

2020 AUGMENTED AND VIRTUAL REALITY SURVEY REPORT



INDUSTRY INSIGHTS INTO THE FUTURE OF IMMERSIVE TECHNOLOGY

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PRESENTED BY

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XRA XR
ASSOCIATION



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Executive Summary

OPTIMISM INCREASES AS IMMERSIVE TECHNOLOGIES ENTER THE MAINSTREAM

Plummeting hardware and software costs, increasingly impactful applications outside of entertainment, and the ubiquity of mobile devices are contributing to the rise of immersive, XR technologies — a category that includes AR, VR and MR.

That's the primary conclusion from the fourth annual Augmented and Virtual Reality Survey, conducted in early 2020 by global law firm Perkins Coie LLP, leading industry group the XR Association, and industry venture capital firm Boost VC. The survey, taken before global markets were roiled by the coronavirus outbreak, found growing momentum for nearly every area of immersive technology's use and, importantly, [expanding avenues for monetization](#). Industry experts are increasingly bullish about the wide range of XR applications, from surgical training for medical students to simulated Mars rover repairs for NASA engineers.

"Industry leaders are noticing tangible and significant advances in the adoption of AR, VR and MR across sectors, such as healthcare, education, workforce training, manufacturing — including advanced manufacturing — and retail," said Elizabeth Hyman, CEO of XRA. "We are at the precipice of an integration of XR technology that will transform businesses and society for the better."

The survey indicates boom times ahead for the industry, with [nearly 200 professionals representing startups, enterprise technology firms, and investors](#) showing strong optimism. Immersive gaming is set to continue growing, but other, broader uses are too — meaning there can be no doubt that the market for XR technologies is growing and maturing at a rapid pace.

The advent of smart city initiatives by governments and business, and technology advocates around the world are also leading the charge for increased XR adoption and market growth. The survey results show that [North America and Asia are ahead of the pack](#) in pioneering those initiatives and that city size isn't the only factor driving leadership in the area. The booming tech mecca of Austin, Texas, ranked among some of the world's biggest metropolises for smart city initiatives, which would have been hard to fathom even a decade ago.

But even beyond smart cities, immersive technology appears poised to become a bigger part of day-to-day life for citizens around the world. Building on the growing optimism expressed in survey results over the last three years, [nearly 40% of respondents expect immersive technology to be mainstream in the next two years](#), and more than three in four say that will happen within the next five years.

Still, industry leaders acknowledge the market has not yet fully scaled. When discussing concerns around funding and investment, 46% admitted that the [lack of an established market](#) for the technology was a barrier to funding. [5G ranked](#) as the most important technology improvement, which, coupled with immersive technologies, respondents believe will lead to mainstream adoption by businesses in the next five years.

"The adoption of 5G will make a difference in terms of new types of content being able to be viewed by more people," said Irena Cronin, CEO of Infinite Retina, a research and advisory firm that helps companies implement spatial computing technologies. "5G is going to make a difference for more sophisticated, heavy content being viewed live when needed by businesses."

Interestingly, the value of AR and VR investment dropped from \$4.5 billion in 2018 to \$3.3 billion in 2019, according to PitchBook. However, the total number of AR and VR investments has held fairly steady over the past three years — a consistency that shows continued interest from angel/seed and early venture capital investors while later-stage VC is increasingly getting into

the game. These findings, combined with survey respondents' plans to increase monetization avenues, mean companies in the AR/VR space are finding product-market fit and shifting toward growth.

Still, challenges (and opportunities) remain, in part because immersive technology as a category can be hard to easily define, but also because industry professionals working in the space imagine a future where computer-assisted visualization models could change everything. With possible applications ranging from sports, video games, and entertainment to healthcare, education, and disaster preparedness — and remote-working options possibly becoming more important in the wake of the coronavirus outbreak — what's ahead for immersive technology will mean big changes for society and big opportunities in business.

The power to spatially visualize data, prepare and practice for real-world scenarios, and conduct remote, real-time training and collaborations that collapse physical space will create profound changes in many bedrock industries and cities around the world.

Key Findings



- In one of the survey's biggest findings, respondents will increasingly seek [to diversify monetization strategies and expand revenue channels](#) for immersive technology compared to their 2019 levels. The fact that monetization channels across the board — including sales of subscriptions (48% to 61%), in-app purchases (41% to 51%), product placement (30% to 47%), and advertising (40% to 47%) — saw significant increases above 2019 expectations signals growing industry strength.
- Expectations for AR technologies continue to outpace VR in terms of expected revenue, market penetration, and consumer adoption, with three-fourths of respondents [expecting the AR market to eventually surpass VR in total revenue](#). This is driven by several factors, one of which is the ubiquity of mobile devices that can be used more readily for AR applications.
- Outside of gaming and entertainment, respondents expect the most disruption from immersive technologies in [healthcare and medical devices](#) over the next 12 months. 38% of respondents pointed to healthcare and medical devices as ripe sectors for disruption, and education followed closely at 28%.
- Six of the 10 [top cities selected for their pioneering work in smart city immersive technologies](#) are in the United States, including New York, Austin, Los Angeles, Chicago, Boston, and San Francisco. Beijing, Tokyo, Dubai, and Barcelona made up the rest of the top 10.
- When it comes to [improvements that will most impact consumer adoption](#) of immersive technology in the next two years, respondents pointed to continued device upgrades. Smaller devices and sleek and fashionable devices tied with 42%, followed by more comfortable devices at 39%.
- Two-thirds of respondents expect [spending by businesses on immersive technologies](#) to be significantly or slightly higher in 2020 than in 2019, while just 6% expect the investment level to be significantly lower than the previous year.

The survey was completed by 191 respondents. In the charts that follow, some questions do not add up to 100% due to rounding, and some exceed 100% because respondents were invited to select more than one answer. The full survey methodology, a breakdown of respondent demographics and a complex appendix of results begin on page 13.

Confidence for Growth and Monetization

Immersive technologies are moving out of laboratory settings and theoretical applications and becoming fully-fledged, revenue-generating marketplaces. That's clear from this year's survey results, as respondents from each group — executives, technologists, startups, and investors — were more bullish about immersive technology products across a variety of monetization channels than ever before.

Respondents were queried in the first months of 2020, before the global economic turmoil resulting from the coronavirus. But compared with previous years' surveys, respondents in 2020 expect to [increasingly pursue](#) sales of products or subscriptions, in-app purchases, product placements, advertising, and events. Across each of these categories, the percentage of respondents indicating they are currently monetizing or plan to in 2020 increased by an average of 13% over 2019 responses, with some revenue channels like product placement and live events jumping 17%. These increases in the span of just one year are dramatic and indicate a business sector coming into its own and a maturing, loyal consumer base that's more willing to accept such revenue models.

A large part of this growth is driven by the rise of AR applications, which are software-based, leading to strong market penetration and lower costs of production. Although only 25% of respondents identified working primarily in AR, 76% agreed that [the AR market would overtake VR in terms of revenue](#), a 5% increase from the 2019 survey. Looking ahead, this doesn't seem to be a trend slowing down anytime soon, with 85% predicting that the AR market overtakes VR [within the next five years](#).

"Both VR and AR will be essential in driving innovation in spatial computing. Long term, the potential for the AR market exceeds VR," said Martina Welkhoff, a partner at the WXR Venture Fund, a venture capital firm investing in early stage spatial computing and artificial intelligence startups with gender diverse teams. "Initially AR will leverage mobile and eventually replace phones for heads up and hands-free digital experiences."

Far and away the most ubiquitous AR-enabled device is the smartphone that resides in the pockets of 3.2 billion people, or nearly 45% of the world's population. With a few clicks, consumers can download apps to visualize clothing purchases, test out new makeup looks, rearrange furniture in their apartment, or play a game catching virtual objects around their neighborhood.

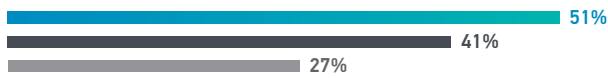
With so many daily digital touch points centered in and around the smartphone, it follows that developing specific content for social media channels is the priority for immersive technology companies' content creation efforts. In 2019, only 31% of respondents were creating specific content for social media, [but that number reached 47% this year](#).

With AR devices in half of the world's pockets, over two-thirds of respondents expect that businesses will be investing slightly or significantly more in immersive technologies in 2020 compared to 2019.

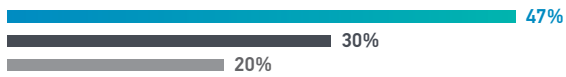
> How are you currently monetizing, or how do you intend to monetize, immersive technology products or services? (Select all that apply)



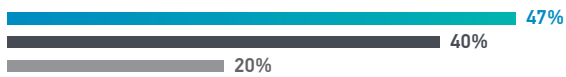
Sale of products or subscriptions (e.g., devices, content, games)



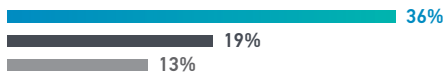
Charge for additional features or in-app purchases within apps that can be downloaded for free



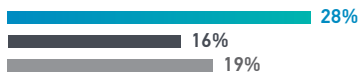
Product placement within the immersive experience



Revenue from advertising within apps



Charge for access to live events (e.g., sports, concerts)



Location-based entertainment (e.g., VR arcades)



Other

Strength Across Sectors



While AR applications may be lighting up consumer smartphones, there's a whole world of immersive technology applications coming online for enterprise use across a variety of sectors including healthcare, education, manufacturing, retail — and even space exploration.

Healthcare specifically is a sector garnering more attention, investment, and interest. When asked [which sectors would experience the most disruption outside of entertainment](#) in the next 12 months, 38% ranked healthcare first, followed by education (28%), workforce development (24%), and manufacturing (21%).

The global AR/VR market in the healthcare industry is [expected to grow](#) to nearly \$11 billion (more than \$5 billion [in North America](#)) by 2025, a compound annual growth rate of more than 36%. Such impressive projections are partly driven by an increasingly large array of immersive technology applications that are being recognized, like simulated surgical training for doctors and nurses, palliative hospice care, pain management, and 3D visualization of diseases at the molecular level.

Recent global events related to the containment and treatment of the novel coronavirus are a testament to just how valuable these technologies can be and how they are being used on the ground today. For example, VR technology that allows doctors to accurately visualize and assess patients remotely has been deployed to aid early diagnosis and treatment while protecting health workers. This type of effective use case demonstrates the powerful role immersive technologies will play in the future of healthcare.

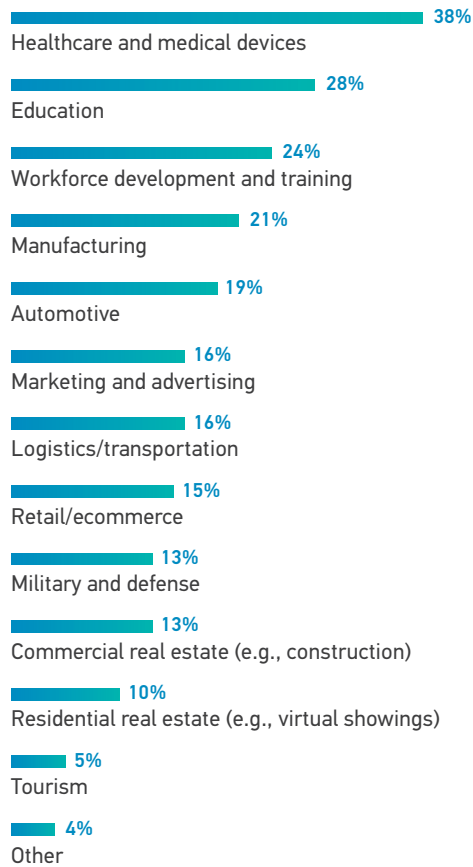
Across a range of industries, respondents expect immersive technology to increasingly improve day-to-day operations, enhance efficiency, and improve outcomes. Seven out of 10 survey respondents said businesses [will focus on workforce training and development](#) when it comes to immersive technology implementation within the next 12 months. One reason could be that training and development is an area where the ROI of the upfront investment, payback period, and resulting impact to the bottom line are easily quantifiable.

For example, an effective “in-person” training for a large company with employees around the world could be completed with immersive technologies without the cost of travel and lodging for participants — an advantage that might be even more pronounced amid global health concerns like the coronavirus. Simulated training scenarios in advanced manufacturing and healthcare are also drawing attention, not just for cost-saving opportunities but also because simulated trainings actually yield better results and improved performance.

The significant advantage immersive technologies provide is the ability to spatially visualize data, patients, environments, and materials accurately and in real time. In healthcare, this can mean giving doctors and nurses the opportunity to get more repetitions and practice for specific surgeries. In manufacturing, 75% of survey respondents expect [immersive technologies to be offered via real-time remote assistance to employees](#), and another 45% expect solutions to be focused on assembly errors.

“Lockheed Martin Space’s Emerging Technologies Lead, Shelley Peterson, is seeing some dramatic improvements — including up to 90% reduction in labor costs due to AR/VR usage on the new Orion spacecraft,” said Nicole Lazzaro, president of XEODesign, an AR/VR consultancy. “That is a great example of a high-stakes, high-cost area where a single assembly mistake can shut down production for days and rack up millions of dollars in costs. If AR spatial applications can help engineers visualize and simulate repairs before touching expensive materials, that’s a huge win.”

> In which sectors do you expect to see the most disruption by immersive technologies in the next 12 months? (Outside of the gaming and entertainment space)



U.S., Asia Lead in Smart City Development



Smart cities are generally defined as places where new technologies like cloud computing, advanced analytics, and blockchain are deployed to improve the delivery of services and quality of life. Increasingly, immersive technologies are becoming a part of the urban landscape in many pioneering cities around the world.

When asked which cities were leading the way, survey respondents chose a cluster of U.S. cities and Asian regional hubs. Among [the American cities cited](#), some were more obvious like New York City, which 29% of respondents selected. However, size wasn't the only reason for a higher ranking. While Austin, Texas, is only the 11th largest city in the country, it's a burgeoning hub of technology, and ranked second, nearly tying with New York City with 28%. Of note, only one European city, Barcelona, cracked the top 10 of recognized leading cities.


Austin is an interesting study in terms of public-private partnerships and level of infrastructure investment needed to introduce new technologies to the urban environment. The city has received a number of smart city accolades, including its selection as one of seven awardees for a U.S. Department of Transportation \$40 million grant to implement urban technology programs.


Respondents overwhelmingly agree (88%) that immersive technologies will become commonplace [as part of smart city initiatives by 2025](#). And relatedly, the number of applications where immersive technology can be used in the service of better, smarter, more livable cities has grown. Industry professionals expect [immersive technology to be used in smart cities](#) through enhanced navigation (57%), urban planning (44%), traffic flow management (44%), improved parking systems (43%), smart building management (42%), and disaster response (37%). The fact that each use case garnered roughly the same amount of interest indicates a large, diversified area holding a significant amount of potential to grow in multiple arenas.

Perhaps not surprising given U.S. dominance when it comes to smart cities, respondents chose [North America as the best geographic area for further investment](#) in immersive technologies — and by a considerable margin. Nearly eight out of 10 respondents (78%) said the region was the most promising, up from 62% in 2019. The next closest region was the European Union at 12%, down from 21% in 2019.


Even if some regions are setting a strong course in smart cities, respondents said one area of advancement was most important for immersive technology adoption: [5G wireless connectivity](#). "5G must be implemented for the full vision of smart cities to be realized," said Martina Welkhoff of the WXR Fund.


> What are some of the top applications of immersive technologies in smart cities? (Select all that apply)

 57%
Navigation (e.g., smart GPS navigation technology, allowing a virtual overlay to live cameras to plot a route, provide real-time updates of traffic, speed limit signs, local events, and display times, search for geographic objects, etc.)

 44%
Urban planning (e.g., infrastructure planning)


 44%
Smart traffic signals and camera monitoring for traffic flow management

 43%
Smart parking (e.g., alert drivers where there is open street parking or garage capacity, and direct drivers via an app)

 42%
Smart building management systems (e.g., systems to monitor and manage buildings' safety, stability and energy consumption)

 37%
Disaster response and recovery (e.g., ensure public safety during unwanted situations like fires, earthquakes and landslides using real-time monitoring systems and AR tools)

 16%
Police training

 10%
Veteran services (e.g., PTSD management among veterans)

 1%
Other

Questions Remain About Legal Issues, Market Readiness



When survey respondents who worked at startups were asked about what factors are limiting venture capital investment for startups in the space, the most common responses were lack of [an established market, untested technology, and slow adoption by businesses and consumers](#).

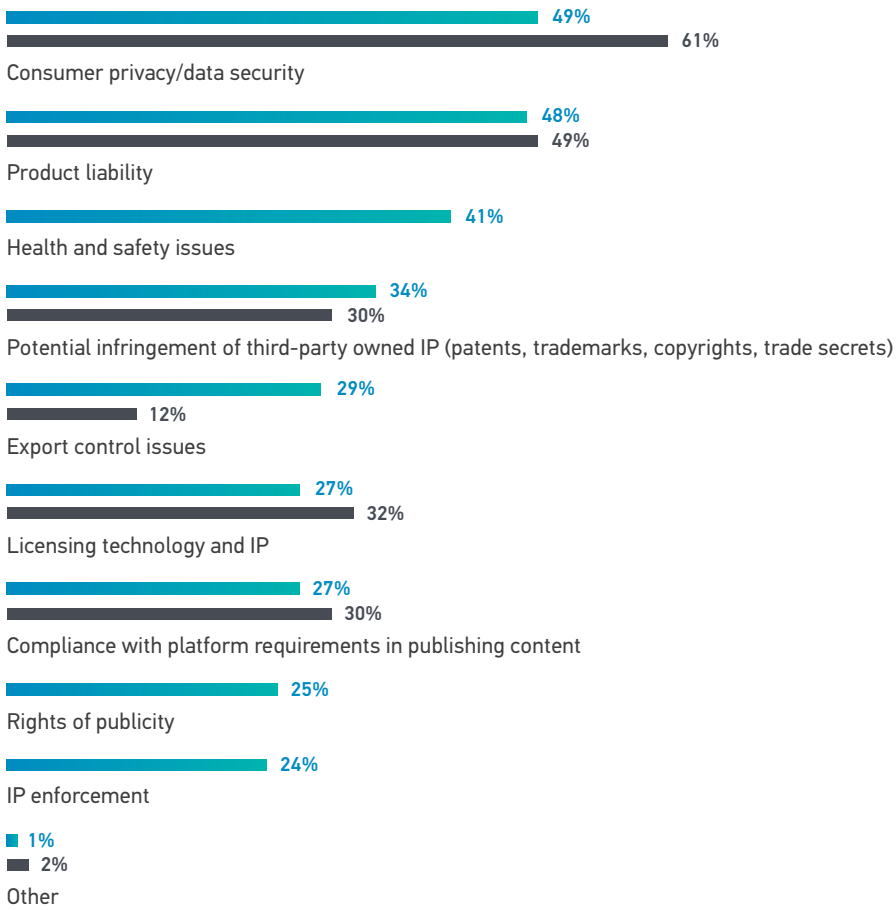
It's unclear whether this has to do with the availability of a connected network, lack of proven technology teams, unfamiliarity of the products, or concerns about costs. Still, many of the concerns are being addressed as 5G networks expand, applications and mainstream use cases grow, and costs of hardware and software drop.

All show a maturing marketplace, and within the industry itself, some developments in the legal arena point to growing confidence. In the 2019 survey, 61% of respondents cited [consumer privacy and data security as the top legal risk](#) for developing immersive technology applications and content. This year, that percentage dropped to 49%. Rather than ignoring the persistent problems surrounding privacy and data security, more companies are [proactively addressing and updating privacy policies and disclosures regarding consumer data](#). In fact, more than half (54%) said they were doing so this year, compared with 47% in 2019. One cause of this could be new regulatory schemes around the world and in the U.S.

"Across the entire technology sector, there's been a greater focus on privacy and compliance — largely stemming from the sweeping California Consumer Privacy Act," said Kirk Soderquist, a partner in Technology Transactions and Privacy at Perkins Coie. "Complying with new regulations might not always be easy, but doing so in a thoughtful and comprehensive way can reduce risks and make organizations stronger."

Respondents were also less worried over patent infringement, from 50% in 2019 to 41% in 2020. An area where litigation concerns increased was in trademark and copyright disputes, going from 56% in 2019 to 61% in 2020. Both changes are likely less about regulation and more about companies in the immersive space maturing and understanding the applicable issues.

> Which of the following legal risks are of concern to your organization in developing immersive technologies or content? (Select all that apply)



Asked to startups, established tech firms, advisers, and outside consultants

Demographics and Methodology



In January and February 2020, 191 professionals completed the 2020 Augmented Reality and Virtual Reality Survey conducted by Perkins Coie LLP, the XR Association, and Boost VC.

Respondents indicated they represented an organization best described as an established technology company (47%), followed by a startup (19%), adviser or outside consultant (16%), investor (12%), or policymaker (5%).

Respondents identified their affiliation as:

- C-Suite (48%)
- Engineer / Producer (14%)
- Marketing / Business Development (12%)
- Consultant / Lawyer (5%)
- Investor (4%)
- Other (17%)

ABOUT PERKINS COIE LLP

Perkins Coie is a leading international law firm that is known for providing high-value, strategic solutions and extraordinary client service on matters vital to our clients' success. With more than 1,000 lawyers in 19 offices across the United States and Asia, we provide a full array of corporate, commercial litigation, intellectual property and regulatory legal advice to a broad range of clients, including many of the market leaders in AR, VR, and MR technology, products, services, and content. The firm represents clients in identifying, anticipating, and resolving legal issues raised by this developing technology, including corporate financings, IP protection, software licensing, privacy and data security, product liability, commercialization, and content strategy execution.

ABOUT THE XR ASSOCIATION

The XR Association (XRA) represents headset and technology manufacturers across the broad XR industry, including Google, HTC VIVE, Facebook and Oculus, Samsung, Sony Interactive Entertainment, and Microsoft. Promoting the dynamic global growth of the XR industry, XRA supports responsible development and adoption of XR technology with best practices, dialogue across stakeholders, and research. XRA is the leading resource for researchers, policymakers, and industry partners across the XR industry.

ABOUT BOOST VC

Boost VC is an early stage investor and accelerator investing in startups working with cryptocurrency, virtual reality, augmented reality, and space technology, among other technologies of the future. Boost VC has invested in over 250 companies from over 30 countries and aims to build an ecosystem of visionaries, leaders, mentors, and investors to build the future.

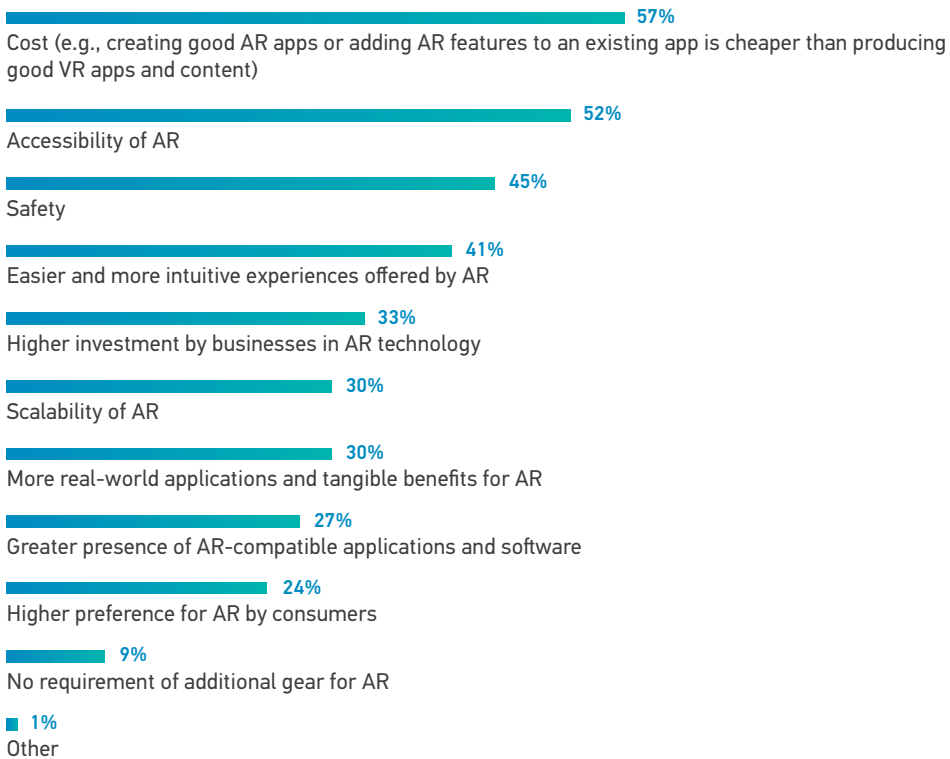
Appendix of Findings



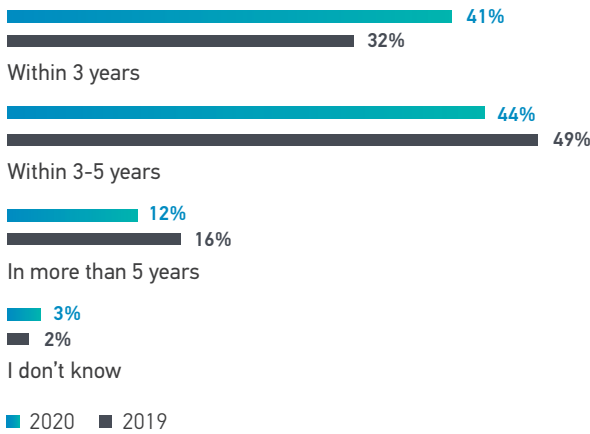
> Do you anticipate that the AR market will surpass the VR market in revenue?



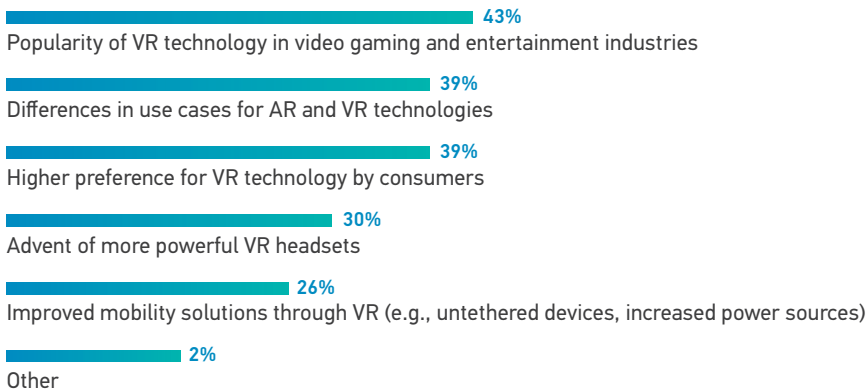
> Which of the following factors are most responsible in terms of the AR market surpassing the VR market? (Select all that apply)



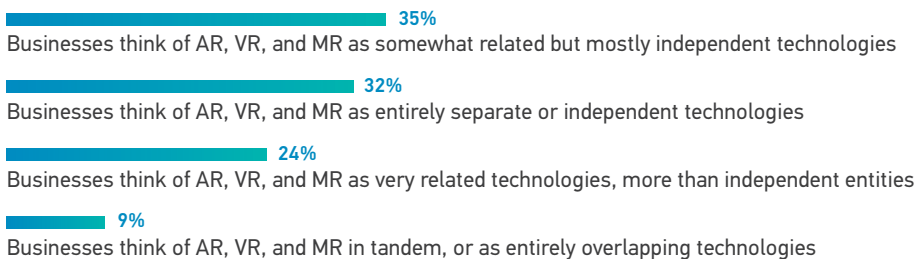
> When do you expect the AR market to surpass the VR market in revenue?



> Why do you feel this way? (Select all that apply) (In the case VR may surpass AR)



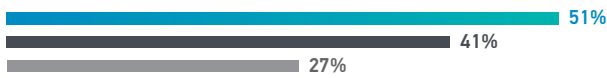
> Which of the following best describes how businesses categorize the relationship between the terms AR, VR, and MR?



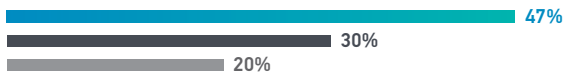
> How are you currently monetizing, or how do you intend to monetize, immersive technology products or services? (Select all that apply)



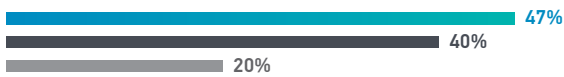
Sale of products or subscriptions (e.g., devices, content, games)



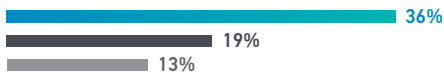
Charge for additional features or in-app purchases within apps that can be downloaded for free



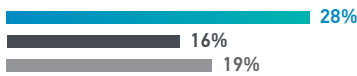
Product placement within the immersive experience



Revenue from advertising within apps



Charge for access to live events (e.g., sports, concerts)



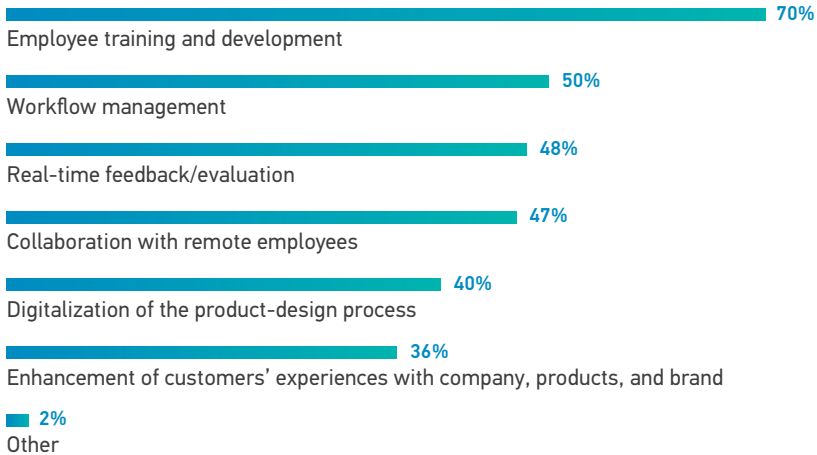
Location-based entertainment (e.g., VR arcades)



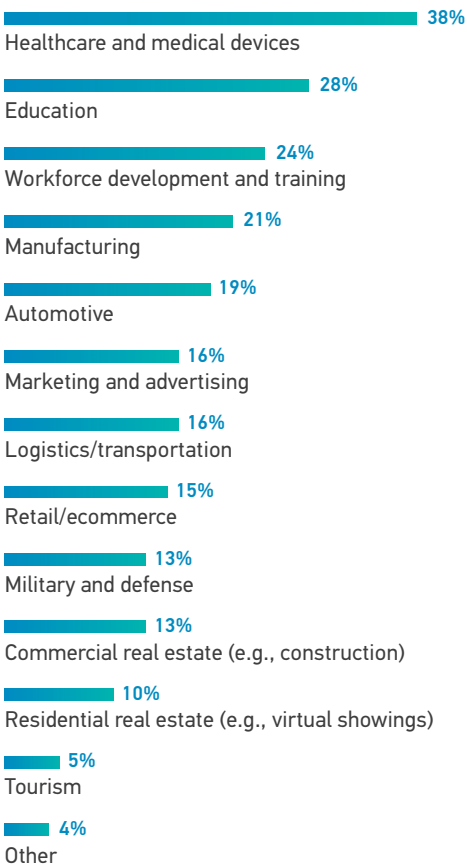
Other

■ 2020 ■ 2019 ■ 2018

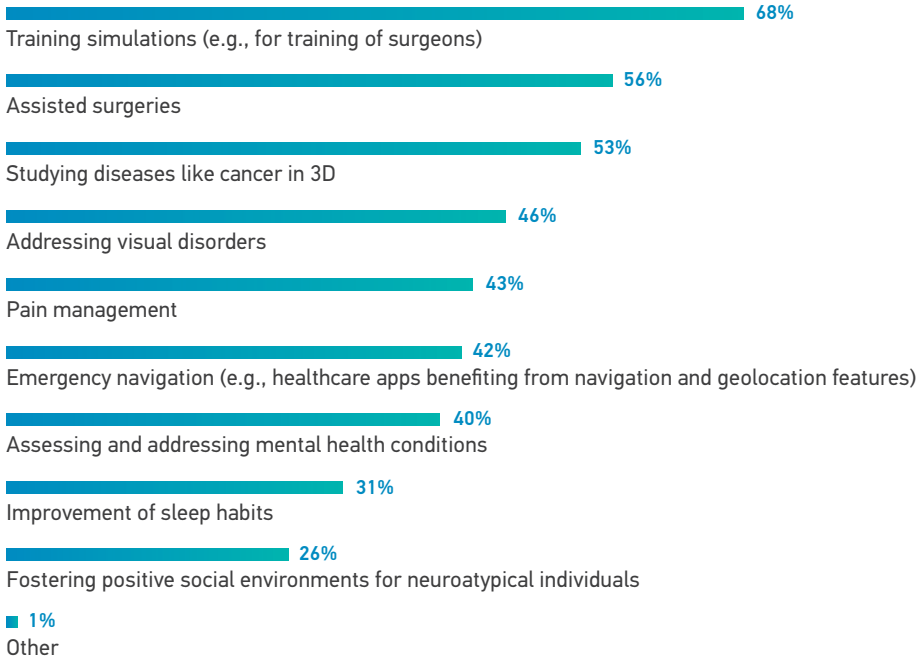
➤ Which enterprise applications/solutions within immersive technologies are businesses most likely to focus on over the next 12 months as a means of improving their day-to-day business operations? (Select all that apply)



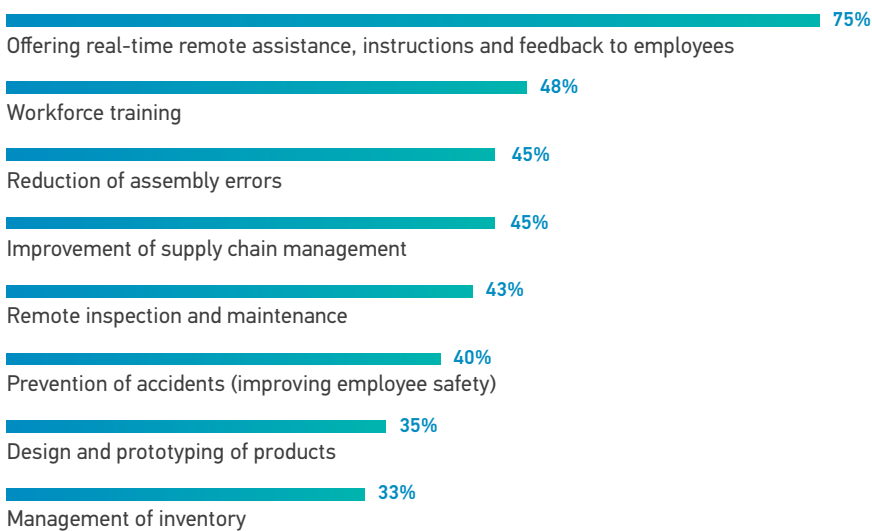
➤ In which sectors do you expect to see the most disruption by immersive technologies in the next 12 months? (Outside of the gaming and entertainment space)



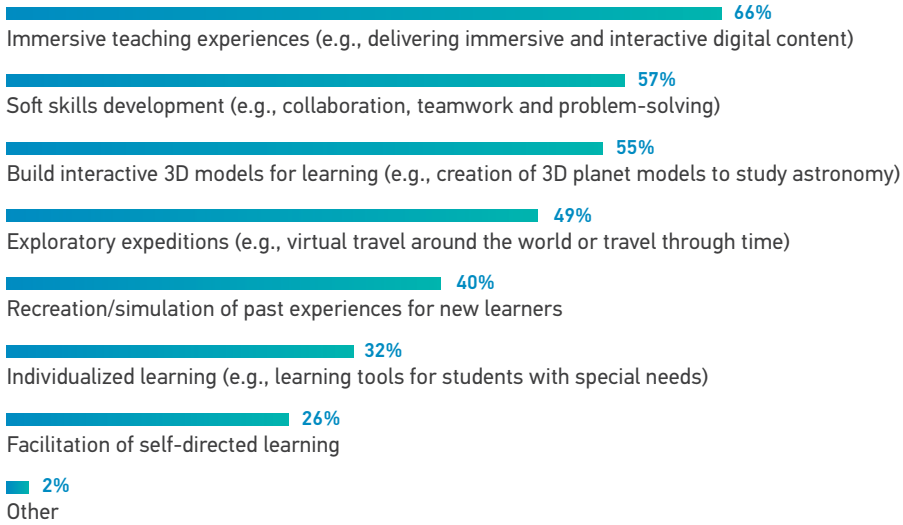
> In the healthcare sector, which of the following new applications/solutions can we expect immersive technologies to offer in the next two years? (Select all that apply)



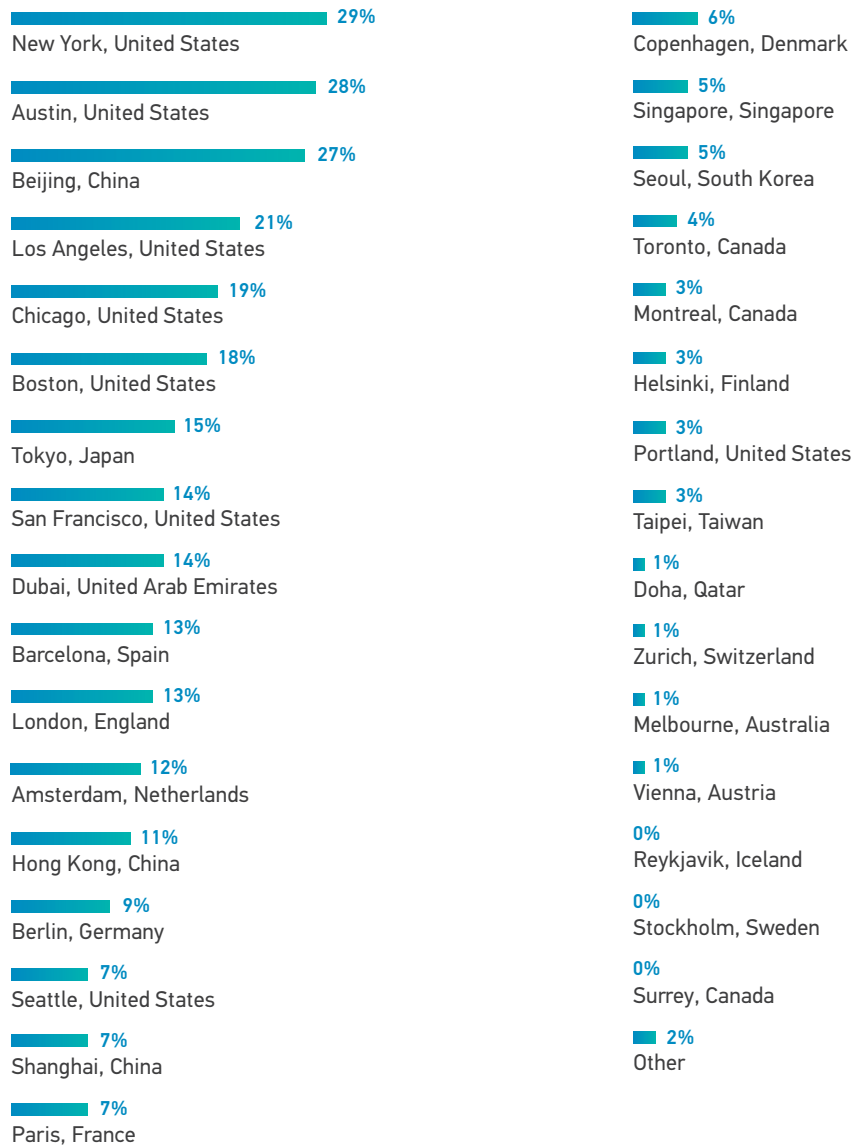
> In the manufacturing sector, which of the following new applications/solutions can we expect immersive technologies to offer in the next two years? (Select all that apply)



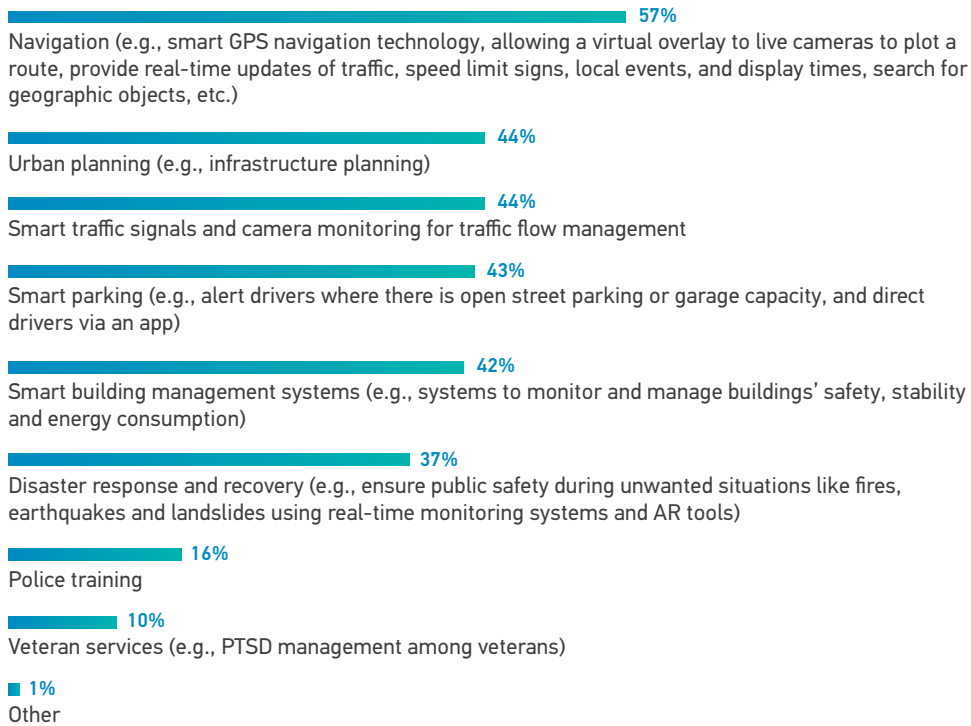
> In the education sector, which of the following new applications/solutions can we expect immersive technologies to offer in the next two years? (Select all that apply)



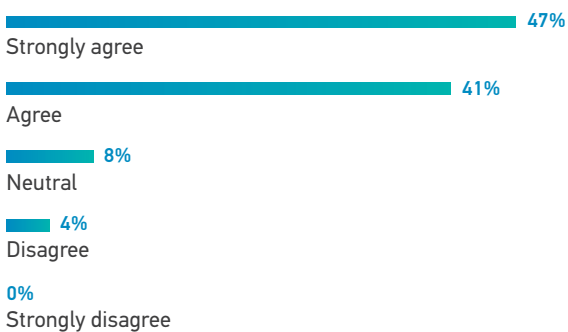
> In your opinion, which cities are the pioneers of using smart city immersive technologies?



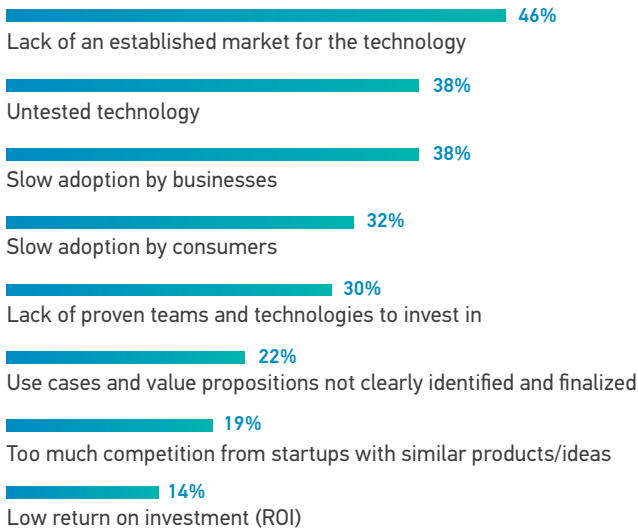
> What are some of the top applications of immersive technologies in smart cities? (Select all that apply)



> Please state your level of agreement with the following statement:
By 2025, developments in smart city immersive technology solutions will become widespread.

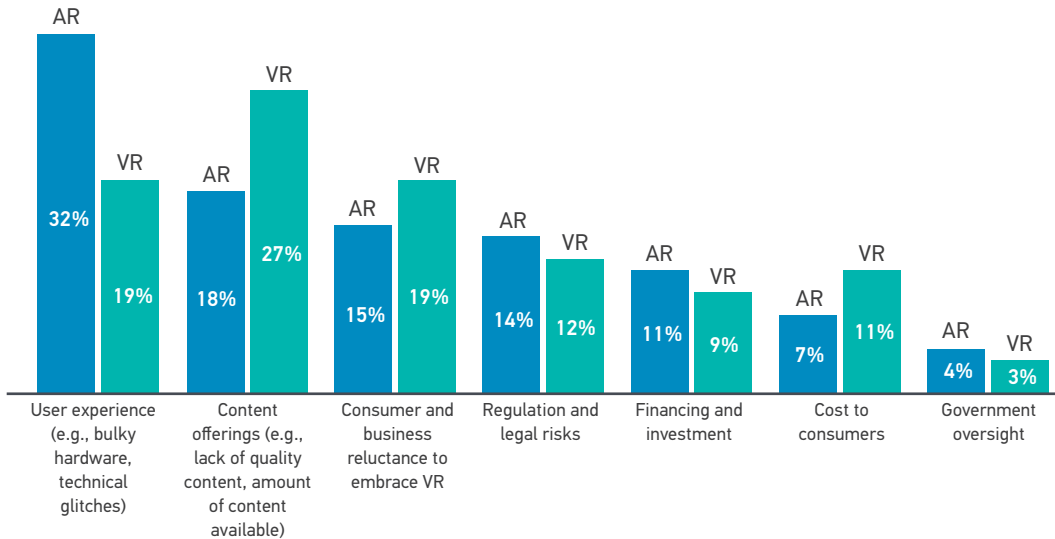


> What are the most common concerns you hear from potential investors when it comes to investing in immersive technology startups? (Select all that apply)

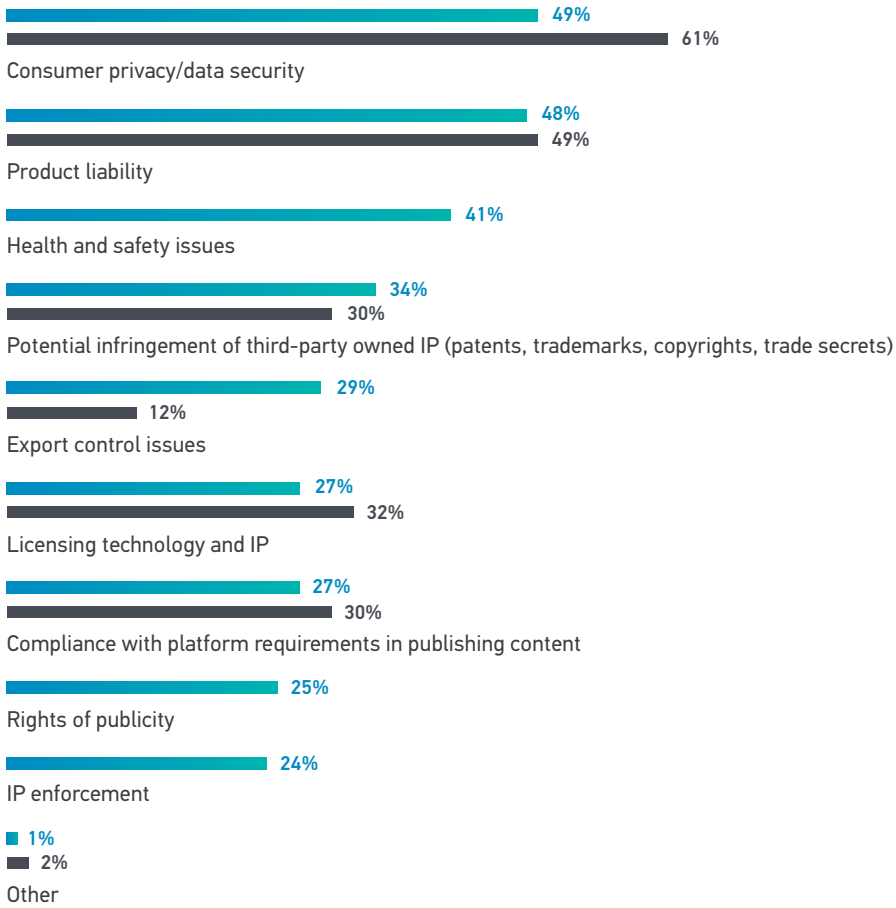


Asked to startups only

> What is the biggest obstacle to mass adoption of AR and VR technologies? Select one for each technology:

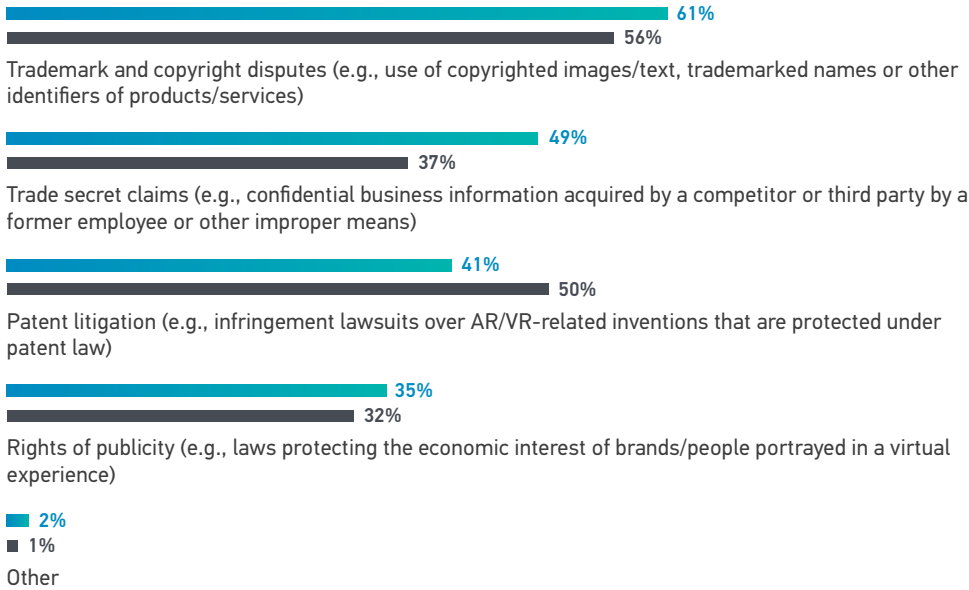


> Which of the following legal risks are of concern to your organization in developing immersive technologies or content? (Select all that apply)



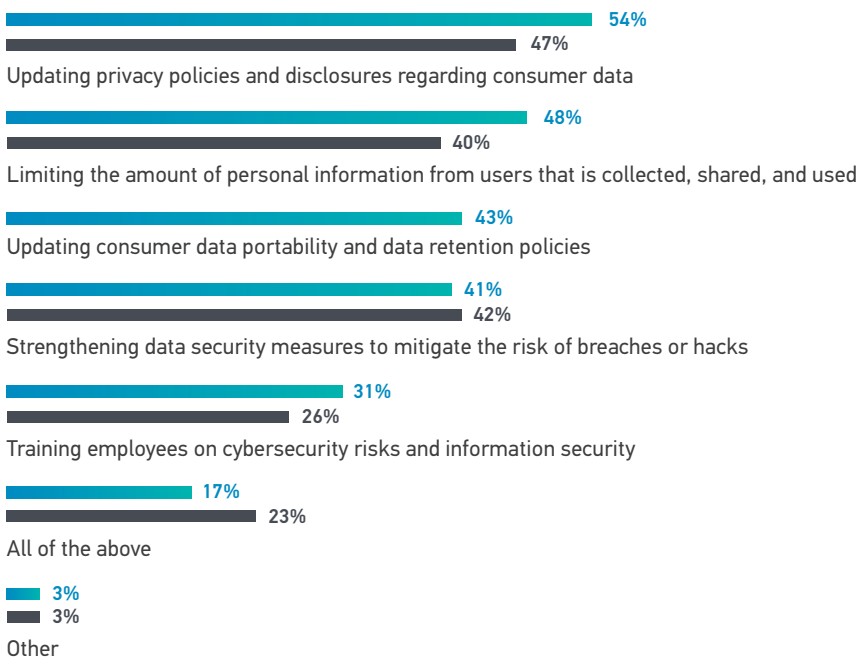
Asked to startups, established tech firms, advisers and outside consultants

➤ Which of the following intellectual property issues do you feel are most likely to drive disputes and litigation in the immersive technology industry? (Select all that apply)



Asked to those who selected licensing technology and IP in the previous question

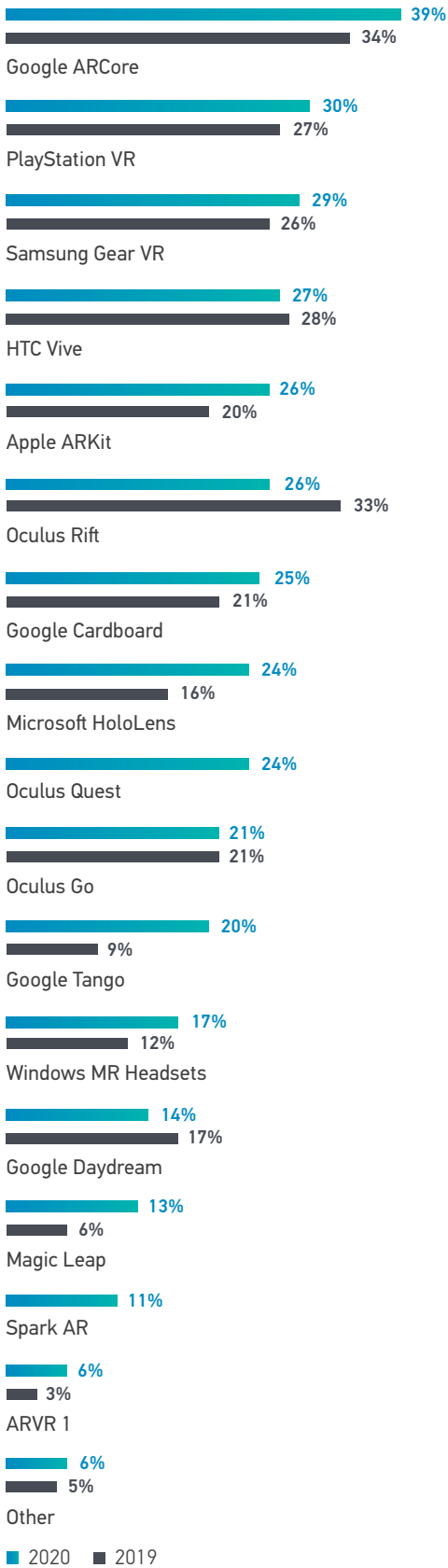
➤ What steps has your organization taken to address privacy and data security concerns with immersive technologies? (Select all that apply)



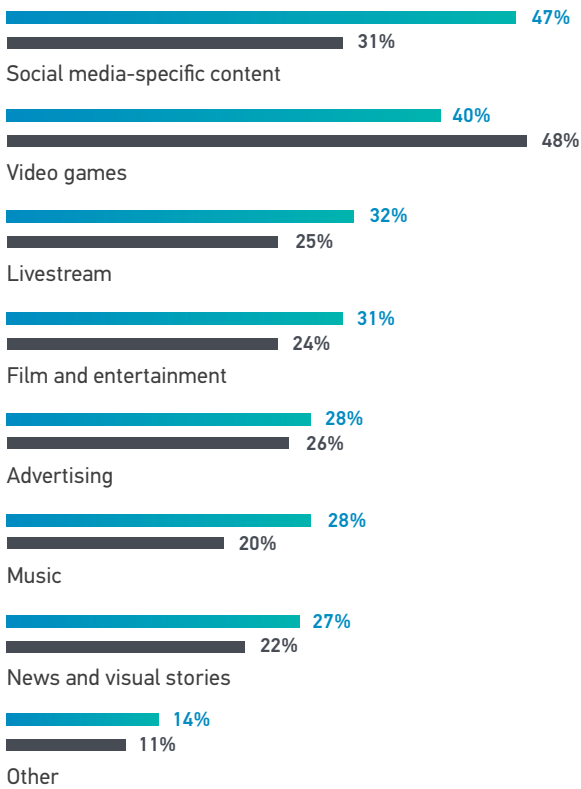
Asked to startups, established tech firms, advisers, and outside consultants

■ 2020 ■ 2019

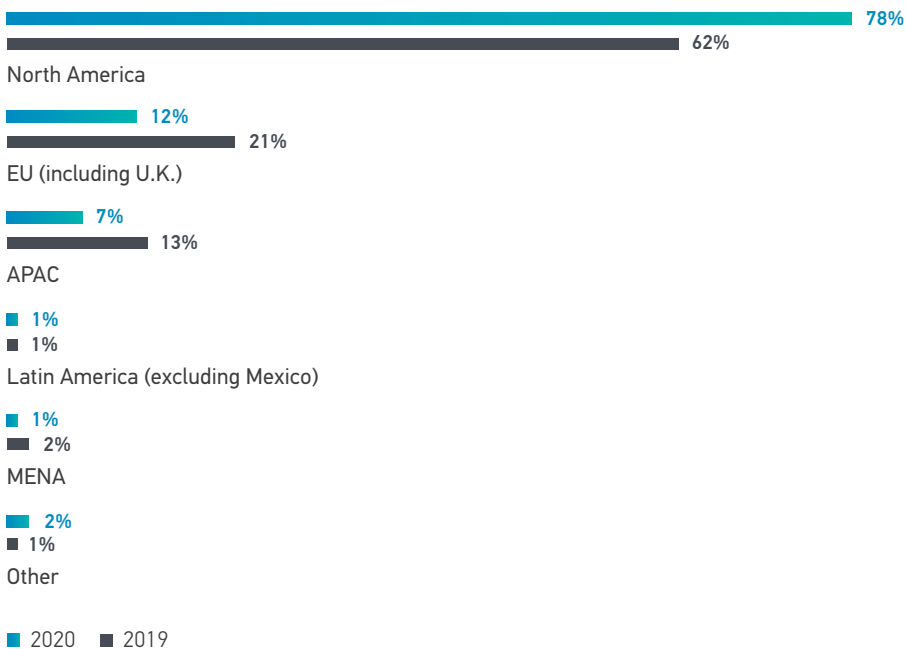
> Which platform(s) are you currently developing for? (Select all that apply)



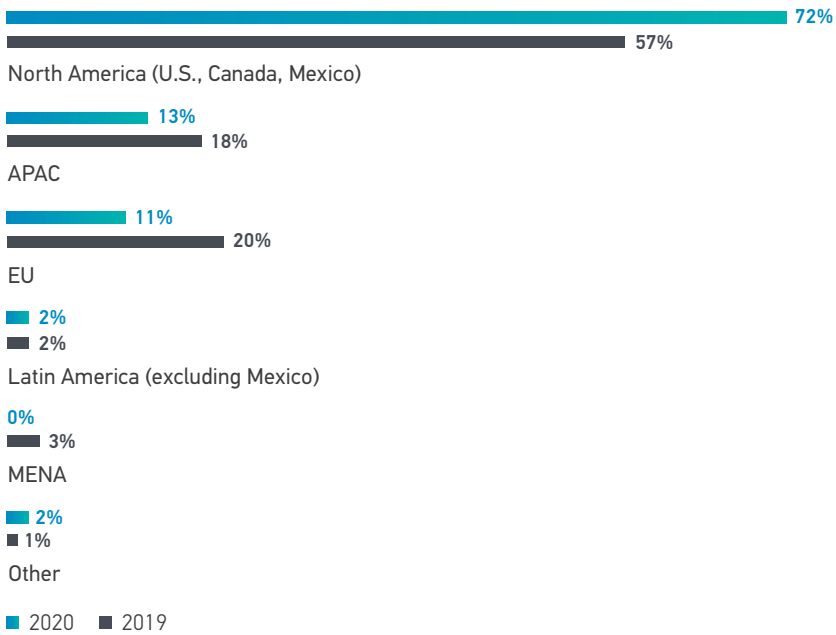
> If your organization is creating content for immersive technologies, what type of content are you currently developing? (Select all that apply)



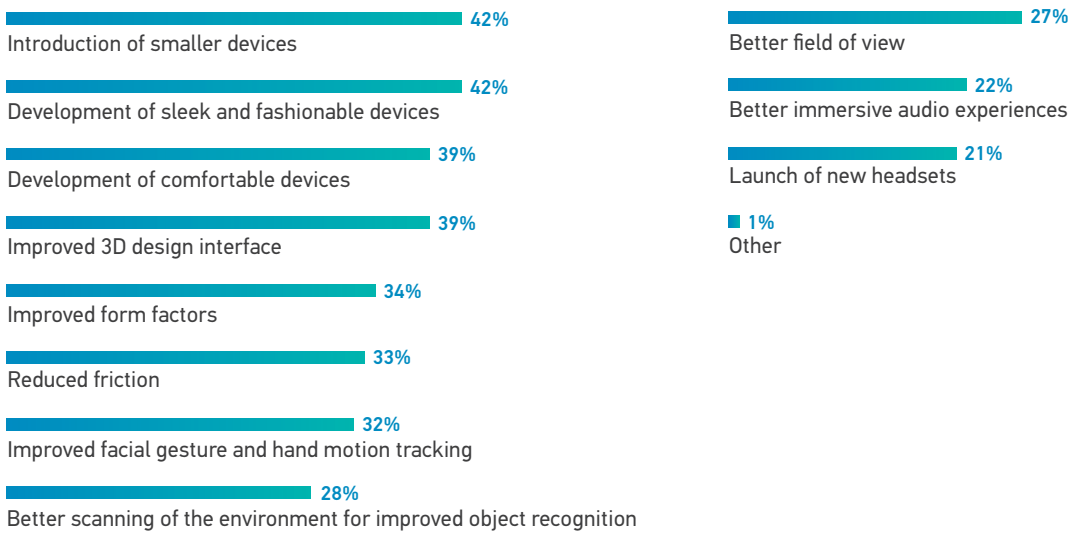
> In your opinion, which region offers the most promising investment opportunities for immersive technologies?



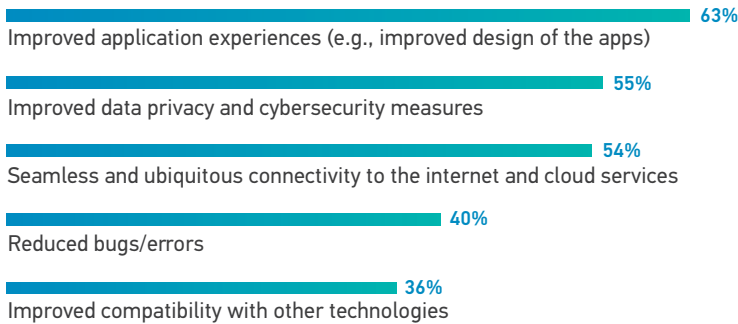
> In which region do you expect to witness the fastest growth in immersive technologies in the next five years?



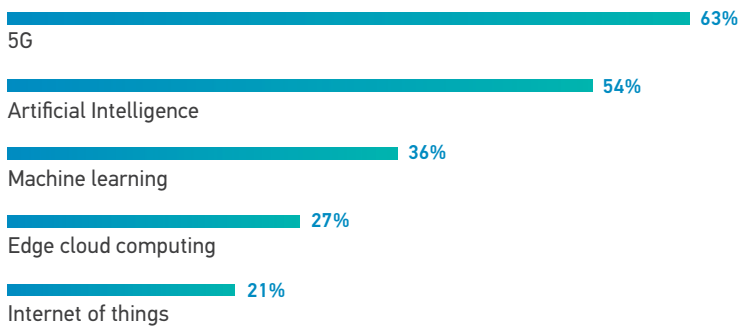
> What are the top improvements/solutions across immersive technology hardware that will make the greatest impact with consumers in the next two years? (Select all that apply)



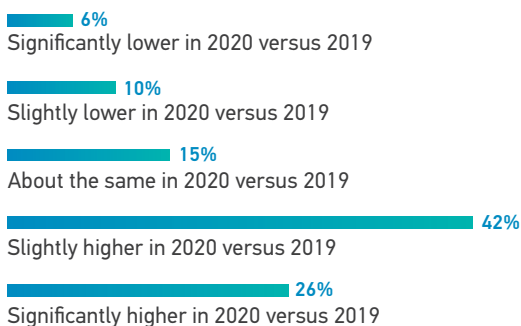
> What are the top improvements/solutions across immersive technology software that will make the greatest impact with consumers in the next two years? (Select all that apply)



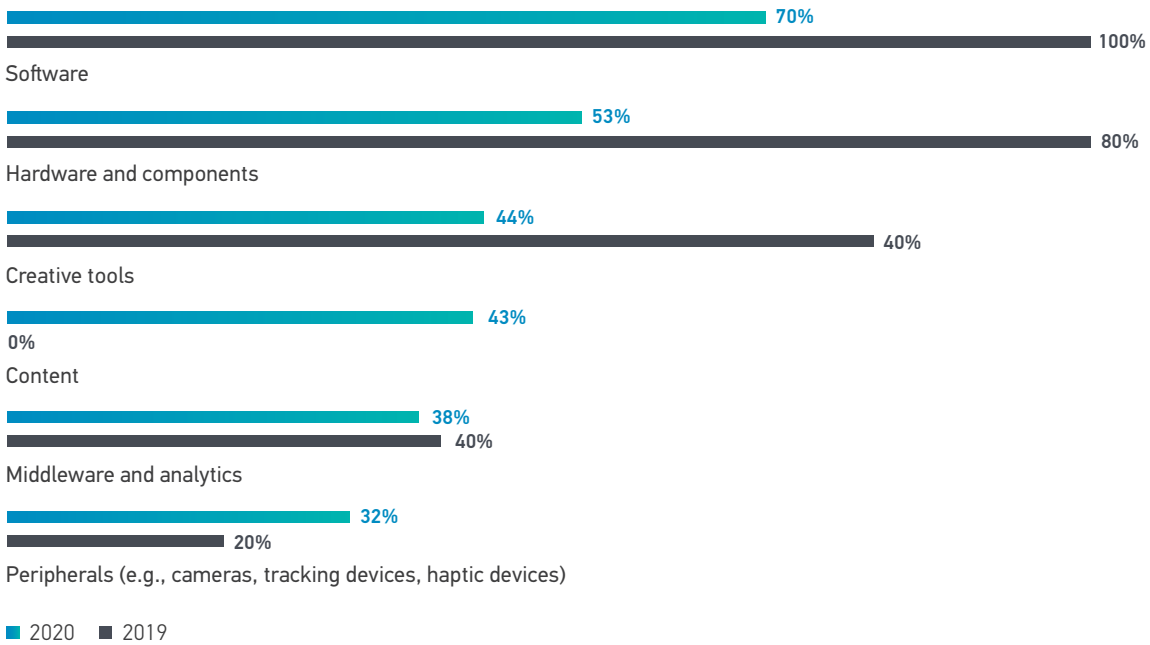
> Which of the following technologies, when combined with immersive technologies, will allow immersive technologies to reach mainstream adoption in businesses in the next five years?



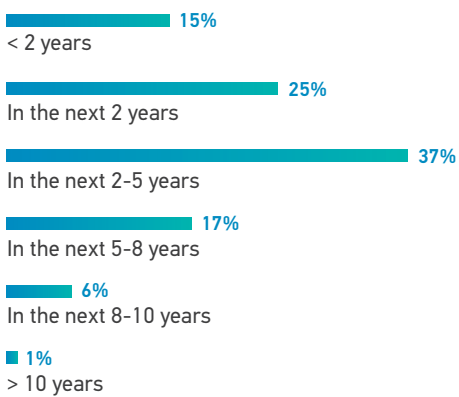
> Thinking ahead to 2020, what do you believe the level of investment by businesses will be in immersive technologies as compared to 2019?



> Which of the following do you believe will be major area(s) of investment within immersive technologies in 2020? (Select all that apply)

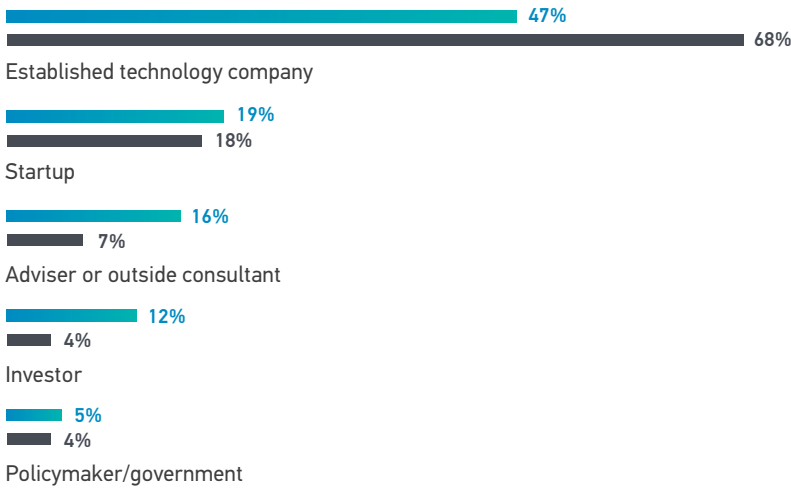


> In your opinion, when will the adoption of immersive technologies become mainstream among consumers?

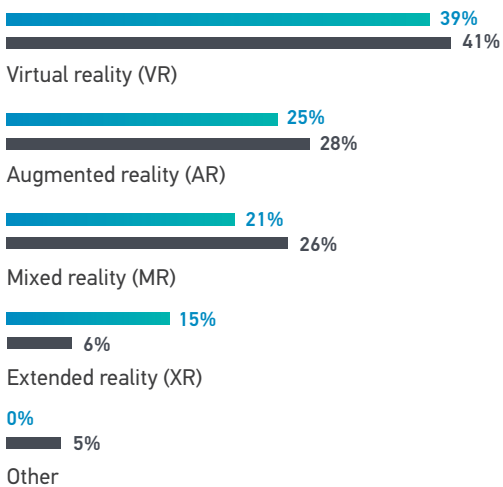


Demographics

> Please select the option that best describes you or your organization.

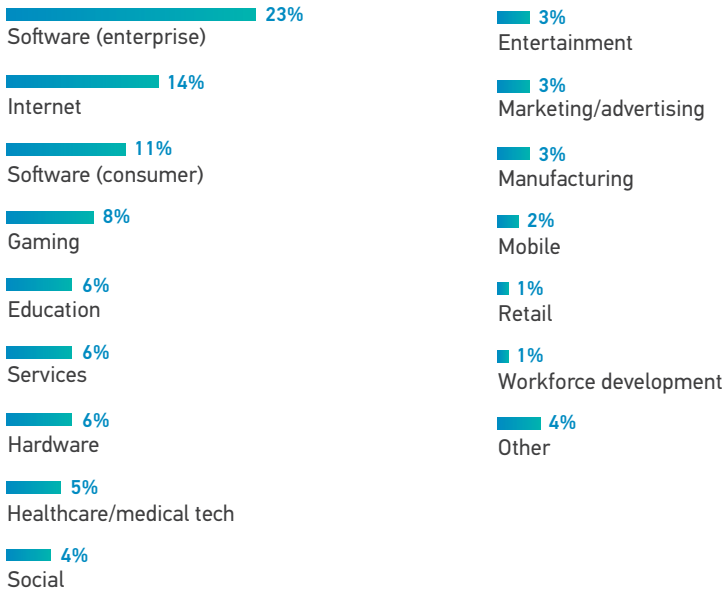


> Which of the following best describes the area in which you or your organization are predominantly focused?

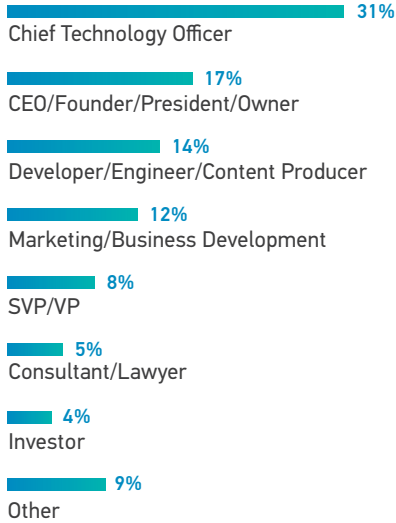


■ 2020 ■ 2019

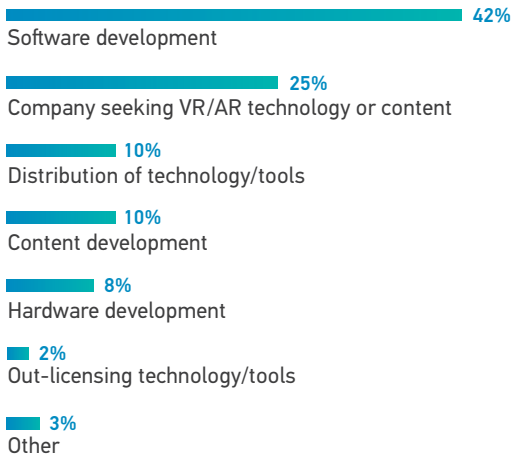
> Which of the following best describes your organization's core industry?



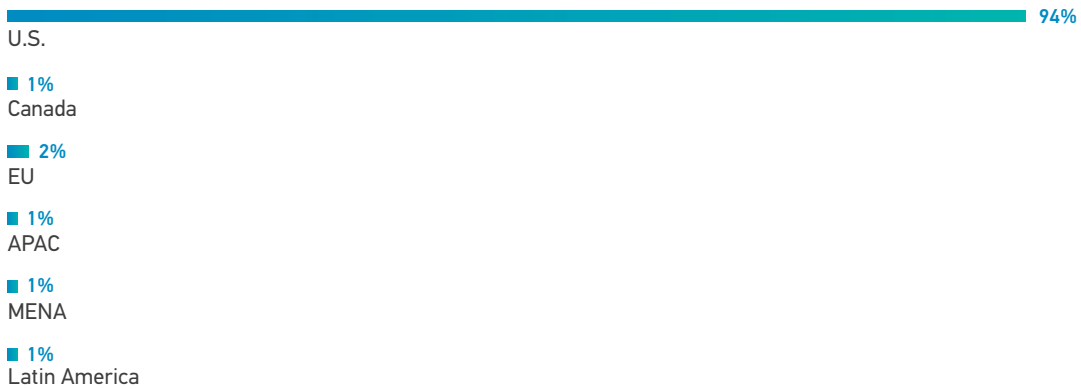
> Which of the following best describes your position with your company?



> Which of the following best describes the area within immersive technologies in which you are focused?



> Where are you based?



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