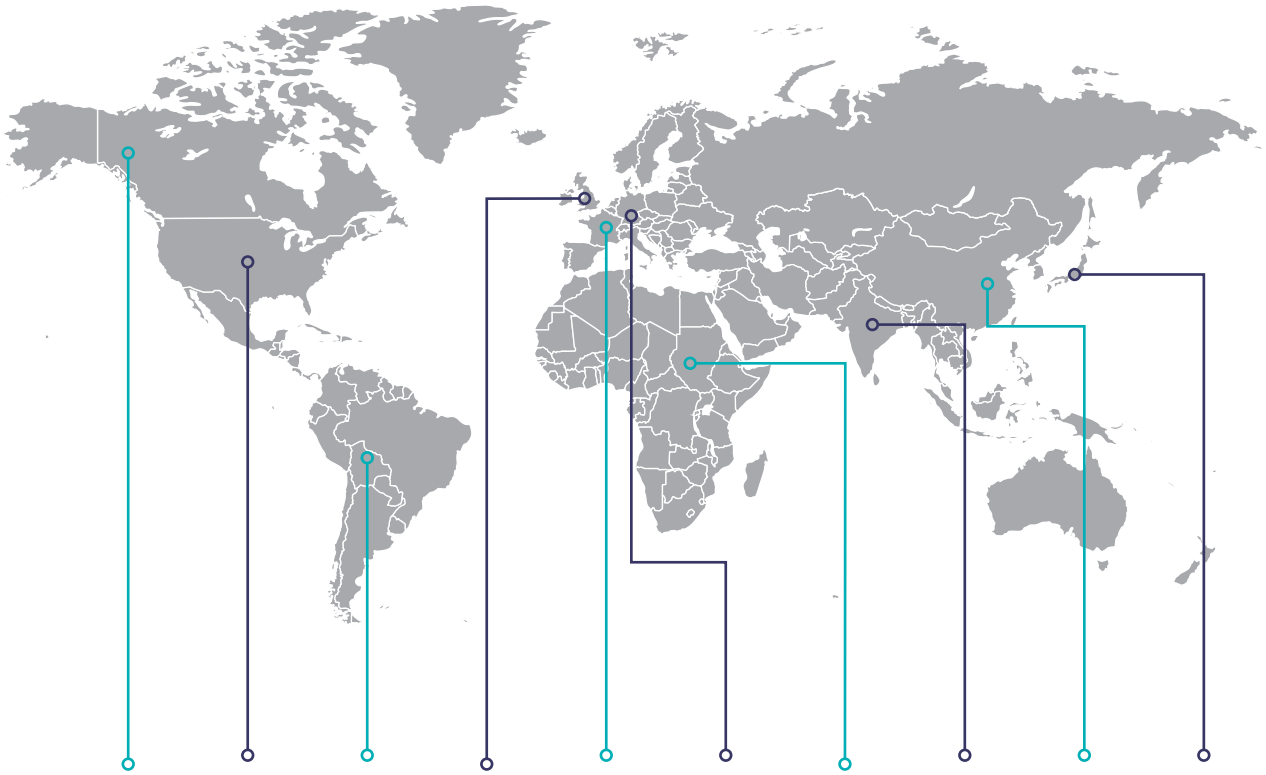


Chart 2: Growth of Immersive Media - Enterprise vs. Consumer Segments

3,4 | Deloitte Analysis, BIS Research

Immersive Media Market Size & Growth across Geographies – Select Markets[5]



		Canada		USA		Latin America		UK		France		Germany		ME & Africa		India		China		Japan	
		AR	VR	AR	VR	AR	VR	AR	VR	AR	VR	AR	VR	AR	VR	AR	VR	AR	VR	AR	VR
2015 - 2017	Size in 2017	0.2	0.1	2.6	1.1	0.4	0.1	0.6	0.3	0.4	0.1	0.8	0.3	0.3	0.1	0.2	0.1	0.6	0.2	0.7	0.2
	CAGR	168%	55%	159%	48%	139%	43%	157%	49%	153%	49%	148%	45%	136%	41%	172%	57%	170%	55%	165%	50%
2017 - 2022	Size in 2022	6.1	0.7	59.3	6.6	5.4	0.6	0.2	12.5	8.1	0.9	15.7	3.5	0.4	0.1	6.0	0.6	15.6	1.6	17.7	1.6
	CAGR	90%	49%	86%	44%	71%	39%	85%	45%	83%	45%	80%	43%	69%	37%	91%	57%	92%	50%	89%	45%

Size is in USD Bn. (Also, for 2017-22 calculated with values from 2018-2022), CAGR in %

Figure 5: Immersive Media Growth across Markets (Select Market)

Currently, USA is the leading market in terms of Immersive Media spending with ~1/3rd of the global market. By2022, while US is estimated to continue to garner 1/3rd share of Immersive Media spending, China, Japan, Germany and UK are projected to emerge as markets with significant AR-VR spending.

5 | Deloitte Analysis, BIS Research

5.3 | Funding & Growth of Immersive Media Organizations

Augmented Reality and Virtual Reality have seen a sharp growth in the interest of entrepreneurs and investors alike in the last 5 years. The large investments in Immersive Media across Augmented Reality and Virtual Reality companies in the last 5 years are testament to the potential of Immersive Media to become the next wave of technology in computing and entertainment.

Number of Companies Founded providing Augmented Reality & Virtual Reality[6]

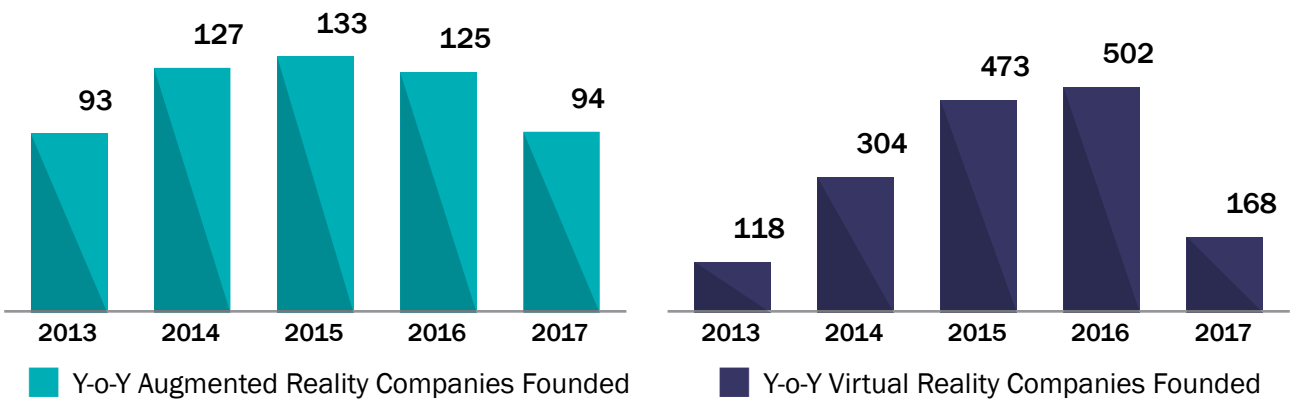


Chart 3: Total Count of Companies Founded Y-o-Y (2013-17)

5.3.1 | Immersive Media Market: Enterprise vs. Consumer, Geographical split

Augmented Reality & Virtual Reality Funding[7]

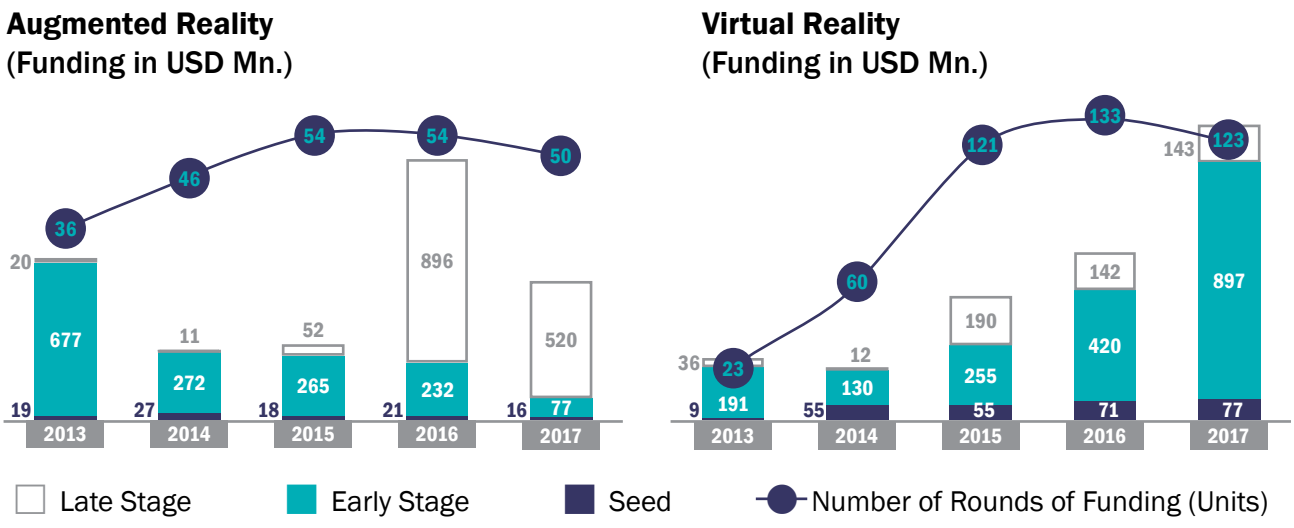
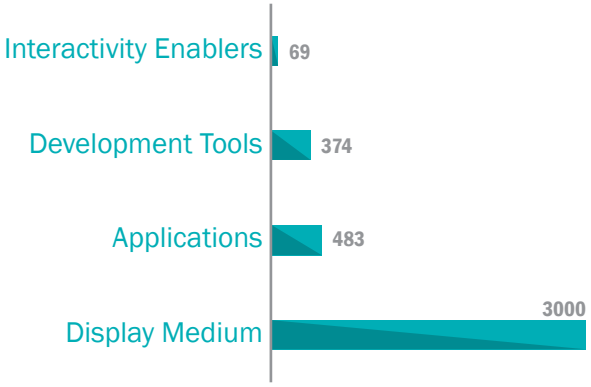


Chart 4: Funding Amounts & Total Funding Rounds (2013-17)

6,7 | Deloitte Analysis, Tracxn Technologies Private Limited

Sub-Sector Funding Activity (2013-2018)[8]

Total Funding (in USD Mn.)



Total Funding (in USD Mn.)

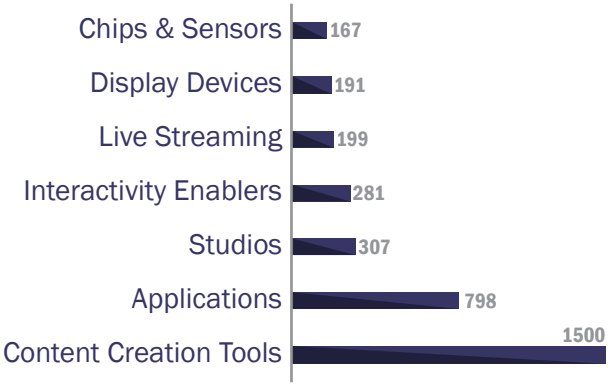
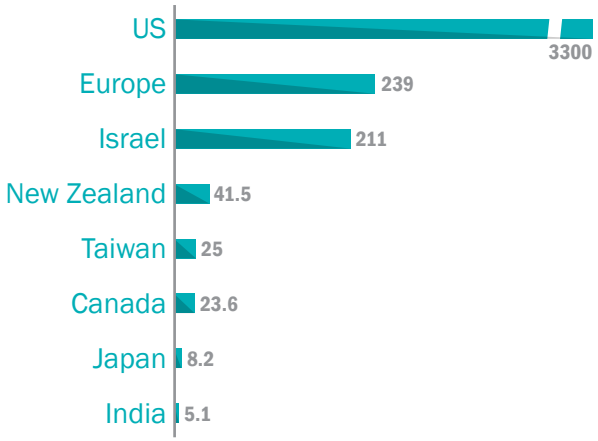


Chart 5: Sub-Sector Funding Activity in Augmented Reality (Left) and Virtual Reality (Right) (2013-YTD 2018)

Investment activity in the sub-sectors shows a difference in approach. While Development Tools seem to have 9.5% of the total investments in Augmented Reality, Tools for Content Creation have received about 43.5% investments over the last 5 years. This speaks of the reduced dependence of investments in creating and making better development platforms with the advent of SDKs from major device manufacturers. However, the increased investment in Content Creation Tools for VR indicates the enhanced need to ensure high-quality content being developed in order to continue to maintain interest, demand and supply of Immersive Experiences through Virtual Reality.

The Geographical division between investments points to a large chunk of the funding being routed to the United States. Other regions and countries such as Mainland Europe, China, Israel, Japan, India, and New Zealand etc. are attracting investments as well.

Geographical Distribution of Investments in Immersive Media[9]



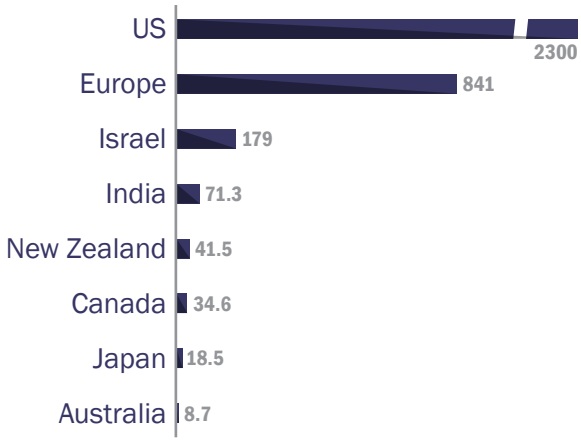


Chart 6: Investments by Major Geographies - Augmented Reality (Left) and Virtual Reality (Right) in USD Mn. (2013-YTD 2018

8,9 | Deloitte Analysis, Tracxn Technologies Private Limited

6 Applications & Use Cases

Immersive media offers a multitude of use cases applicable across various industry verticals.

6.1 | Application Categories of Immersive Media

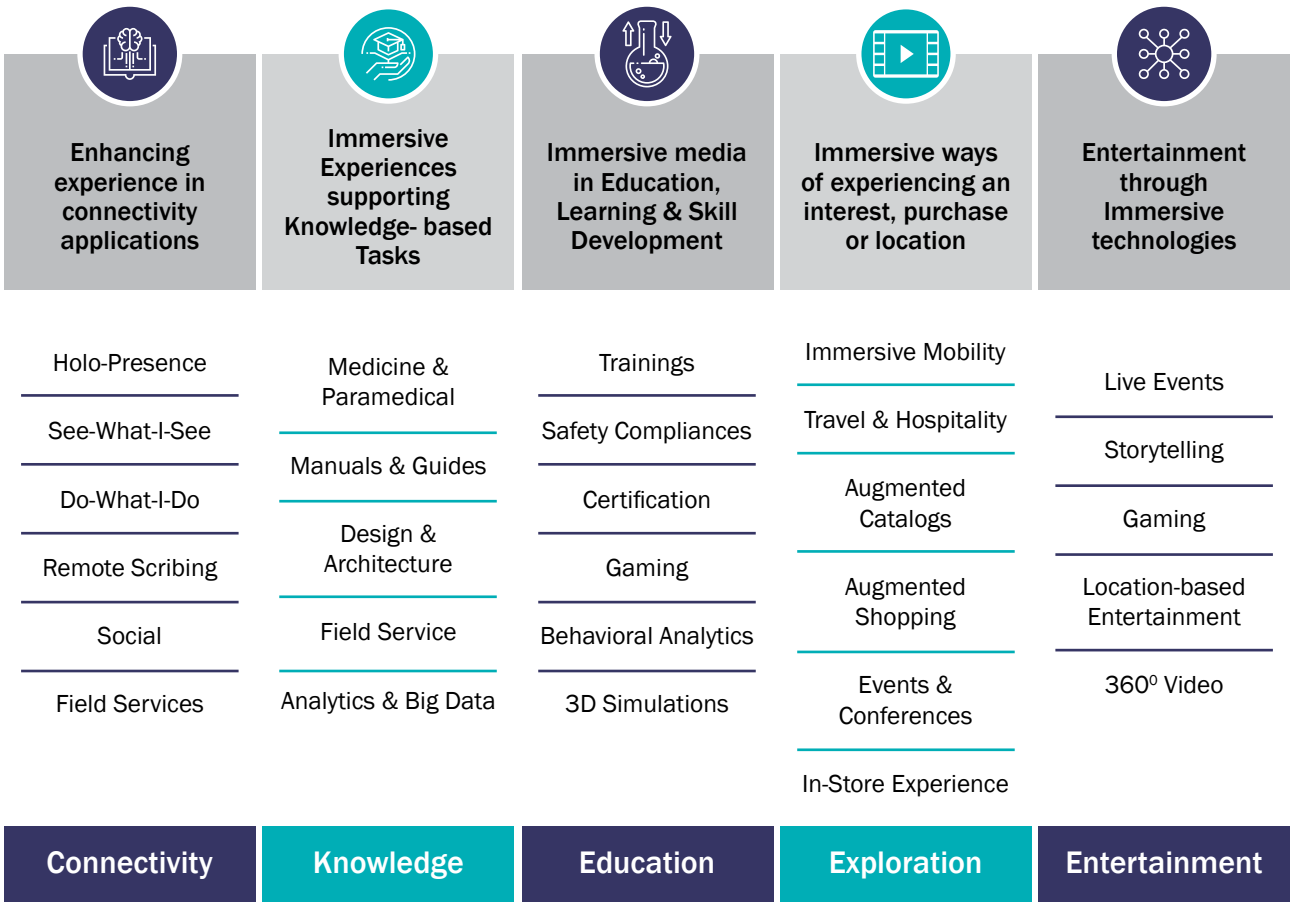


Figure 6: Categories for Applications of Immersive Media

6.2 | Key Use Cases

Dimension
CONNECTIVITY

Application
HOLO-PRESENCE

The technology of creating an augmentation to the real-world with a digital rendition of an individual in true depth 3D using multiple projections is Holographic Presence (or Holo-Presence)

Potential Value Delivered

Impression of real-time interaction possible, giving further comfort to consumer of the content, and can save on logistical costs as well as mitigate resource crunch in sectors such as Education, Arts etc.

Ongoing Deployments (Illustrative)

Mixed Reality solutions have a myriad of applications in the Maintenance, Repair and Overhaul sector, enabling field services to higher efficiency, safety and quicker turnaround

Potential Value Delivered

With access to manuals and guides in multi-media form, efficiency of the MRO operation potentially increases. Lower costs, and higher efficiency can enable higher profitability

Ongoing Deployments (Illustrative)

Dimension
CONNECTIVITY

Application
FIELD SERVICES
(MIXED REALITY)

Dimension
KNOWLEDGE

Application
ARCHITECTURE

Architecture by virtue of its nature, is heavily dependent on the ability to ensure that the end-user can see or visualize the concept of the architect in his mind. Virtual reality can enable said visualisaton even before the actual design is ready in physical form

Potential Value Delivered

Enabling utilization of space, model evolution and advanced planning through visualisations instead of 3D models made through Computer Aided Design

Ongoing Deployments (Illustrative)

WHA. | UTILE | DESIGN GROUP

Immersive Intelligence is a collaborative fact-based decision process for understanding complex systems and data sets using immersive spaces

Potential Value Delivered

In the experience of being 'one with the data', and to be able to get a realistic visualization of the data, the users are able to explore virtually limitless datasets, and take action/decisions

Ongoing Deployments (Illustrative)

Google News Lab | TITANS OF SPACE 2.0

Dimension
KNOWLEDGE

Application
IMMERSIVE INTELLIGENCE

Dimension
EDUCATION
Application
TRAININGS

Use of Virtual Reality is expected to take center stage with the enterprise and education sectors in Training and Development. Simulation of real-time environments and presentation to the end-user will help enable cost reduction and enhanced learning

Potential Value Delivered

Costs for trainings are lower as dependence on individuals conducting them, and costs for logistics are lower. Immersive trainings are the closest to reality, and a robust methodology to ensure learning

Ongoing Deployments (Illustrative)

Walmart

CEDARS-SINAI

Leading Player in Industry Sector an immersive interactive induction product for its new employees to gain an overview of the company's processes from 'rig to retail', and across Business Groups

Potential Value Delivered

Cost and Time savings in the range of 70-85% have been observed with the onboarding procedure, with potential for more engagement with employees during their entry into the organsiation

Ongoing Deployments (Illustrative)

saudi aramco

PARALLAX

ADITYA BIRLA HINDALCO

ADITYA BIRLA GROUP

Dimension
EDUCATION
Application
SIMULATIONS

Dimension
EXPLORATION

Application
TRAVEL & HOSPITALITY

Seat selections and potential choices for superior experiences on the luxury airline were in standard desktop and smartphone offerings which the airline wanted to transform to enhance customer satisfaction

Potential Value Delivered

Satisfied and impressed customers, who have made informed choices leading to reduction in complaints, expectation mismatch and overall increase in customer satisfaction

Ongoing Deployments (Illustrative)

Emirates | American Airlines

International Retail chain wanted to engage more customers through their smartphones inside and outside their physical flagship stores, and take that engagement to the friends/connections of these customers

Potential Value Delivered

Engagement with the customer and the customers social media circle of influence stands to enhance revenue streams by rising interest in the product

Ongoing Deployments (Illustrative)

ZARA | Walmart

Dimension
EXPLORATION

Application
RETAIL

Dimension
ENTERTAINMENT

Application
LOCATION-BASED ENTERTAINMENT

With 360⁰ Videos becoming increasingly less appealing, and customers expecting a more immersive and interactive gaming experience, standard VR gaming in public spaces such as Malls, Hotels, Theme Parks was becoming increasingly obsolete rather quickly

Potential Value Delivered

Implementation of VRCades for leading Cinema provider in US, Canada, China led to 90% customer satisfaction and 75% week-over-week revenue increment in initial weeks

Ongoing Deployments (Illustrative)

IMAX | Walt Disney World

Whether Live Sports, Trade Shows, Product Launches or any other live setting, enhanced engagement with the audience is the ask of every participant organisation

Dimension
ENTERTAINMENT

Application
AUGMENTED REALITY IN LIVE EVENTS

Potential Value Delivered

Higher engagement delivery with the potential to increase sales customer footfall; Alternatively, higher engagement with audience in high-tech/learning events such as exhibitions etc.

Ongoing Deployments (Illustrative)

CES LAS VEGAS, NV | RUGBY WORLD CUP 2015 | RUSSIA 2018 | LUCASFILM LTD | हमारे डाक

With significant high impact applications in the offing for Augmented Reality and Virtual Reality, providers from across the globe are focusing on innovation to establish higher reasons for adoption. Backed by evolving technology, Immersive Media offers practical solutions with real benefits, which will mature further in future.

6.3 | Key markets for Immersive Media content and Services

Content/applications developed are expected to grow further and form the core of the market in the subsequent years. The below mentioned are the key industries expected to witness the highest level of adoption of Immersive Media globally

6.3.1 | Gaming Industry

The global gaming market is estimated at USD 137.9 Bn in 2018, with 2.3 Bn gamers worldwide. The mobile gaming market is alone estimated at USD 70.3 Bn, witnessing a growth of 25.5% year-on-year. The market is expected to reach USD 180.1 Bn by 2021, driven partly by the strong growth expected in VR games market. A record USD 2 Bn was invested in 2017 in the gaming industry, with majority of the investment going into AR/VR game development.

For VR games alone, the market is forecasted at USD 5.08 Bn by 2017 and USD 39.47 Bn by 2021. By type of hardware, console games is expected to take the major share, but significant growth is expected in mobile and arcade game VR titles.

Chart 8: Global VR Gaming Market (in USD Mn.)

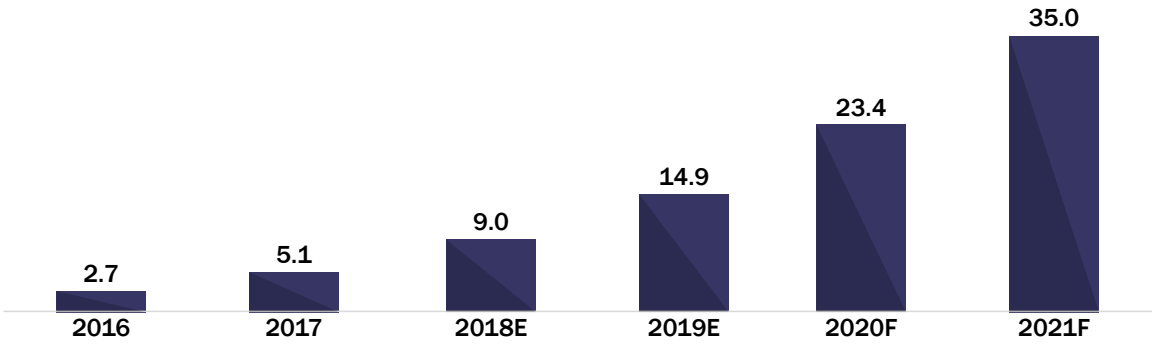


Chart 7: Global VR Gaming Market (USD Mn.)

Immersive Media can play a large role in the overall improvement of experience and growth of the sector in the following highlighted areas:

6.3.2 | Entertainment Industry

The level of investment and the diversity of the activities in Immersive media market in the entertainment industry has significantly increased over the past few years. In fact, it is one of few Industries to receive significant attention from the developers and investors alike. The entertainment sector has seen the number of investments go up by 79% in second half of 2017 compared to the same in 2016. Investments in the area of entertainment have been seen in the fields of Hardware, production and enhancing the existing business capabilities.

Jaunt, a VR start-up has developed an end-to-end cinematic virtual-reality content-creation platform. It has raised USD 100 Mn so far, led by Disney and other Hollywood players. Jaunt already has more than 200 pieces of contact in its library, including sports and concert programming.

Similar investments are seen in Ryot, Felix and Paul studios, Within, Penrose studios, Baobab studios etc., among others.

In India, the production of content has gained pace over the recent years, using VR, AR and 360° technologies. Enlighten, Memesys, Meraki, Transcend and Trimensions etc., are some of the start-ups working in Entertainment industry.

Immersive Media can play a large role in the overall improvement of experience and growth of the sector in the following highlighted areas:

6.3.3 | Hotel and Travel Industry

Hotel and Travel Industry is witnessing increasing use of VR technologies as a new marketing tool. 360° video and photos are used to provide the consumers the look and feel of the destinations across the world. VR technologies have the power to drive growth in the travel industry by increasing people's desire to travel.

In Sept 2015, Marriott International hotel chain has announced the launch of 'VRoom Service' created in collaboration with Samsung Electronics. Guests are provided the option to order a Samsung Gear VR headset to experience VR within their rooms. This is in addition to the 'The Marriott Teleporter' it has already introduced in 2014. A "4D VR" system provides information to the five senses in addition to the 3D vision.

In addition to Marriott International, a range of other travel companies is using VR as a marketing tool. Spectra VR, The Thought Studio, Tesseract, Trimensions, Meraki, and Transcend are some of the start-ups in India actively involved in developing content for the Tourism and Hospitality Industry.

Provider	Immersive Media Offering
TAJ	Tajness, 360° view of Taj Hotels signature experiences
DELTIN GROUP	Offers 360° view of Deltin Caravela, India's only Casino Float
Marriott HOTELS · RESORTS · SUITES	The Teleporter, VR Room service
Hilton	Offers 360° view of Hilton's Barbados resort

Table 1: Immersive Media in Hospitality

Immersive Media can play a large role in the overall improvement of experience and growth of the sector in the following highlighted areas:

6.3.4 | Sports & Live Events

The first applications of AR in Sports was seen in late 1990's, in American football, with the projected first-down line and in Hockey, with the puck tracking. With the increased development of Immersive media technologies, Sports Industry is also witnessing a significant adoption. The sport experience is being amplified in every possible field, ranging from consuming content to training to recruiting athletes.

Provider	Immersive Media Offering
NEXTVR	Live streaming of VR content of professional sports, such as NBA, NFL, International Champions Cup (ICC) football, NASCAR race, NHL etc
vLive	Integrating social functionality; Fans can interact with each other through VoIP

Table 2: Immersive Media in Sports & Live Events

6.3.5 | Education

Education is expected to witness major transformation with the introduction of Immersive media technologies. By engaging students with VR and AR technologies, in-depth learning experiences are made possible, which involves including creative and interacting elements. Abstract and difficult concepts can be easily understood aided by 3D rendering of the objects enabling visualization, thus providing deeper understanding of the concepts.

zSpace, Nearpod, Immersive VR Education and Universiv are some of the prominent Immersive media start-ups working in the education space.

Immersive Media can play a large role in the overall improvement of experience and growth of the sector in the following highlighted areas:

6.3.6 | Retail

Immersive Media, specifically Augmented Reality, has led to the onset of a major change in the approach to purchasing. Dubbed as the latest technological revolution in retail after mobile shopping, Immersive Media has enabled potential buyers experience "Try-before-you-Buy" in their chosen environment, as well as the store itself. For instance, the ability to place the heavy furniture such as a sofa set in the field of view using your iPad has been made possible by Augmented Reality. This experience enables the end-user to see and appreciate how that large purchase would look in their home. In turn, this has led to the reduction in returns and exchanges – a cost that most stores and companies would bear in a highly competitive market.

Companies such as Target, Walmart, IKEA, Urban Ladder, and Zara are prominent users of Immersive Media with innovative use cases.

Immersive Media can play a large role in the overall improvement of experience and growth of the sector in the following highlighted areas:

6.3.7 | Automobile

Automobile manufacturers are constantly trying to place futuristic technologies in play to deliver a higher value and enticing experiences to the customer across sales, driving & usage and service. Internal innovations to streamline manufacturing, stock management and distribution are focus areas as well. In the recent years, automotive manufacturers have begun to increase their usage of Immersive Media to enable an interactive and detailed sales process.

For instance, Infiniti Cars uses a VR video-based approach to enable the customer to experience the car as if it were driving, thereby filtering customers for test-drives and potentially converting higher sales. BMW is globally engaging in AR to enable virtual shopping by allowing customers to customize the car variant while they are in the showroom to select paint, wheels and other options on a stock configured car.

Manufacturers such as Volkswagen Group have used Augmented Reality in the form of a maintenance tool – Volkswagen MARTA to help service their next-generation Volkswagen XL1. Volvo is utilizing Microsoft's HoloLens to enable production line workers to digitally view assembly instructions in real-time while working to put together parts of the vehicle. Work instructions, associated technical drawings and even videos from the last person who completed the procedure can be viewed in the AR glasses. This allows workers to keep their hands on their task with virtual guidance, negating the need to walk over to a workstation to check anything and increasing outputs

7 Emerging Technology Innovations

As Immersive Media grows, it will leverage technology innovations, a few key examples are explained below

Camera & Image Capture

- Multi-Lens Camera
- 3D Sensing Camera
- Smart Contact Lens

Mapping & Environment

- Simultaneous Location & Mapping

Display

- AMOLED- based Micro Display
- High Angular Resolution FOV

#1 Select Technology
Multi-Lens Camera

Usage of multi-lens cameras in the recent past, to create depth-inclusive imagery and video, has been very high. Recent advances in multi-lens cameras on Smartphones have led to an even superior image quality or video quality with depth characteristics. Virtual Reality, like Augmented Reality, is expected to draw from Multi-Lens cameras in order to create truly immersive experiences.

Image 1: Apple iPhone X Rear Camera (Multi-Lens)

Key Players

Challenges

Limited usage beyond recreation of images for AR applications

Impact

Majority of the devices being powered with Multi-lens cameras

End-user experience will show significant improvement

Positive influence AR uptake as well expected, especially when AR is experienced through hand-held devices

#2 Select Technology
3D Sensing Camera

Leveraging infrared technology to not only capture standard images, but also sense the depth of the surroundings is the prime application of the 3D Sensing Cameras. As compared to the standard 3D Cameras offering on certain smart devices, 3D Sensing Cameras have applications that range beyond day-to-day photography applications, especially in the Augmented Reality and Virtual Reality space.

Image 2: Depth Sensing Cameras on the Apple iPhone X

Key Players

Challenges

Evolution of SDKs require devices to have 3D Sensing Cameras as a mandatory/default hardware; Limited Uptake of these premium devices

Impact

3D Sensing Cameras to enhance customer experience and delivery quality of apps through depth-based immersive experiences

#3 Select Technology
Simultaneous Localization & Mapping (SLAM)

Simultaneous Localization and Mapping also called as SLAM, a technology whereby a robot or a device, can use sensor data to construct or update a map of an unknown environment, while simultaneously keeping track of its location using complex computations and algorithms. This technology is enabled by using depth sensing cameras, gyroscope and other modern sensors. Its incorporation into Virtual and Augmented reality headsets helps the device in establishing its location and its surrounding environment. It enables the Immersive media developers to create more interactive and realistic experiences and provide more accurate augmentation and depth information

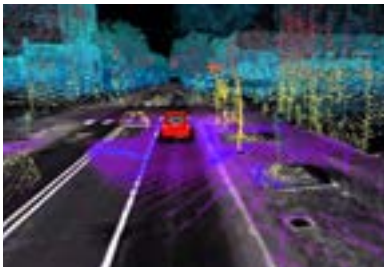


Image 3: Illustrative Render of SLAM

Key Players

wikitude | metaio | kudan COMPUTER VISION | Qualcomm snapdragon

Google | facebook | Microsoft HoloLens

Challenges

Parameters of the camera such as focal length and principle point are required to be calibrated, which requires the usage of complicated and hence costly algorithms

SLAM requires high-powered devices to efficiently map and track the environment, which significantly increases the cost of devices it is used on

Impact

SLAM has replaced the traditional marker-based technology tracking which required pointing the camera at a defined image to see the AR experience

#4 Select Technology
Smart Contact Lens

Smart Contact Lens are contact lens with embedded technology to support a variety of applications, mainly around creating an AR-environment, or detecting certain vital body parameters using sensors. They have been on the embryonic stage of evolution with key technology organizations expressing significant interest in them. However, the real life application of the same would be to take pictures to enable the creation of an augmented reality environment using the smartphone to which the lens connect wirelessly

Image 4: Illustrative Impression of Smart Contact Lenses

Key Players

Google | SAMSUNG | MEDELLA HEALTH | SONY | ©macula

Challenges

Concerns around invasion of privacy, especially around recording

Impact

High potential for usage to create augmented reality environments

Exploring the potential of using Smart Lens in the MRO, Industrial and Media industries may result in a higher uptake

#5 Select Technology
Amoled-based Micro Displays

Displays carrying AMOLED (Micro) technology may have existed for many years. Major applications have been in military applications, and Head-mounted displays in the commercial space have carried these as well. Major drivers for the adoption of AMOLED-based Micro Displays over the traditionally applied Liquid Crystal on Silicon (LCoS) has been the ability to reduce size and weight.

Image 3: Micro Display

Challenges

Lower color lifetime than LCoS, making the technology unreliable, and potentially too expensive

Displays are challenging to be mass produced, and innovation to reduce costs is not as fast as traditional display makers

Impact

Augmented reality (AR) glasses will be easier to use because the size of light engine will be greatly improved by AMOLED-based micro displays

More room for other components to be built in, such as 3D-sensing camera, human interface (either touchpad or voice control) or larger battery

#6 Select Technology
HIGH ANGULAR RESOLUTION AND WIDE FIELD OF VIEW DISPLAYS

VR, AR and MR head-mounted displays (HMDs) require higher definition, high screen resolution and high aperture ratio to reduce the screen-door effect. FOV of most VR, AR and MR headsets ranges from 20° to 40° due to volume and weight restrictions. Improving AR visual interaction performance, including the FOV, is expected to gain pace with development of screen technologies such as Organic Light-Emitting Diode-on-silicon (OLEDos) and micro projection technologies such as Lead Computing Optical Sight (LCOS)

Challenges

OLEDos and LCOS technologies are still in the development phase, the displays are expected to be more expensive compared to the available display technologies

Impact

With the increased development and integration of these technologies onto the VR and AR devices, it makes the devices more appealing and superior in terms of user experiencea

8 The India Story

India is well positioned to leverage the opportunity presented by demand of Immersive Media globally, while also growing to become a large consumer of these very experiences

1. Immersive Media Market in India is estimated at USD 0.55 Bn. in 2018, but is expected to grow to USD ~6.5 Bn by 2022. Augmented Reality is estimated to grow to USD 5.9 Bn and Virtual Reality is estimated to grow to USD 0.5 Bn by 2022

2. Real Estate, Media & Entertainment, Automotive and Retail are expected to be the verticals with maximum adoption of Immersive Media

3. Indian AR-VR supply landscape comprises of significant large and small players in the areas of 'Tech & Platform Development', 'App Development' and 'System Integration' – both the domestic and the global Immersive Media market provides a significant opportunity for these players to tap into

4. Partnerships and collaborations are expected to be the key drivers of the ecosystem in India, with majors such as Facebook, Snapchat, Niantic forging relationships with Indian firms

5. Challenges limiting the growth of Immersive Media in India include Prohibitive Costs of Devices, Limited Content Availability and Low Awareness about the Value Proposition of Immersive Media

8.1 | Immersive Media Growth in India

Immersive Media Market in India is estimated at USD 0.55 Bn. in 2018, but is expected to grow to USD ~6.5 Bn by 2022. Augmented Reality is estimated to grow to USD 5.9 Bn and Virtual Reality is estimated to grow to USD 0.5 Bn by 2022.

Projected Augmented Reality Market Growth in India (2015-22)[10]

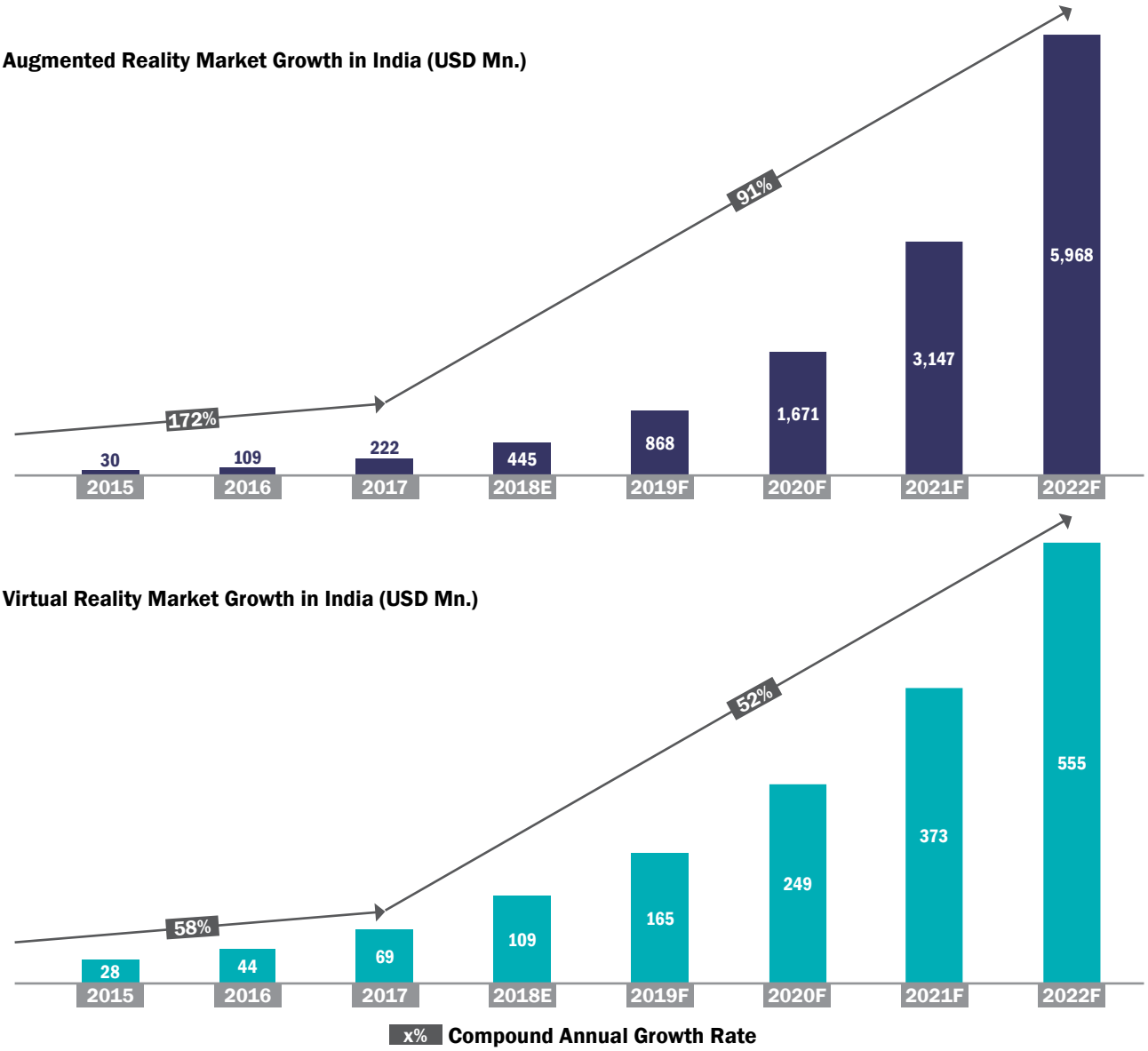


Chart 9: Market Growth for Augmented Reality & Virtual Reality in India (Incl. Consumer & Enterprise User spending)

8.2 | Demand and Supply Landscape

8.2.1 | Demand Landscape

The needs of the customer have changed significantly. Enterprises are seeking differentiation by providing a 'wow' experience to the consumer, while continuing to stay focused on profitability. In a high-competition environment bringing down costs of customer acquisition and reduction of overheads in terms of real-estate space to sell goods and services have led to the incremental adoption of Augmented Reality and Virtual Reality. Similar rationale has led to the upwards drive of the use of AR and VR in the Maintenance, Repair and Overhaul domain, as well as learning & development for businesses.

10 | Deloitte Analysis, BIS Research

Industry	Illustrative Use Cases	Applicability Potential: Connectivity	Knowledge	Education	Exploration	Entertainment	Propensity to Deploy Immersive Media
Automobile	Manufacturing Operations		☑	☑	☑		◔
	Car Sales & Service						
BFSI	Customer Experience (Electronic Banking)	☑	☑	☑	☑		◑
	Learning, Training & Development						
Defense	HUD in Military Aircraft, Vehicles and Boats	☑	☑	☑	☑		◔
	Special Forces Gear & Training across AR & VR						
Education	Learning through Live-like systems	☑	☑	☑	☑		◕
	Learning/Training in safe environments						
Gaming	Mobile Hand-held Gaming using AR & VR					☑	◔
	Console & Computer Gaming using VR						
Healthcare	Learning & Training/Education	☑	☑	☑	☑		◑
	Surgery, Patient Care etc.						
Hospitality & Travel	Customer Experience & Revenue Uplift		☑	☑	☑		◕
	Learning, Training & Development						
Logistics & Supply Chain	Asset Tracking/Supervisory Control	☑	☑	☑	☑		◑
	Customer Service/Support						
Media & Entertainment	Advertising & Revenue Generation	☑	☑		☑	☑	◕
	Media Consumption						
Oil & Gas	Manufacturing	☑	☑	☑	☑		◑
	Training & Development						
Real Estate	Showcase of property/real-estate product	☑	☑	☑	☑		◕
Retail	Shopping Experience Enhancement	☑			☑		◕
	Product Launches/Support						
Telecom	Telecom/TowerCo Setup/Maintenance		☑	☑			◔
	Sales/Customer Service						

Indian companies across the Automobile, Real Estate, Retail, e-Commerce and other similar sectors have been experimenting and in recent times adopting the use of Augmented Reality to match their customers' experience requirements.

Maturity: Low → High

Automobile

Applications/Use Cases

Sales & Marketing
Vehicle Experience in the form of Product Variations (AR), Driving Experience (VR)

Maintenance & Repair
Guided repair and maintenance of vehicles for service staff

Manufacturing Process
Manufacturing support through augmented reality as well as trainings for crew members

Key Drivers

Value Creation
AR & VR create immense value across the product value chain from R&D through Manufacturing to Sales and Support reducing costs

Product Experience
Enhancement of customer experience by creating enhanced user interactions helping industry players differentiate their product in a large market like India with varying requirements

Driving Assists
Assisting drivers by Digital Overlays of important information such as Speed, Turns etc. through HUD as the number of cars increase

Indicative Implementations

Mahindra XUV500 | TATA MOTORS Connecting Aspirations | BMW | VOLVO

Education

Applications/Use Cases

Live Learning
Course material shifting to truly immersive multi-media learning through smart devices instead of 2D textbook learning

Safe Learning
In specific scenarios where the live environment is dangerous to learn in, trainings and education can be imparted using VR leading to safe learning

Key Drivers

Changing Method of Learning
Gamification and Demonstrations through Augmented Reality using smart devices is a more effective way of learning

Pupil's Comprehensive Growth
Value Education, Science, Mathematics, History and other subjects that define overall learning facilitated through immersion

Creating an Entertainment-based Learning Paradigm
With standard rote-based learning being increasingly frowned upon, entertainment to retail pupil attention can be facilitated through VR and AR

Indicative Implementations

PESITM education for the real world

BYJU'S The Learning App

Hospitality & Travel

Applications/Use Cases

Sales & Marketing
Room Experience for Guests while booking a specific property to type of accommodation within selected property

Tourism Activities
Augmented Reality would enable the guided-tour business with usage of personal devices to attract audiences to try and learn more details about monuments and places visited

Key Drivers

Selection
By creating a life-like interaction with properties, rooms and facilities, guests can experience what they buy before they buy it

Access to Information
Both foreign and domestic travelers are prone to access information about things to do, places to visit and experiences which are supported by use of AR increasing footfall and revenue

Enhancing Experience
Using technologies like Beacon, hoteliers enhance customer experience by pointing them to locations within the property to increase revenue

Indicative Implementations

Media & Entertainment

Applications/Use Cases

Gaming

Various experiences are available and possible with use of Virtual Reality in the gaming industry across platforms which further enable the interactive and virtual gaming experience creating a larger engagement span

Media Consumption & Advertising

Using Virtual Reality for Immersive Movie and TV consumption being a prominent use case, as well as use of AR and VR for advertising in Print, Out-of-Home and Social Media to drive immersion and customer engagement

Key Drivers

Changing Advertising Paradigm

Advertising has changed significantly in the last 5 years with Internet-enabled devices being the preferred method for low-cost high-conversion advertising compared to traditional print and television ads.

Potential for Interaction & Experience

Potential customers can experience the product/ service prior to buying through immersive media as compared to where images or standard videos paint a standard picture

Interactive & Immersive Content

Films, Television and other audio-visual content would become more immersive, thereby enabling customers to spend more time on these devices driving up advertising and subscription revenues

Indicative Implementations

Real Estate

Applications/Use Cases

Showcase

Showcase real-estate product digitally to the end-user in a vanilla or highly customized experience

Key Drivers

Enhanced Customer Experience

Industry leaders are looking to enhance the experience of the customer in trying-before-buying of being able to walk through the halls of their apartment/ office before making the decision

Personalisation

Computer generated setting make it easier to personalize, thereby giving the potential buyer a view of the product in their taste or per their vision

Reach

With no requriements to travel to the construction site, the reach is virtually limitless; buyers can experience sitting in a different geography

Indicative Implementations

KANAKIA

LODHA
BUILDING A BETTER LIFE

LARSEN & TOUBRO

Retail

Applications/Use Cases

Try-before-Buy

Virtual Changing Rooms, App-based Tryouts, Social Media integration for feedback

Guided Experience

AR-based Location Maps, In-Store Walking Directions etc. for guided purchasing/buying

Location-based Advertising

Beacon-technology based advertising of offers through Prompts/Camera Hold-up

Key Drivers

Versatility with Virtual

Retail industry is looking to upgrade the user experience to being highly versatile by leveraging the virtual world to engage with customers, drive up walk-ins and convert to sale

Optimization of Resource

Improvement in utilization of store/shelf space, training and enabling faster customer response times with minimal use of hands, optimizing resource – both human and store – has been focus

Interactive Shopping

Traditional shopping with other people has been the mainstay for the industry so far. However, as individuals shop alone, adding interactive shopping elements ensures eyeballs, and potential uplift of revenues for lower cost of marketing

Indicative Implementations

Urban Ladder

IKEA

8.2.2 | Supply Landscape

India is home to a large number of providers across various sizes and types of organizations. The capabilities vary, as per the objectives. While organizations like Sony work actively towards their own range of devices and platforms (read PlayStation VR), other organizations such as GMetri serve domestic and International Clients. Larger Organizations with expertise and resources such as Tata Elxsi, Wipro and Infosys have capabilities in creation, deployment and integration of large-scale complex solutions as well as serving niche client requirements across both domestic and international markets.

Illustrative Immersive Media Ecosystem Players in India[11]

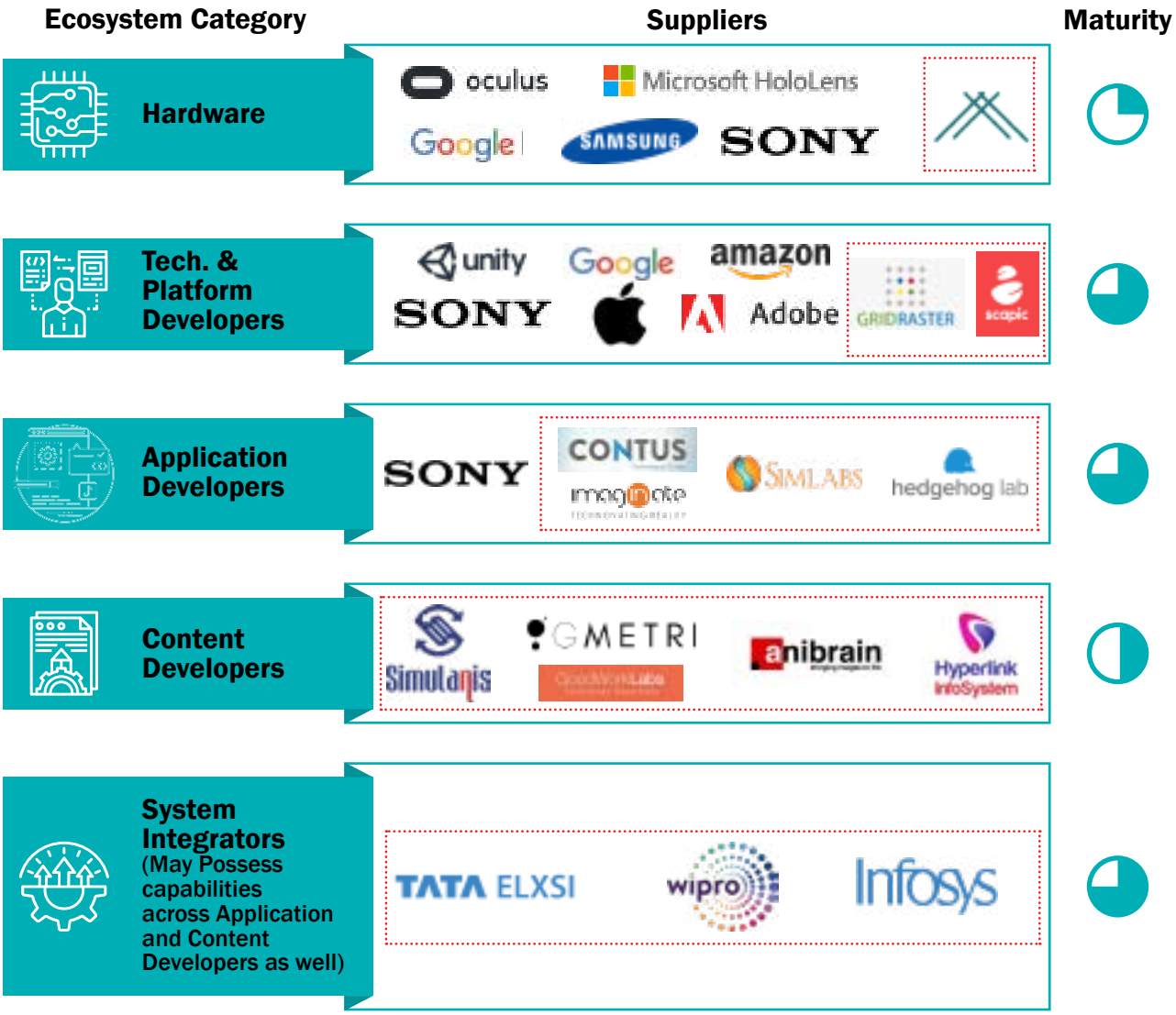


Table 4: Illustrative Supplier Landscape in India

As indicated above, India's strength is visible in the domains of Technology & Platform Development, Application Development and System Integrators where our maturity levels are high. Areas of Content Development as well as Hardware see a lower maturity in terms of their advancement, competitiveness to market leaders and scale to go to the masses.

11 | Deloitte Analysis, BIS Research

8.2.2.1 | Startup Ecosystem

The Indian startup ecosystem has been an instrumental player in the overall interest and adoption of Immersive Media in India as well as delivery of quality immersive experiences overseas.

AR/VR focused Start-ups during 2013-18 **70+**

CAGR (2013-18) **26-28%**

- EdTech
- RetailTech
- Real Estate
- Gaming
- Travel
- Media & Entertainment

Hardware

Key Trends

Indian startups are working towards creating the next generation of devices for consumption of content through Virtual Reality

Head Mounted Devices is the emerging focus area for Hardware players with Google Cardboard-based Devices forming a large number of devices

Indian Startups have also worked on the production devices such as the creation of the world's first pure VR camera

Startups (Illustrative)

	Year of Founding	Key Product/Offerings
CULAR	2016	VR Headsets
TESSERACT	2015	VR Headsets
procus	2015	Immersive Media Hardware
VR BOX OFFICE	2015	1800 Stereoscopic Hardware

Tech. & Platform Developers

Key Trends

Focus on Platforms and Tools has increased significantly over the last 3-5 years, with a number of startups mushrooming in this space

Startups delivering Tools and Platforms across the sectors to ensure that high-quality content reaches the audience, with innovation driven product launches such as Edge-based Processing & Rendering, Sharing of VR Content, AR-based Experiences across Retail, Real Estate etc.

Startups (Illustrative)

	Year of Founding	Key Product/Offerings	Sector Focus
GMETRI	2016	Platform for creation & sharing of VR content	All
GRIDRASTER	2014	Platform for creation & sharing of VR content	All
scapic	2017	Web-based VR Content platform	All
ar	2014	AR-customer engagement platform	Real Estate, Retail, Media & Entertainment
COLUMBUS again	2011	Colombus Again SDK for AR	All

Application Developers

Key Trends

Applications for Augmented Reality and Virtual Reality have taken the majority of the attention of developers

With multiple tools and platforms available and supported by significant improvement of devices, applications for AR and VR are seeing an uptake, thereby driving demand for indigenously developed applications across industry sectors

Automotive, Education, Healthcare, Gaming, Entertainment and Real Estate are the major demand generating sectors

Startups (Illustrative)

	Year of Founding	Key Product/Offerings	Sector Focus
Firefly	2018	AR-based Books for Pre-Primary Children	Education
CARTOSENSE	2017	Surgical guidance through Augmented Reality	Healthcare
veloce	2017	Virtual Reality Simulators for Gaming & Entertainment	Gaming
CUBEDOTS	2016	AR-based Applications for Enterprises	Real Estate
AUTOVRSE	2016	Design Visualisation Tool & Platform	Automobile Design

Content Developers

Key Trends

Indian Startup Ecosystem has been supporting a large volume of content demand based on the emerging use cases for AR & VR

Gaming has become a highly lucrative sector after the worldwide release of Pokémon Go!

Entertainment using VR through Videos, VR Experiences and VR Gaming driving up the VR consumption and are expected to continue to thrive with higher adoption of devices

Startups (Illustrative)

	Year of Founding	Key Product/Offerings	Sector Focus
MERAKI	2015	VR Content for multiple entertainment sector	Media & Entertainment
MOTIONWORK STUDIOS	2008	VR Content, Games for Mobile Devices (Android, iOS)	Gaming

8.2.2.2 | Service providers playing the role of system integrators to industrialize services

Illustrative

TATA CONSULTANCY SERVICES

TCS's new standalone business unit for Digital Workplace Services for Business 4.0 focuses on design thinking as the catalyst for the delivery of end-to-end digital workplace services

It is using gamification, AR, VR, and mixed reality experience, and e-learning as a service to further improve end-user experience.

TATA ELXSI

Field Force training, Product visualisation, Manufacturing, In-Store experiences, Product marketing, Remote collaboration

Solution aids technical and creative professionals to engage in interactive, real-time engineering and design review, data analysis, critical training, presentation, or command-and-control operations

accenture

Accenture's Extended Reality group creates and delivers impactful immersive experiences that fuel new business growth for enterprises

Provides design & engineering, information visualization, manufacturing & operations, virtual conferencing solutions

IBM

IBM's Watson division is working with the creators of the Unity game engine on an open-source SDK that could make video games a whole lot smarter

With IBM Watson integration, games and simulations will have an improved ability to comprehend natural language, including speakers intent and to respond intelligently

Infosys NIA

Infosys integrates digital twins, or digital models of complex physical object, AI platforms like Infosys Nia, chatbots and augmented reality to provide enterprise solutions

Focuses on feature films, large scale VR experiences, enterprise AR solutions simulators, and the video game market.

Solutions in Marketing, Retail, Fashion, Industrial training and maintenance, Utilities, Medicine etc.

Pilots and POC's are created and showcased to enterprise customers to drive Immersive media adoption

Provides AR application development, content development & management and enterprise Integration

Developed content management portal, Mobiliya AR360 to manage AR content consumed by device applications

8.2.2.3 Partnerships, Collaborations and Investments enabling growth of Supply-side Ecosystem

Partnerships & Collaborations

In the recent times, large number of partnerships between market leaders, startups and ecosystem players have seen AR & VR become mainstream. Multitude of collaborations in informal and formal setups are enabling the ecosystem to leverage individual player expertise in delivering world-class solutions for clients. Such partnerships may seek to achieve one or more objectives: Drive Revenues increase Presence, Drive up innovation

Partnering Organizations	Objective
&	| Partnership created to foster innovation in areas of AR & VR in 2018 | Participants to be part of Facebook Start program | Access to be given to T-Hub's network of mentors, industry experts, investors, service providers and community/ecosystem
NIANTIC & Jio	| Partnership established in late-2016 | Expectation of the same was to launch global phenomenon AR-based game Pokémon Go! in India
& tyroo	| Partnership between Snapchat and Tyroo announced in 2018 | Tyroo to play role of Monetization partner in India and APAC region | Tyroo's AI-based platform to be used to generate higher ad-revenues across 9 million users in India

Investments

Key Investment Strategies

Co-creation of IP along with clients and partners

Setting up centers of excellence and innovation labs

Collaboration with universities on joint research, skilling and recruitment

Investments in start-ups for co-innovation & partnerships with large technology firms

Partnering Organizations	Objective
ACADEMIC INSTITUTES	| Bengaluru gets India's first AR/VR academic centre | Centre of Excellence for Virtual and Augmented Reality to be set up at IIT Bhubaneshwar
CENTRE OF EXCELLENCE (COE)	| Unity Technologies and Tata Elxsi Launch Centre of Excellence | Capgemini and PTC Launch Center of Excellence in Mumbai for smart connected products | Unity to Launch Center of Excellence of Partnership with Veative Labs | Tech Mahindra Collaborates with Unity Technologies to open centre of excellence in Bengaluru

12 | Deloitte Research, News Articles, Individual Company Press Releases

8.3 | Key Drivers for Growth of Immersive Media in India

Increasing adoption of immersive media leading to rapid growth of industry is credited to the following growth drivers

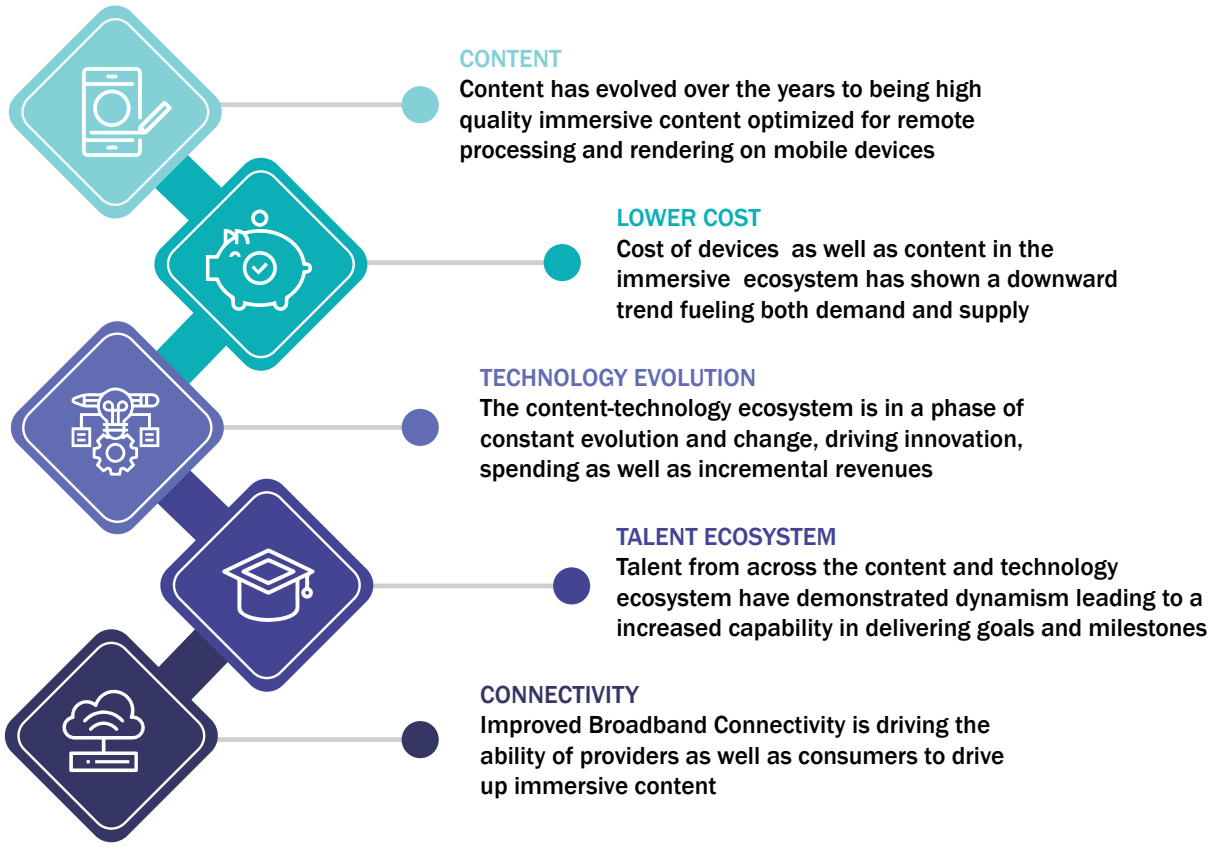


Figure 7: Key Enablers to the Growth of Immersive Media in India

8.3.1 | Content

Type of content and quality has changed dramatically in the last decade. With the advent of 3D and High Resolution formats (HD, UHD, 4K, 8K etc.), the video content quality has seen a significant increase. Additionally, usage of advanced Computer Generated Imagery models have led to the incremental realism in gaming and animated media. With devices being able to increasingly support superior content, the immersive media consumption has seen an upward trend-keeping step with the enhanced entertainment and consumption experience. India's growth in consuming high definition content on smart devices is positioning India to be a lucrative market for immersive content as well.

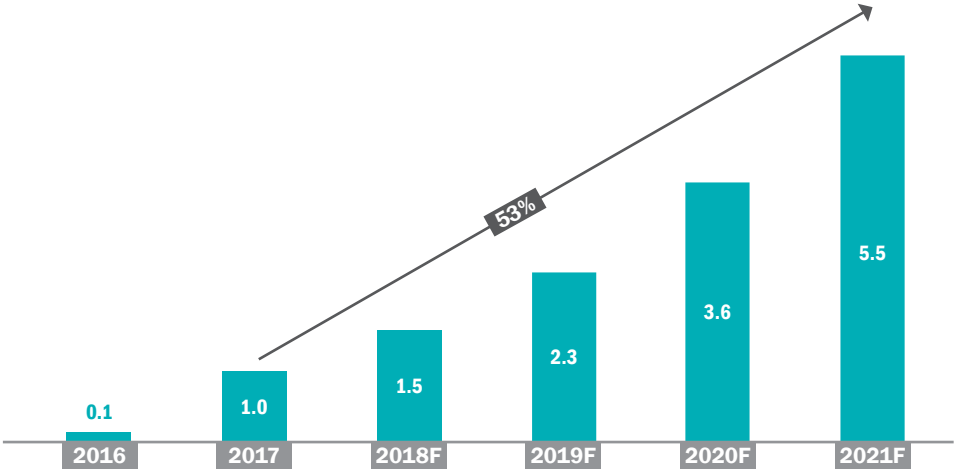


Chart 10: Mobile Video Traffic Growth in India (in Exabyte)

8.3.2 | Lower Costs

Once considered a technology that fit only large budgets for a limited ability to use, Immersive Media is becoming less expensive by the day, mainly due to the innovation in Devices, cheaper manufacturing processes amongst other factors. Lower costs will drive adoption of AR VR compatible devices and hence consumption of content. Manufacturing supported by larger support from the Government in terms of Grants and Subsidies is expected to play a larger role in the uptake of devices as it will directly influence the cost of purchase for the end-user.

8.3.3 | Technology Evolution

Technology enabling Immersive Media has been on a trajectory of constant change. The evolutionary curve of the technology – display, development platforms and tools, as well as the technology used to render and experience immersive media have seen an upward and steep rise in quality. As with major technology evolution, accessibility as well as higher quality content plays an entrancing role in the minds of the end-user. Improved quality has driven the supplier-end of the ecosystem the necessary boost as well.

8.3.4 | Talent Ecosystem

India has been able to demonstrate highest capabilities in the IT and BPM sector based on the costs of delivery as well as the technical knowhow making India an attractive destination to produce IT solutions for domestic as well as International Clients. Over the last decade and a half, India's rising capabilities in the CGI and Creative space in production and post-production of content has further solidified its position as key players in the global immersive media ecosystem.

8.3.5 | Enhanced Connectivity

Immersive Media, when stored on a specific device, has little or no dependency on the data networks. This is possible in the case of movies, games and other applications downloaded to the end-devices. However, with increasing content being stored on the cloud and consumed on devices either displaying or rendering the content, seamless and high-speed internet connectivity becomes crucial. The change to the connectivity landscape in India with mass-rollouts of first 3G and now 4G/LTE networks has led to higher speeds. Quality of the connection continues to remain a concern.

Broadband Penetration Growth (2014-2018)

CAGR for Fixed Broadband (4 Years)	5%
CAGR for Fixed Wireless Broadband (4 Years)	2%
CAGR for Mobile Broadband (4 Years)	66%

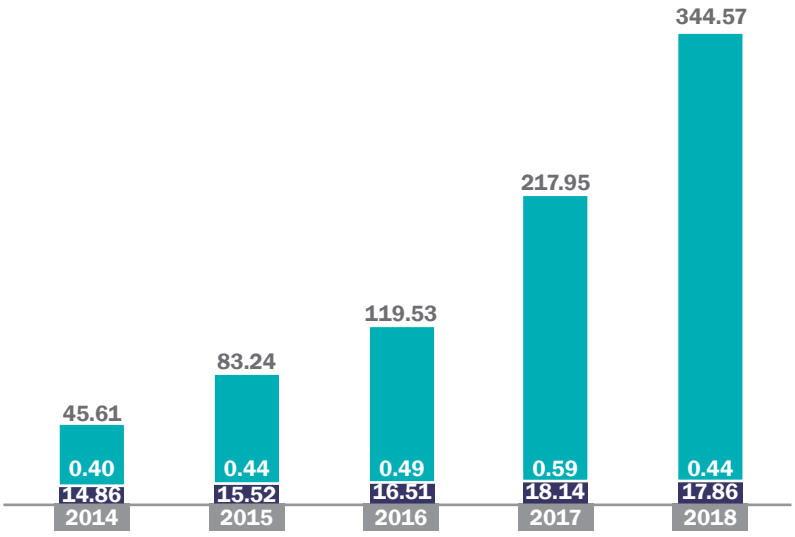


Chart 11: Broadband Penetration Growth in India

8.3 | Key Limiting Factors & Challenges

India, a large consumer of technology, driven by the increasing disposable income and large populace is faced with limited uptake of immersive media due to multiple limiting factors and challenges

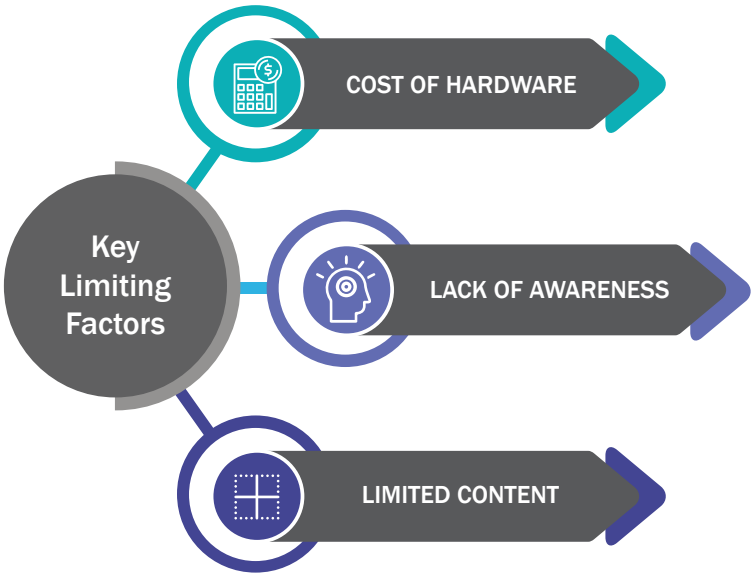


Figure 8: Key-Limiting Factors

8.3.2 | Cost of Hardware

Current AR and VR applications for consumers and businesses are essentially built for smart devices. However, these apps tend to consume significant battery life due to screen-on time, as well as usage of the Graphics Processor Unit (GPU). This poses to be a significant limiter.

Other devices that can help drive the adoption of AR and VR include using Head Mounted Devices and Heads-Up Display devices. These are currently very expensive e.g., Google Glass (currently discontinued) retailed at over USD 1,500 on launch in the US, Epson's Moverio HMD and Smart Glasses range starts at USD 699 upwards. Pure play VR devices in the form of tethered headsets currently cost between INR 44,000 (Occulus Rift) and INR 70,000 (HTC Vive).

High prices are proving be a deterrent to the adoption of the technology in the consumer segment as well as the Small and Medium Scale enterprises too.

8.3.3 | Limited Content

A key challenge to the uplift of Immersive Media has been the lack of availability of content. Across both the Augmented Reality and Virtual Reality ecosystems, the content has not grown at the pace of the projections of the industry. Use Cases of implementation of AR in the Industry-space have seen growth; however, remain low due to technical challenges. For example, the usage of AR in retail would require 3D models of the objects and building 3D models of the entire inventory is an expensive and an extremely time consuming process. Also constantly changing range of products on offer further complicates this. Virtual Reality content has not grown and evolved with number of hours being spent on Virtual Reality content being at an all-time low. The reasons for this are many, for instance, the availability of standard video interfaces and devices such as Computers, Smart Devices, Television sets etc.

8.3.4 | Lack of Awareness

Another key limiting factor to the growth of Immersive Media in India is the lack of awareness of the technology, and its potential benefits.

Awareness on immersive media is lacking owing to the following factors:

- Lack of value proposition for adoption of immersive media
- Potential Return on Investment/Business Case is lacking both in a qualitative and quantitative view

Businesses are adopting the technology only when influenced by their foreign parent organizations, or when they aim to be ahead of the curve on cost/profit-based adoptions.

9 Recommendations

In order to drive adoption of Immersive Media in India and to leverage the global opportunity, certain measures may be taken by the relevant stakeholders

1. The Indian Government plays a dual-roal to enhance growth of Immersive Media in India – 1. Act as a consumer, and 2. Act as an Enabler/Catalyst. Initiatives to ensure affordability of devices through Government support and programs may be considered

2. AR-VR players improve availability of skilled and competent talent leveraging both formal and vocational education ecosystem

3. AR-VR players improve focus on creation of customized content in order to appeal to larger masses across age group, cultures, regions and other demographics and for business

Figure 9: Recommendations for the Growth of Immersive Media in India

9.1 | Making Devices Affordable

Devices are at the heart of immersive experience consumption. With current devices being priced at exorbitant levels, general Indian masses will not be able to purchase these, and might shy away from the technology altogether. Two key measures may be considered by the Government in order to enhance affordability in the immediate future:

9.1.1 | Immediate Reduction of Duties on Import of VR Devices (such as headsets)

The Basic Duty, Countervailing Duty and Countervailing Special Duty levied total up to 26% of the invoice value of the devices. While the same has been created with a view that the VR Headset manufacturing in India take a boost, the end-result is that premium headsets are extremely expensive even for the affluent class to afford as a purchase.

9.1.2 | Measures for enhancing the manufacturing for devices in India

Under the Make in India program as well as the banner of the Digital India program, special considerations may be made for large manufacturers to establish manufacturing facilities in India thereby driving down prices as well as offering direct and indirect benefits to the nation

9.2 | Enhancing Talent Employability

Talent across the AR and VR ecosystem are predominantly across two major skills, Creative and Engineering. While these resources are available in abundance, significant time is spent along with additional resources of the employers to re-skill these resources to platforms and technologies across the Immersive Media Ecosystem.

9.2.1 | Increasing involvement of ancillary education ecosystem

Non-Institutionalized Education and Vocational skills providers such as Aptech, MAAC etc., may increase focus in the skilling of professional and creative career seekers in areas of Augmented Reality and Virtual Reality. For instance, TalentQuest, a talent management and learning Solutions Company, has collaborated with PES University and Unity Technologies to launch academic Augmented Reality, Virtual Reality (AR/VR) Centre of Excellence (COE). The Centre of Excellence, managed by TalentQuest, is to provide a one-year AR/VR certification program, managed by TalentQuest with Unity Technologies to provide licenses of its software for hands-on learning at the COE.

9.2.2 | Potential rollout of Professional Qualifications through University system

The University Grants Commission and All India Council for Technical Education, in consultation with key stakeholders and with inputs from the industry, may consider programs for Professional Degrees (such as Bachelor of Engineering/ Technology, Bachelor of Arts, Bachelor of Science and corresponding Masters and Doctoral programs) which would focus purely on the AR and VR ecosystems. This would enable the masses to overcome any apprehensions on the potential of the industry to generate and provide sustainable employment, and will result in the growth of the supply side of the ecosystem in India

9.3 | Creation of Content

Content plays a critical role in the growth of media consumption across markets and their respective segments. In terms of content, a two-prong approach may be taken to ensure that masses are motivated to adopt a revolutionary method of consuming content:

9.3.1 | Content for Consumers

Content across both AR and VR needs to be customized to meet requirements of the masses, which includes generation of Vernacular content, which covers various languages in India, and regional centric as well. Content needs to be produced for various age groups and must appeal to all levels of technology friendliness.

9.3.2 | Content for Businesses

As Indian businesses are warming up to the idea of Immersive Media to reduce costs and enhance productivity and open up revenue sources, use cases that are unique to India and the buyer mindset in India need to be thought out and explored in detail.

9.4 | Health-Effects Mitigation

A key concern in the minds of both proponents as well as buyers of Immersive Experiences is the potential health effects of adopting these technologies. Particularly with Head-mounted and Headset devices in AR and VR respectively, concerns of sickness and spatial disorientation are expressed.

9.4.1 | Emphasis on dealing with VR Sickness & other Health Effects

The policy makers and manufacturers should work towards the employment of GVS (Galvanic Vestibular Stimulation) or similar technologies in order to mitigate the effects of VR sickness.

9.4.2 | Awareness on Usage of Smart Devices in AR environments

The Government and concerned ministries and Law Enforcement departments must issue advisories and implement strict laws that are preventive of accidents and incidents that harm the personal safety of the user, other individuals, property and potential national security concerns. With the explosion of technology, boundaries would need to be enforced in order to prevent a crisis due to uncontrolled usage in certain environments.

9.5 | Government's Direct Role in Driving Adoption

The Government, other than being the policy maker, is also the largest consumer and first adopter of most revolutionary technologies. This has always been due to the extensive spending capacities of the exchequer, and has served as a factor to instill trust in the minds of the general populace – if the Government can adopt, so can we.

9.5.1 | Government as a Customer

The Government of India (through departments, undertakings) can adopt Immersive Technologies in the areas of Skilling, Education, Rural Development, Infrastructure Development, Manufacturing, Agriculture and other areas, thereby becoming a large customer to the ecosystem.

9.5.2 | Government as an Enabler & Catalyst

The Government can play a very large role in the proliferation of the technology and its other aspects, which include boosting production via marquee programs such as Make in India, ensuring high uptake in specific sectors under schemes and programs such as Digital India, and supporting the developer and creator ecosystem by making special considerations under Startup India.

As the ecosystem matures, additional measures pertaining to policy building and realignments may need to be undertaken to support and supplement the rapid growth.

Profiles of Key Players

Company	Year of Founding	Ecosystem Category
OCULUS VR	2012	Hardware

About

- Founded in 2012, in Irvine, California
- Aimed at producing Virtual Reality headsets for video gaming
- Acquired by Facebook in 2014 for USD 2.3 Bn.
- Oculus has acquired over 3 other startups in the last 6 years of existence

Key Offerings

- Samsung Gear VR/Oculus VR launched containing Proximity Sensors, Touchpad and an inbuilt inertial measurement unit
- Oculus Rift – A Specialised VR Headset which required games and applications to be custom developed using Oculus' own SDK
- Oculus Go – A Standalone (untethered) headset that has been the kickstart of the revolution of headsets which have inbuilt processing capabilities

Company	Year of Founding	Ecosystem Category
SONY INTERACTIVE ENTERTAINMENT	1993	Hardware

About

- Sony Interactive entertainment is a multinational video game and digital entertainment company headquartered in California
- The focus is on developing VR headsets exclusively for gaming and VR games for the headsets

Key Offerings

- Developed and launced virtual reality headset, PlayStation VR in October 2016
- Compared to other headsets that require high-end computers, PSVR only require a PS4
- Sold 3 Mn PlayStation VR headsets and 21 Mn Immersive games as of Aug 2018

Company	Year of Founding	Ecosystem Category
MICROSOFT	1975	Hardware

About

- Microsoft Corporation is an American multinational technology company headquartered in Redmond, Washington
- Worked on producing Mixed Reality headsets, with focus on improving productivity at work

Key Offerings

- Developed mixed reality smartglasses Microsoft HoloLens and launched them in March 2016, targeted for developers
- Microsoft HoloLens is the first self-contained holographic computer, enabling to engage with digital content and interact with holograms in the world
- In October 2016, it was made available for pre-orders in limited countries around the world
- HoloLens 2 is expected to have a world-wide release in early 2019, with Microsoft's latest generation of the Kinect sensor, and a custom AI chip to improve performance

Company	Year of Founding	Ecosystem Category
SAMSUNG ELECTRONICS	1969	Hardware

About

- Samsung Electronics is a South Korean multinational conglomerate headquartered in Suwon
- Worked on AR, VR and MR technologies to offer wide range of Immersive experiences

Key Offerings

- Partnered with Oculus to launch Samsung Gear VR
- Samsung Gear VR has sold over 7.2 Mn headsets in 2016 and 2017 combined
- Samsung launched MR headset, HMD Odyssey in Feb 2018, on Windows Mixed reality platform

Company	Year of Founding	Ecosystem Category
GOOGLE	*1998*	Hardware

About

- Google LLC is an American multinational technology company headquartered in California
- Working on Hardware technologies to enable viewing VR content on smartphones

Key Offerings

- Launched Google cardboard in June 2014, shipped 10 Mn units and over 160 million Cardboard app downloads have been made till date
- Google improved on cardboard hardware platform to launch Google Daydream in 2016 2nd generation Daydream view was released in Oct 2017 and Lenovo's Mirage Solo is the first standalone headset running on Google's Daydream platform

Company	Year of Founding	Ecosystem Category
MICROSOFT	1975	Technology & Platform Developers

About

- Microsoft Corporation is an American multinational technology company headquartered in Redmond, Washington
- Workied on to create an API to build apps that can work on all of Microsoft devices without changing the code

Key Offerings

- Universal Windows platform was an API created by Microsoft to build apps that run on Windows 10, Windows 10 Mobile, Xbox One and Hololens without the need to be re-written for each
- Extensions can be added to the existing code to work on specific devices and apps for Microsoft HoloLens are built on this platform

Company	Year of Founding	Ecosystem Category
APPLE	2012	Technology & Platform Developers

About

- Apple Inc. is an American multinational technology company headquartered in California
- Focus is on developing software development kit, a platform to build AR apps for iOS

Key Offerings

- Apple introduced ARKit, a software development platform with iOS 11, build AR apps for iOS
- ARKit combines device motion tracking, camera scene capture, advanced scene processing, and display conveniences to simplify the task of building an AR experience
- Apple unveiled ARKit 2 in June 2018, a platform that allows developers to integrate shared experiences, persistent AR experiences tied to a specific location, object detection and image tracking to make AR apps even more dynamic

Company	Year of Founding	Ecosystem Category
GOOGLE	1998	Technology & Platform Developers

About

- Google LLC is an American multinational technology company headquartered in California
- Worked on creating SDK for AR apps to be built for Android devices. Using different APIs, ARCore enables the device to sense its environment, understand the world and interact with information

Key Offerings

- Launched ARCore, AR app development platform in March 2018.
- ARCore uses three key capabilities; Motion tracking, Environmental understanding and Light estimation to integrate virtual content with the real world

Company	Year of Founding	Ecosystem Category
AMAZON	2006	Technology & Platform Developers

About

- Amazon Web Services is a subsidiary of Amazon.com that provides on-demand cloud computing platforms to individuals, companies and governments, on a paid subscription basis
- AWS is working on creating a SDK aimed at creating content for VR, AR and MR devices

Key Offerings

- AWS launched Amazon Sumerian, a toolkit and platform for developers to build apps for VR, AR and MR devices, without needing to have any specialised programming or graphics skills
- Similar to AWS, Sumerian is priced using the service's usage-based model instead of a subscription

Company	Year of Founding	Ecosystem Category
FACEBOOK	2004	Technology & Platform Developers

About

- Facebook is an American online social media and social networking service company based in Menlo Park, California
- Working on AR platform to make it easier to create and distribute AR experiences.

Key Offerings

- Facebook revealed Camera Effects Platform and the associated AR Studio in April 2017. They are tools to make it easier to create interactive experiences using the Facebook camera
- Face Tracker, Sensor data, Scripting APIs are some of the key features incorporated into the platform

Company	Year of Founding	Ecosystem Category
GRIDRASTER	2014	Technology & Platform Developers

About

- Gridraster is a start-up founded in 2014 and is based out of Bengaluru
- Working on creating an Infrastructure layer to overcome device limitations like computation power and battery life

Key Offerings

- GridRaster is building an edge-cloud based platform to power truly immersive high-quality VR/AR experiences on mobile devices
- It provides cloud-based, remote augmentation at real-time to enable high-poly complex models and contents to effectively run on mobile devices and smartglasses

Company	Year of Founding	Ecosystem Category
GMETRI	2017	Technology & Platform Developers

About

- GMETRI is an Immersive media start-up based out of Bengaluru
- It is working on creating an Immersive media platform, to create content that can be accessed on a wide range of devices and can be deployed in organisations seamlessly

Key Offerings

- GMETRI is working on an VR/AR/MR platform, with an authoring, deployment and analytics toolkit that makes it extremely simple for enterprises to formulate, create and deploy immersive solutions
- Currently focused on creating solutions for Industrial training and Retail Industry

Company	Year of Founding	Ecosystem Category
SCAPIC INNOVATIONS	2016	Technology & Platform Developers

About

- Scapic is a VR AR start-up that lets people create, share and explore Immersive experiences
- It is headquartered in Bengaluru
- It has received funding of USD 0.5 Mn till date

Key Offerings

- Scapic has developed a platform to build Virtual/Augmented/Mixed Reality content easily
- Scapic's drag-and-drop editor makes it simple to build immersive experiences from scratch in minutes. It has the option to upload its own assets to create experiences, or its library can be used to help create immersive experiences

Company	Year of Founding	Ecosystem Category
YEPPAR	2016	Application Developers

About

- Yeppar is an Augmented reality start-up based out of Jaipur, Rajasthan
- It is working on creating an AR mobile application to view AR content on smartphones

Key Offerings

- Yeppar has developed an AR mobile application catering to Print Media, Real Estate, Education and Training among others

Company	Year of Founding	Ecosystem Category
NIANTIC LABS	2010	Technology & Platform Developers (Application Developers as per Pokemon Go)

About

- Niantic, Inc. is an American software development company based out of San Francisco
- Niantic is building a state of the art planet-scale AR platform for current and future generations of AR hardware
- It has received funding of USD 225 Mn in 3 funding rounds till date
- It has recently acquired Evertoon, Matrix mill, Escher Reality and VR studio Seismic Games to increase its offerings in AR and to venture into VR

Key Offerings

- Released their first AR game, Ingress in 2012 for android devices
- Pokemon Go, is the second AR game Niantic has released, developed in partnership with Nintendo and The Pokemon Company in July 2016. It has become widely popular, with its downloads crossing over 750 Mn by June 2017

Company	Year of Founding	Ecosystem Category
MARRIOTT INTERNATIONAL	1927	Application User

About

- Marriott International is an American multinational diversified hospitality company that manages and franchises a broad portfolio of hotels and related lodging facilities
- Marriott is exploring emerging technologies to offer the best possible experience to their Hotel guests

Key Offerings

- Marriott has partnered with Samsung Electronics to provide VRoom Service – a first-of-its-kind guest service that allows guests to order inspiring virtual reality experiences to their rooms
- The experience is to be experienced on Samsung Gear VR headsets
- The content for the VR headsets called VR Postcards, are created in collaboration with Framestore's Virtual Reality Studio, which features stories from real travelers

Company	Year of Founding	Ecosystem Category
WALMART	1962	Application User

About

- Walmart Inc. is an American multinational retail corporation that operates a chain of hypermarkets, discount department stores, and grocery stores. It is headquartered in Bentonville, Arkansas
- Walmart is working on Immersive media technologies to improve the shopping experience of customers and also to provide training virtually to all its employees
- Walmart has recently acquired Spatialand that makes software tools that lets creators transform existing content into immersive, virtual reality experiences

Key Offerings

- Walmart partnered with Oculus Rift to train 150,000 of its employees every year. The training experiences which uses 360 degree video content is developed by STRIVR labs
- Walmart is also testing a "3D Virtual Shopping Tour" feature on its website that allows shoppers to see what furniture looks like in a staged home

Company	Year of Founding	Ecosystem Category
NEXTVR	2009	Content Producers

About

- NextVR is a VR platform for delivering live sports and music in VR to fans globally. It is based out of California
- It has received funding of USD 115.5 Mn in three funding rounds till date

Key Offerings

- NextVR has partnerships with leaders in sports and entertainment including the NBA, FOX Sports, Live Nation, International Champions Cup etc.
- NextVR has also streamed live US presidential debate in VR

Company	Year of Founding	Ecosystem Category
JAUNT	2006	Content Producers

About

- Jaunt is an Immersive media start-up headquartered in Silicon valley
- It has received funding of USD 100.2 Mn in four funding rounds till date

Key Offerings

- Jaunt is the leading XR solutions provider, helping partners produce and distribute the full spectrum of immersive content (VR, AR and MR)
- It has full-service global production house, Jaunt Studios, and the Jaunt XR Platform's state-of-the-art distribution technology, to leverage XR to tell their stories in the emerging immersive age

Company	Year of Founding	Ecosystem Category
IMAGINATE/ NUSPACE	2011	Content Producers

About

- IMAGINATE is an AR and VR based technology enterprise that offers innovative visualization products and services
- It is headquartered in Hyderabad
- It has received funding of USD 0.5 Mn till date

Key Offerings

- Imaginate's flagship product NuSpace is an enterprise telepresence platform that enables immersive and interactive collaboration across different geographical locations using VR/AR for purposes such as industrial design, support and sales etc.
- Dressy is its patent pending virtual fitting room based personalization solution for fashion ecommerce, which enables shoppers to get look/fit of any apparel. Dressy is available as an enterprise plugin combined with an API that can be integrated on any retailer's website or mobile app

Company	Year of Founding	Ecosystem Category
ARTIFICIAL REALITY	2005	Content Producers

About

- Artificial Reality is a CGI and Mixed reality start-up based out of Mumbai

Key Offerings

- Artificial Reality has worked on solutions and created content in Automobile, Retail and animation etc.

Company	Year of Founding	Ecosystem Category
CHYMERA	2015	Content Producers

About

- Chymera is a VR advertising and monetization network for mobile virtual reality based out of San Francisco
- It has raised an undisclosed amount in angel funding

Key Offerings

- Chymera has worked on building monetization and discovery channels for VR/360 Video
- Chymera's advertising platform enabled
  - Publishers to monetize their content
  - Advertisers to engage with target audience in VR
  - Consumers to discover & experience new content

Company	Year of Founding	Ecosystem Category
INTEGRA	1994	Content Producers

About

- Integra is a leading digital content services company providing innovative source-to-publish solutions to global publishers

Key Offerings

- Digital learning solutions to organizations across diverse industry verticals
- Learning content and interactive learning, based on digital learning solutions to organizations in the education and enterprise segments
- Emerging disruptive content technologies like Augmented Reality, Virtual reality, and Mixed Reality.

Company	Year of Founding	Ecosystem Category
WIPRO	1982	System Integrators

About

- Wipro Limited is an Indian IT Services corporation headquartered in Bengaluru, India
- Wipro is currently offering VR and AR solutions to cater to the requirements of wide spectrum of the Industry

Key Offerings

- Wipro is working on providing Immersive media solutions in Marketing, Retail, Fashion, Industrial training and maintenance, Utilities, Medicine etc.
- Currently the solutions are being offered to enterprise customers. Pilots and POC's are created and showcased to enterprise customers to drive Immersive media adoption

Company	Year of Founding	Ecosystem Category
TATA ELXSI	1989	System Integrators

About

- Tata Elxsi is an Indian design company and a part of the Tata Group, headquartered in Bengaluru, India
- Focus is on to develop Integration solutions to implement complex heterogeneous solutions across various industries

Key Offerings

- Tata Elxsi is currently working on providing visualization solutions in Field Force training, Product visualisation, Manufacturing, In - Store experiences, Product marketing, Remote collaboration
- Tata Elxsi's Virtual Reality/ Visualization solutions provides the best way for teams of technical and creative professionals to engage in interactive, real-time engineering and design review, data analysis, critical training, presentation, or command-and-control operations

Company	Year of Founding	Ecosystem Category
IBM	1911	System Integrators

About

- IBM Corporation is an American multinational technology company headquartered in Armonk, New York
- IBM has partnered with Unity to explore the emerging opportunities in AR VR

Key Offerings

- IBM's Watson division is working with the creators of the Unity game engine on an open-source SDK that could make video games a whole lot smarter
- With IBM Watson integration, games and simulations will have an improved ability to comprehend natural language, including speakers intent and to respond intelligently

Company	Year of Founding	Ecosystem Category
MOBILIYA	2011	System Integrators

About

- Mobiliya is a global enterprise mobility and mobile System integration (SI) company based in San Francisco Bay area
- Mobiliya provides system integration, engineering support for mobile and other connected devices

Key Offerings

- Mobiliya is involved in AR Application development, AR content development, Enterprise Integration and AR content management
- Healthcare, Telecom, Oil and Gas and Consumer goods manufacturing are some of the Industries transformed using Augmented reality
- Mobiliya has also developed content management portal, Mobiliya AR360 to manage AR content consumed by device application

Company	Year of Founding	Ecosystem Category
PARALLAX LABS	2016	Technology & Platform Developers

About

- Provides End to End soltutions in Virtual, Augmented and Mixed Reality to Business, Educational & Government Organisations

Key Offerings

- Solutions are custom made based on the unique requirement of the clientele, the real innovation is in the implementation of the solution, because of the novelty of the technology, every solution needs to go under months of research
- Industrial Training and Maintenance in Healthcare, Pharma, Education, Heavy Machinery & Automobile are the key verticals

Appendix – Additional Case Studies

Appendix
Additional Case Studies

Some additional case studies of implementations of immersive media across industries

DASSAULT SYSTEMES

Dimension
EXPLORATION

Application
PRODUCT STAGING IN EVENTS FOR AUTOMOBILES

The solution created by Dassault Systems creates a vehicle stage that is aimed at and event experiences that communicate brand and product themes to target audiences in the most captivating way

Challenges

Exhibitions and Trade Fairs have streams of crowds visiting stalls and multitudes of exhibits

Standard exhibits do not draw large attention spans

Automobile manufacturers are constantly trying to wow their audiences

Solution Offered

Using CAD based projections to create artificial surroundings on the exhibits

AR & VR create immersive experiences and can reveal inner components

Attention grabbing gamification possible

Potential Value Delivered

Higher interactions, higher brand-recall possible with further focus on visitor purchase considerations and capture leads

Dimension
KNOWLEDGE

Application
AUGMENTED REALITY-ASSISTED ASSEMBLY (AURA)

Combines wearables (e.g. Google Glass™), Machine-Vision, and Augmented Reality to guide plant operators in performing complex tasks right the first time. This product forms part of our Empowered Worker™ Suite of IIoT Solutions to manufacturing industry

Challenges

High costs incurred due to manufacturing 'mistakes'

Speed and Efficiency improvements slower

Lower availability of manufacturing assets

Lower effectiveness of training has been a matter of concern

Solution Offered

Proper guided fixing of decals by an operator to varying fender types in an automotive assembly line

Guided Sub-Assembly of automotive structures

Training on the assembly line via live video streams for remote guidance

Potential Value Delivered

Higher interactions, higher brand-recall possible with further focus on visitor purchase considerations and capture leads

Immersive experience for the aspirants who want to acquire skills & training to build an exciting career in the Media & Entertainment industry; AR-based course material

Challenges

Higher effort and lower uptake during counselling

Deeper nuances of course material not possible using existing books/ manuals/reading material

Solution Offered

VR-based solution for counselling allowing students to experience immersive views about course and program

AR-based material allowing for deeper connect between material and students

Potential Value Delivered

Reduced counselling time as well as deeper understanding of nuances of the Media & Entertainment Industry; Increased time spent as well as ensured longevity of books/material

Dimension
EDUCATION

Application
AR & VR IN ANCILLARY EDUCATION

KEEVES TECHNOLOGIES PVT. LTD

Dimension
KNOWLEDGE

Application
SAFETY GUIDE IN VR ENVIRONMENT

A safety guide in VR environment and having a gamified experience. Learn to use an angle grinder to cut tile, mortar and pavers; make quick work of rust and loose paint removal; sharpen blades and cut or grind steel

Challenges

Safety is a major concern for enterprises in the segment as it affects the consumer as well as employees of the company engaging in this work

Solution Offered

Enhanced Product usability

Increased knowledge during transitions and productivity improvement

Potential Value Delivered

Increased Productivity Safety and Usability to drive end-usage

The game has been built using Virtual Reality technology to help patients suffering from Alzheimer's., creating a virtual environment, where the patients are offered a daily task. Successful completion of a task results in some kind of reward, motivating patients to continue.

Challenges

Mentally stimulating games are not available

Issues exist in the older era solutions designed for patients in terms of experience and ergonomics

Solution Offered

Digital application designed with the purpose of the helping dementia patients to enhance day-to-day memory

Potential Value Delivered

Ranging across Early Detection of Alzheimer's to encouraging social bonding with the patients, assessment of progress of the patient as well as other benefits of using the application

DATAMATICS
Data to Intelligence

Dimension
KNOWLEDGE

Application
GAMIFICATION FOR ALZHEIMER'S PATIENTS

Trezi

Virtual Reality product to improve design collaboration in the building/AEC industry by offering immersive visualization, spatial awareness, interactivity with design elements, data management and communication features

Dimension
CONNECTIVITY

Application
DESIGN

Challenges

Inefficient and ineffective design collaboration in the Building industry – poor design visualization, multiple design iterations, multiple non-intuitive design tools, etc.

Time and cost overruns and delayed decision making

Solution Offered

One-click VR walkthrough of one or more 3D models

Query model objects for geometric and material properties

Integrated product catalogs for selection & placement in VR model

Potential Value Delivered

Intuitive and immersive VR solution, addresses collaboration issues within all building industry stakeholders, Easy to use, quick to learn and produces error free work

AR smart utility that enables an iPhone user to measure any real world object using the phone's camera. The app gives the most accurate measurements within no time.

Quovantis

Dimension
KNOWLEDGE

Application
MEASURE

Challenges

Logistical challenge of carrying measuring devices

Challenge in measurement of 3-Dimensional objects

Solution Offered

Helps in 3D measurements by depicting the readings right on top of the object itself

Capability of measuring very large horizontal objects

Picture of the object, along with measurements can be saved and shared anytime

Potential Value Delivered

Using a phone as a measuring device is an innovative step towards simplifying the lives of the users. The app can be a helpful tool in sectors like Real estate & Manufacturing

Plutomen
NEW NEVER ENDS

Dimension
EXPLORATION

Application
AUTOMOBILE SALES IMMERSIVE EXPERIENCE

AR based app for potential car buyers to visualize car models along with its features

Challenges

High cost of inventory in automotive industry, especially in showrooms keeping car models on display

Showrooms limit no. of models displayed leading to slow down in sales

Solution Offered

AR based app loaded with many features for potential car buyer will want - the ability to see look of the car; information on special features; demos and videos; 360-degree views of the interiors; even virtual test-drives

Potential Value Delivered

For the car manufacturer such a tool would be useful in gauging interest and demand, being in touch with potential customers and assist selling without needing to stuff their showrooms with models

Marker-based and Marker-less 360 Walkthrough of Real Estate Projects, Virtual Reality for Real Estate Projects

Challenges

Lower engagement due to tedious walk-around of projects

Solution Offered

360 Augmented Walkthrough of Site

AR – Live Brochure

VR Content for HTC Vive

Microsite Integration with 4K 360 Walkthrough

Potential Value Delivered

Enhanced engagement, clearer understanding of actual product to customers, and emergence of newer marketing options

magicbricks.com

Dimension
EXPLORATION

Application
AR & VR FOR REAL ESTATE MARKET

Magic EdTech

Dimension
EDUCATION

Application
IMMERSIVE EXPERIENCES TO K-12 STUDENTS

Products can be used by students in a self-learning mode, or can be used by teachers for a classroom demonstration. These products can be directly linked to curriculum, or can be used as supplementary material.

Challenges

Current educational content is limited in being immersive

Student engagement with content is limited

Certain concepts are difficult to experience/explain due to their abstract nature

Solution Offered

AR-based solutions which are either clickable, QR-readable which create immersive experiences for students

Interactive simulations through AR being rendered by Teacher/Instructor command

Potential Value Delivered

Increased engagement with educational content; better understanding of abstract or difficult to experience concepts; Increase in subscriptions with higher level of engagement and improved learning

PARALLAX

Setup a galactic VR experience at the Indian Space Research Organisation's Vikram Sarabhai Space Exhibition in Ahmedabad

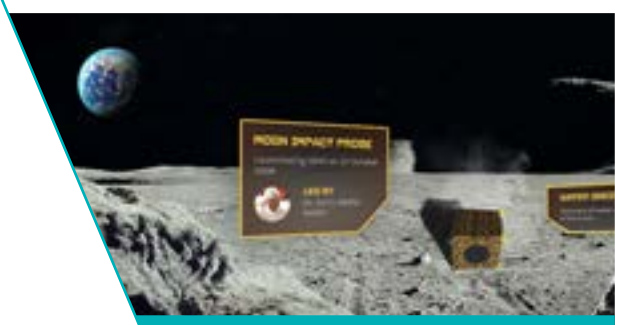
Challenges

Solution Offered

A Virtual Reality tool to experience the planetary system from a first person perspecctive

Potential Value Delivered

Everyday, approximately 250 to 300 children from nearby schools go on a virtual field trip amongst the planets of our solar system, witness the Moon Impact Probe mission led by APJ Abdul Kalam from a first person perspective and land on the surface of Mars.



Dimension
EDUCATION

Application
VR EXPERIENCE AT INDIA SPACE RESEARCH ORGANIZATION (ISRO)'S VIKSRAM SARABHAI SPACE EXHIBITION

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Glossary of Terms

Abbreviation	Explanation
3D Audio	Three Dimensional Audio – A manipulation of sounds by change in placement of source of sound in space
AI	Artificial Intelligence
AR	Augmented Reality
Bethesda	Bethesda Game Studios, USA
BIS	BIS Research, USA
Bn.	Billion
CAGR	Compound Annual Growth Rate
CGI	Computer Generated Imagery
CoE/COE	Centre of Excellence
DEC	Digital Electronics Corporation, USA
Enlighten	Enlighten Technologies, USA
GPU	Graphics Processing Unit
GUI	Graphical User Interface
GVS	Galvanic Vestibular stimulation
HMD	Head Mounted Device
HUD	Heads-up Display
IBM	International Business Machines Corporation, USA
INR	Indian Rupee
IoT	Internet of Things
IT	Information Technology

Abbreviation	Explanation
ITeS	Information Technology Enable Service
LTE	Long Term Evolution(4G)
Mainframe	Mainframe Computers
Memesys	Memesys Culture Lab, India
Meraki	Meraki Virtual Reality Studio, India
Mn.	Million
MR	Mixed Reality
NCR	National Cash Register Corporation, USA
NFL	National Football League
PC	Personal Computer
PS	Sony PlayStation
SDK	Software Development Kit
SI	System Integrators Ubisoft Entertainment SA, France
Ubisoft	Ubisoft Entertainment SA,
USA	United States of America
USD	United States Dollar
Volkswagen MARTA	Mobile Augmented Reality Technical Assistance developed by Volkswagen Group, Germany
VR	Virtual Reality
WB	Warner Bros. Interactive Entertainment, USA
YTD	Year to Date

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