CFC Media Lab

Pulse on VR: A Workflow and Ecosystem Study
Final Report

2017

Prepared for:

Canadian Film Centre

Prepared by:

Nordicity

This study is led by CFC Media Lab in partnership with OMERS Ventures as co-principal investigators

An interactive version of the data presented in this report can be found online at: pulseonvr.ca

Community Partners:

Table of Contents

List of Figures

Glossary of Terms

Virtual reality (VR): The presentation of immersive environments through the use of specialized display and control technologies that place the perspective of the player/observer within the environment itself

Augmented reality (AR): the use of digital technologies to overlay visual elements onto the real world (e.g., Heads-up-displays, PokemonGO)

Ecosystem: A geographically proximate group of companies whose activities feed into different parts of a value chain

Software Development Kit (SDK): This is a set of software development tools that allows the creation of applications for a certain software package, software framework, hardware platform, computer system, video game console, operating system, or similar development environment

Application Programming Interface (API): This is a set of routines, protocols, and tools for building software applications. An API specifies how software components should interact.

VR Product types: This report separates VR companies into the following types:

- **VR Content and applications:** These companies create content for existing VR platforms (e.g., videos, games)
- **VR Content creation tools:** These companies create tools that support and enable the creation of VR content (e.g., editing, stitching)
- **Application software development:** These companies create software that is not directly used to create content but supports the wider industry (e.g., developer API/SDKs, user analytics)
- **Distribution Platform**: These companies create or maintain virtual places to host and distribute content (e.g., app store, online sales portal, virtual world)
- **Infrastructure/backend solutions:** These companies create products that facilitate and protect sensitive non-client-facing parts of the value chain (e.g., data security, cloud services)
- **VR Hardware/accessories:** These companies create the physical products that are used to record, display and interact with VR environments (e.g., headsets, controllers, haptic feedback devices, VR cameras)

Internal use: products are created for internal use to fill gaps in the development process for VR products. In this case, no market version of the product exists, or is available at a competitive price.

Commercial use: products created for commercial use are intended to be sold in a market, either to other parts of the VR value chain or directly to consumers

Active VR experience: this type of VR content has interactive elements that the VR avatar can alter from within the environment (e.g., games)

Passive VR experience: this type of VR content guides the user through the virtual environment without any input from them (e.g., VR narrative video)

Hybrid experience: this type of VR content has elements of both active and passive VR. A virtual walking tour of a museum where the user can activate different pieces of passive exhibition content from within an active environment would be an example of this kind of VR experience.

Open source software: this type of software is developed using free public resources, and the base code of the finished product is publicly available for anyone to improve, repurpose, or incorporate into other software.

3rd party software: this kind of software is licensed from a third party for use in creating other products.

The State of Virtual Reality in Canada

Pulse on VR: Situation Analysis: Q1 2017

Key Takeaways:
In the first quarter of 2017, the VR industry (in Canada and everywhere else) remains a nascent sector. The hype has begun to subside and real data is beginning to emerge. As it does so, we see a number of key points:

- Sales performance is stronger for lower-cost platforms, but mainstream adoption seems beyond the immediate horizon;

- Investments in VR, though strong in 2016, have begun to stabilize;

- Much of the investment in VR is being made by platforms and manufacturers seeking a killer app. Most VR companies in Canada are making some form of content or application;

- A VR industry rooted in reality, not potential, presents an opportunity for the companies that comprise Canada's VR industry;

- Much of that opportunity rests in the availability of timely information about this rapidly-evolving industry – such as from _Pulse on VR;_

- Companies also need access to sufficient talent and funding to seize those opportunities.

Augmented and Virtual Reality (AR and VR, respectively) have the potential to become the next evolution of how we interact with technology. Similar to the evolution of personal computers, game consoles and smartphones in the computing sector, AR/VR has the potential to create new markets and disrupt existing industries.

VR Sales: Real, Mixed Results

But just how real is this potential? What do the initial sales figures tell us about the reality of VR?

As laid out in the following table, sales figures have started to provide more about how quickly VR is being adopted into the "mainstream."

Headset	Cost	Other Cost	Sales (as of Feb 26, 2017)	Potential Community
Samsung Gear	$99	$600+	5,000,000	> 26 million Galaxy S5 – S7
HTC Vive	$799	$1000+ for PC	420,000	125 million active STEAM users
Oculus Rift w/ Touch	$598 (as of yesterday)	$1000+ for PC	243,000	
Sony VR	$500	$260 for PS4	915,000	50 million PS4 users
Google Daydream	$79	$649	216,000 (2016)	4 million Pixel (as of Jan 2017)

On one hand, some figures are promising. For example, Sony surprised many with robust figures attributed to its sale of 915,000 PSVR headsets in four months, while Samsung stood by their assertion that 5 million headsets were shipped in early 2017. At the same time, numbers for the premium headsets were somewhat less promising. HTC sold less than 500,000 Vive units and Oculus sold an estimated 243,000 Rifts.

In short, while the lower cost and bundled headsets are selling, we have yet to see meaningful adoption.

The VR "Stack"

Top-line sales figures, however, don't tell the whole story of VR. Rather, one must dig deeper into how VR products are made to understand how the industry is developing. To that end, the VR ecosystem can be broadly structured around the "stack" of interrelated components illustrated to the right →

Hardware, the bottom layer of the VR stack, is dominated by larger players (e.g. Samsung, HTC) and is shaped by significant investments in VR headsets and specific enabling solutions (e.g. capture, tracking). 2016 marked a turning point for the industry as leading hardware companies met a number of product milestones from the launch of PlayStation VR, Google's Daydream platform and Oculus Touch motion controllers to Microsoft's announcement that Holographic VR headsets will be coming soon on the Windows platform.

While innovation is accelerating across the stack, opportunities to build new and fast-growing businesses are concentrated at the top of the VR stack, in content and applications. The VR platforms and manufacturers are funding the development of content they hope will help to stimulate broad adoption of VR – the elusive "killer app." Moreover, an increasing number of startups are exploring opportunities in software and content, areas where the platforms (e.g. Oculus) and manufacturers (e.g. Samsung) do not have the expertise to build competitive products/services

Content and applications delivered to end customers

Software enablers (e.g. analytics tools)

Hardware (e.g. headsets, accessories)

Investments in VR: VR Content is King?

Major VR platforms (e.g., Oculus, HTC, Samsung etc.) continue to make content investments to expand their launch catalogues, and strategic and corporate investors like Twentieth Century Fox who invested in 2016 in content studios with strong technology IP.

A select number of these investments are outlined in the following table.

Company	Product/Service	Investors	Investment $$
NextVR	Live streaming	Time Warner, Comcast Ventures, RSE ventures, Madison Square Gardens, and more	Series A $30.5 million

Company	Product/Service	Investors	Investment $$
Baobab Studios	Content Studio (animation)	Horizons Ventures, Twentieth Century Fox, Evolution Media Partners (backed by TPG and CAA), and more	Series B $25 million
Felix & Paul	Content Studio + Technology Infrastructure	Comcast Ventures, LDV Partners, Phi Group, Caisse de dépôt et placement du Québec	Series A $6.8 million
Vertebrae	Adtech	N/A	$10 million
Big Screen	Social productivity app	Andreessen Horowitz, True Ventures, Presence Capital, Ludlow Ventures, David Bettner and SV Angel	$3 million

As 2016 drew to a close, investments in content studios made way for notable investments in B2B companies focused on sectors outside of entertainment, including Andreessen Horowitz' VR investment in social productivity app Big Screen. By Q1 2017, however, according to Crunchbase data, both the number of financings and total capital investments in AR/VR slowed down.[1] In effect, investors' overall opinion of VR has shifted recently despite simultaneous shows of confidence such as notable investments in Google's acquisition of Owlchemy Labs.

Reality as an Opportunity

Even if the VR industry finds itself in the Gartner-coined "trough of disillusionment" a drop in public expectations and investor confidence should not be cause for dismay.[2] Rather, the slowing of the hype cycle creates space to intentionally design the foundations for the measured and thoughtful growth of this emerging industry. This development is good news for Canada, a source of both public support and significant talent that is positioned to stake a claim in this growing industry.

In order to take advantage of this opportunity, companies will need to have an accurate picture of the current Canadian landscape. We also need to track the evolution and growth of VR while providing the right incentives as the VR market reaches maturity in the next two to five years.

It is for this reason that *Pulse on VR* was launched to present an ongoing snapshot of the Canadian VR ecosystem as it evolves. Every quarter starting Q1 2017, *Pulse on VR* will present data gathered from our survey of the VR ecosystem and the workflows, tools, challenges and opportunities that face the creators and technologists working in it. This continuing project is motivated by a desire to better understand how VR experiences are created and distributed (the workflow) and which technologies are most prevalent among companies.

---

[1] Joanna Glasner. (2017) "Despite Hype, VR Investment Fades In Q1 2017." Crunch Database. Retrieved from: http://about.crunchbase.com/news/despite-hype-vr-investment-fades-q1-2017/

[2] Gartner. (2017) "Gartner Hype Cycle: Interpreting Technology Hype." Retrieved from: http://www.gartner.com/technology/research/methodologies/hype-cycle.jsp

Pulse on VR also sheds light on VR's market potential including the challenges and opportunities companies are identifying as they attempt to seize the potential of this potentially transformative medium and shape the future of the VR ecosystem.

Pulse on VR presents information from jurisdictions across Canada – specifically Ontario, Québec, Manitoba, Alberta, and British Columbia – with additional insights gathered from California. This work is intended to benefit companies, funders, investors and content creators working in VR that are seeking to understand where they fit into the ecosystem and how VR workflows apply to their projects.

State of the Canadian Ecosystem

A sizeable majority (84%) of Canadian VR companies are focused on building VR content and/or applications. Canada's strengths in film, game development and visual effects have made it one of the prime hubs for VR content creation and application development. Canadian VR content and application companies such as Felix & Paul Studios, Secret Location (acquired by eOne), Liquid Cinema, Mettle and Cloudhead Games are some of the most well-known companies globally. There may currently be a window of opportunity to invest in a VR content/tech thesis as quality content and applications will capture significant value in the medium term. Moreover, as the hardware install base expands, the content and application market will grow rapidly over the medium to long term.

Whether in Canada or California, technology and content are deeply integrated in VR. Both of these key elements must advance in tandem for the VR sector to succeed in the long term. Today, one of the key barriers to consumer adoption is lack of quality VR content. High quality VR content is difficult to produce because entirely new creative workflows and technology infrastructure are needed. Unlike traditional media, the technology stack needed to create, produce and deliver premium VR content needs to be built from ground up. These requirements are giving rise to a new form of content leader – creators that have technology in their DNA. Given Canada's historical and present investments, through the National Research Council, Industrial Research Assistance Program, Canada Media Fund, Telefilm and regional media agencies across Canada, in the post-production and interactive media sectors, this type of hybrid creative and technology talent runs rampant in Canada which may give us an advantage in the global VR ecosystem.

Key Challenges in Canada

Canada, thus, has an opportunity to become a leader in VR. However, entrepreneurs should prepare themselves to tackle three key challenges as highlighted by the Pulse on VR study.

- *Market Maturity*: The VR market is in the early stages of development and there is uncertainty around how quickly consumers will adopt VR headsets and/or pay for VR experiences. VR study results indicate that Canadian VR companies expect that VR market will achieve mainstream adoption in the next 2 to 5 years.

- *Talent*: Similar to other emerging technologies, it is more likely than not that VR will face a talent crunch. It is unclear whether there will be sufficient talent to fill future demand from both large and small players. Entrepreneurs may need to implement grass roots recruitment tactics (e.g. working with universities) and provide training to source and retain talent. Moreover, a potential a VR talent crunch in Canada could fuel consolidation between Canadian VR companies.

- *Funding*: Investors are cautiously optimistic about the prospects of VR. Platforms such as Oculus have been seeding development of content and applications. However, platform funding is unsustainable. There are also uncertainties around the public funding allocated to VR projects and the enthusiasm of private investors. Entrepreneurs are encouraged to pursue unique use cases (e.g. B2B) with viable business models and it will be important for VR start-ups to stay nimble and prepare for at least 24 months of runway.

References

Sales figure:

http://fortune.com/2017/02/19/virtual-reality-vr-sales/

https://www.technologyreview.com/s/603208/behind-the-numbers-of-virtual-realitys-sluggish-debut/

https://www.theverge.com/2017/2/26/14745602/sony-playstation-vr-sales-better-than-expected

https://flipboard.com/@theverge/-a-year-after-the-htc-vives-launch-vrs-h/f-3d5947c852%2Ftheverge.com

Investment figure:

https://www.cnet.com/news/vr-ad-tech-company-vertebrae-raises-10-million/

http://fortune.com/2016/10/18/20th-century-fox-baobab-studios-funding/

https://techcrunch.com/2017/02/24/vr-social-productivity-app-bigscreen-raises-3m-in-round-led-by-andreessen-horowitz/

http://variety.com/2016/digital/news/nextvr-80-million-funding-1201833578/

http://variety.com/2016/digital/news/comcast-felix-paul-virtual-reality-vr-funding-1201796003/

1. Introduction

The year – 2016 – when virtual reality (VR) was predicted to evolve from "virtual" to "reality" is behind us. [3] But what was the reality? Does VR present a market opportunity that lives up to the hype? What are Canadian companies creating as part of the emerging VR ecosystem?

To start to answer those questions, this project presents a snapshot of the Canadian VR ecosystem and the workflows, tools, challenges and opportunities that face the creators and technologists working in it. In this section, we introduce the project's scope, objectives and overall approach.

1.1 Project Scope and Objectives

The impetus for this engagement was rooted in a desire to better understand the VR ecosystem in Canada from how VR experiences are created and distributed (the workflow) and which technologies are most prevalent to the companies themselves. *Pulse on VR* also sheds light on VR's market potential including the challenges and opportunities companies are facing as they attempt to seize that potential and shape the future of the VR ecosystem.

Pulse on VR presents information from specific jurisdictions across Canada – notably Ontario, Québec, Manitoba, Alberta, and British Columbia. This work is intended to benefit companies, funders, investors and content creators working in VR that are seeking to understand where they fit in the ecosystem and how VR workflows apply to them and their projects.

About CFC Media Lab

The Canadian Film Centre's Media Lab (CFC Media Lab) is an internationally acclaimed digital media think tank and award-winning production facility. It provides a unique research, training and production environment for digital media content developers and practitioners, as well as acceleration programs and services for digital entertainment start-ups and related SMEs. Program participants have emerged as leaders in the world of digital media, producing ground-breaking projects and innovative, sustainable companies for the digital and virtual age. CFC Media Lab is funded in part by the Federal Economic Development Agency for Southern Ontario, and the Province of Ontario through the Ministry of Tourism, Culture and Sport.

About OMERS Ventures

OMERS Ventures is the venture capital investment arm of OMERS, one of Canada's largest pension funds with over $77 billion in net assets. OMERS Ventures is a multi-stage investor in growth-oriented, disruptive technology companies across North America. It seeks like-minded partners with a shared vision of building a vibrant and successful knowledge economy.

1.2 Approach and Methodology

The primary source of data for the *Pulse on VR* research was a voluntary online survey to VR content creators, and those companies that make software and/or hardware that enable VR content. This survey was, in turn part of a larger methodology, the phases of which are presented in the following visual:

---

[3] BBC.com., "2016: the year when VR goes from virtual to reality." January 1, 2016.
http://www.bbc.com/news/technology-35205783
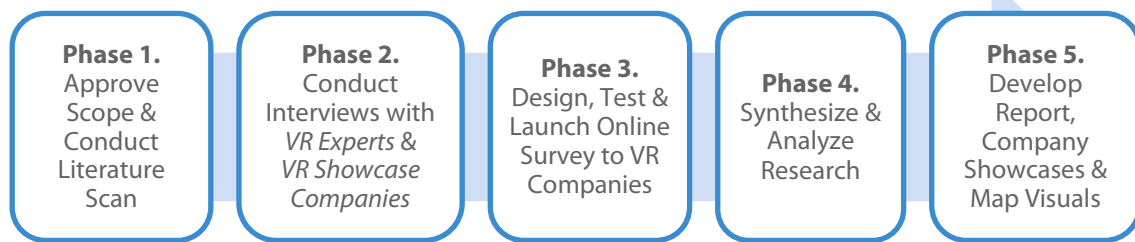
1. **Approve Scope & Conduct Literature Scan:** In this Phase, the CFC Media Lab, OMERS and Nordicity agreed on the key research questions and sources for insights related to those questions.

2. **Conduct Interviews with VR Experts & VR Showcase Companies:** CFC Media Lab and Nordicity interviewed a selection of leading Canadian as well as international VR thought-leaders and companies. Insights from these interviews have been integrated throughout the report, with company interviews resulting in company showcases, illustrating what success in this space looks like – from various vantage points.

3. **Design, Test & Launch Online Survey to VR Companies:** Nordicity developed an online survey for completion by VR companies based in its core jurisdictions – British Columbia (BC), Alberta, Manitoba, Ontario, and Québec. For a response to be deemed valid, respondent companies had to report having at least one employee focused on VR-related activities. The survey was launched on June 1, 2016 at the Augmented World Expo (AWE) Conference in Santa Clara, California and closed in August 2016. The survey received **212** valid responses from our core Canadian jurisdictions and 20 more from around the world which suggests the global interest and demand for the types of insights this project delivers. Beneath each chart there is a number called the 'n-value' (e.g., n=212), which is an indicator of how many companies in our sample answered that question. The survey was voluntary and results were <u>not</u> grossed up to any known universe of VR companies in Canada. As such it was more like a census and should *not* be used to measure the size of the Canadian industry but rather to illustrate its attributes and activities. We have indicated throughout where this fact has an impact on the interpretation of results. It is Nordicity's point of view that the results were adequately varied and robust that, overall, these results are likely representative of the VR industry in Canada in 2016.

4. **Synthesize & Analyze Research:** In this stage the team brought together all lines of research – from the literature search, survey results and interviews - and identified highlight learnings that it shared with funders and partners for review and feedback.

5. **Develop Report, Company Showcases, Map and Other Visualizations:** In this Phase, the team turned to developing the draft report and company showcases while CFC Media Lab engaged a third-party supplier to support the development of the website, including infographics. These infographics are based on the material presented in this report and are best viewed online, as is the map of companies that participated in the survey which will be updated on an annual basis.

2. VR Ecosystem in Canada: A Snapshot

In this section, we present an overview of the VR ecosystem in Canada, drawing on the results of the online survey and interviews.

2.1 Canada's VR Industry

The 212 VR companies captured by the survey were spread across our target jurisdictions. The following chart shows the distribution of respondent companies based on the province in which they are located.

Figure 1: Responses by jurisdiction, Canada
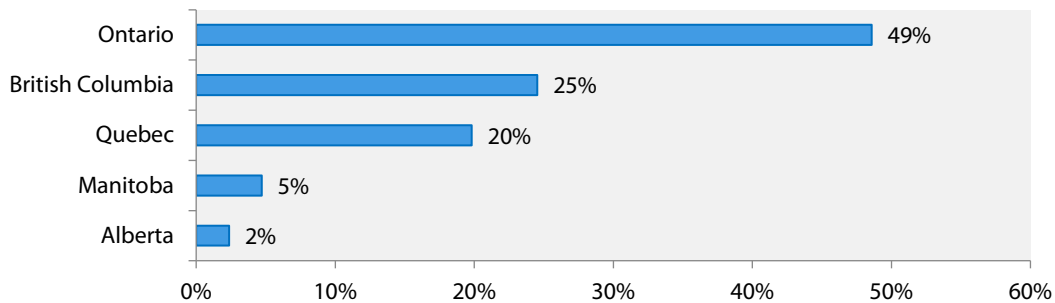
n=212
Source: Nordicity Pulse on VR survey (2016)

- Almost half (49% or roughly 103 companies) of responses to the survey were from companies located in Ontario.[4]

- One-quarter of respondent companies were based in B.C. (53) while the remaining 20% (approximately 42) were based in Québec.

- **N.B**. In the rest of the charts that follow throughout this report, responses from Alberta and Manitoba have been combined to create a more meaningful reporting sample.

Pulse on VR – Website and VR Ecosystem Map

Alongside this report, the project team and its funders are developing a living repository of data regarding active VR companies in Canada.

Accordingly, additional infographics and visualization, drawing on the content of this report, will be available on the Pulse on VR website.

---

[4] While Ontario-based firms do represent a larger portion of our sample, the voluntary or census-like survey distribution approach, means that we cannot guarantee that Ontario is home to 49% of all VR companies in Canada. As *Pulse on VR* continues to collect data in future years the accuracy of the results will continue to improve.

2.1.1 VR Companies and Employment

The bare fact that a company is engaged in the creation of one or more VR products/services, does not necessarily mean that all of their company activities are related to VR. One good proxy for company activities is the focus of a company's employees. To that end, the chart below shows the distribution of VR-focused employees by the share of VR-focused employment at those companies, in other words, companies with:

1. Solely VR-focused employees (or 100% VR-focused employment);

2. Between 51 and 99% VR-focused employees, and;

3. Between 1 and 50% VR employment.

Figure 2: Percentage of VR employment

■ 100 % of employees   ■ 51 to 99% of employees   ■ 1 to 50% of employees
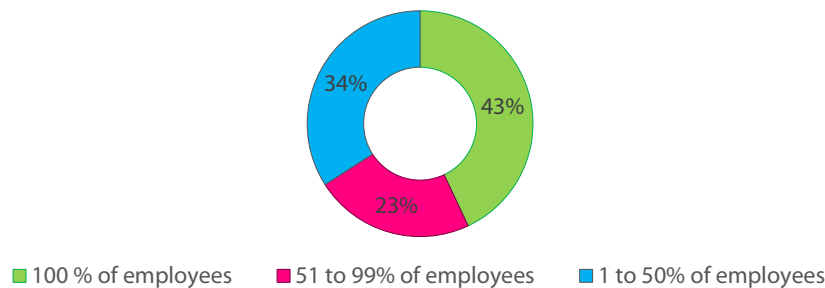
n=211
Source: Nordicity Pulse on VR survey (2016)
Note: some companies based in Canada may have employees based in other jurisdicions.

- Of the total **1,356 VR employees** captured in our survey, some 43% worked at companies that have 100% VR employment.

- About one-third (34%) of VR employees were employees at companies with 50% or less employment in VR.

- While the weighting is not particularly uneven, three quarters of employment tended to be (77%) divided between companies that were either 100% VR-focused or less than 50% focused in VR. This observation may become clearer through the charts below.

Of course, not all of the companies in the VR space started working on VR projects at the same time. The following chart shows a cumulative total of the number of companies in our sample active in the VR space, by the year the company was founded (since 1991).

Figure 3: Cumulative total of active companies in VR by year founded (by % of VR workers)
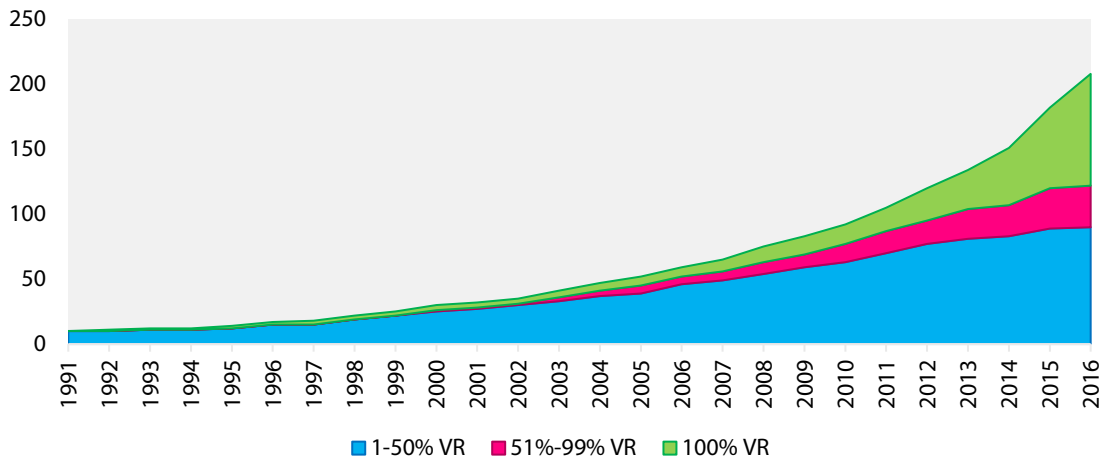
n=208
Source: Nordicity Pulse on VR survey (2016)

- For companies that are not exclusively employing VR-focused workers, the pace of new companies founded is relatively steady over time and within our sample are companies founded long before the recent "VR-boom."

- That said, around 2012, however, there was a sharp increase in the number of companies founded with 100% VR employment, and this trend continues into the present.

Looking at the year that companies first engaged with VR, as in the figure below, we see a much clearer indication of when VR began to concern the companies in our sample.

Figure 4: Cumulative total of active companies in VR by year of engagement with VR (by % of VR workers)
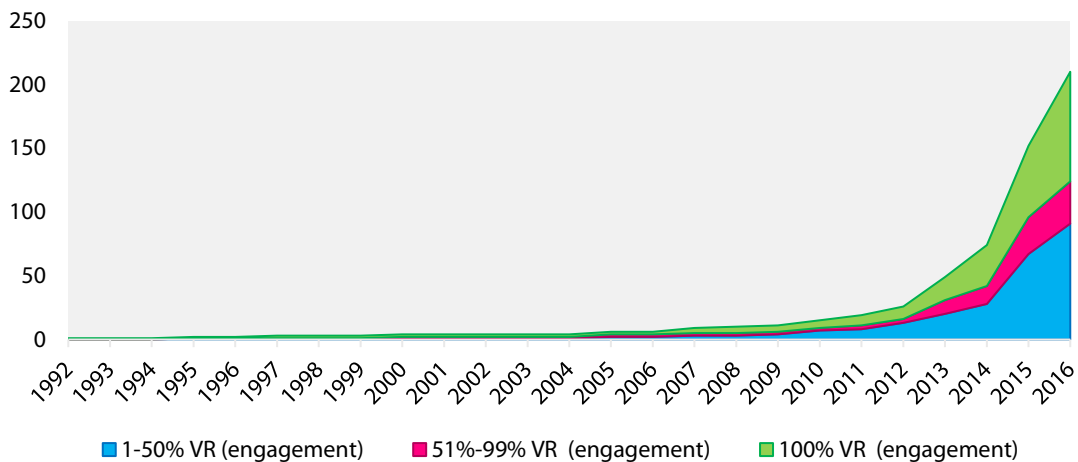
n=195
Source: Nordicity Pulse on VR survey (2016)

- Between 2012 and 2013 and again between 2014 and 2015, there were significant spikes in Canadian companies' engagement with VR products and activities.

- These spikes were not limited to companies uniquely doing work in VR, but spread across all companies with any degree of VR employment.

The following chart provides a closer look at the years that companies first engaged with VR in Canada, focusing on the years 2012 to 2016. Unlike for the two charts above, the figures represented below are *not* cumulative; rather, they simply provide a count of the number of companies indicating they engaged with VR in that year.

Figure 5: Number of companies engaging with VR by year
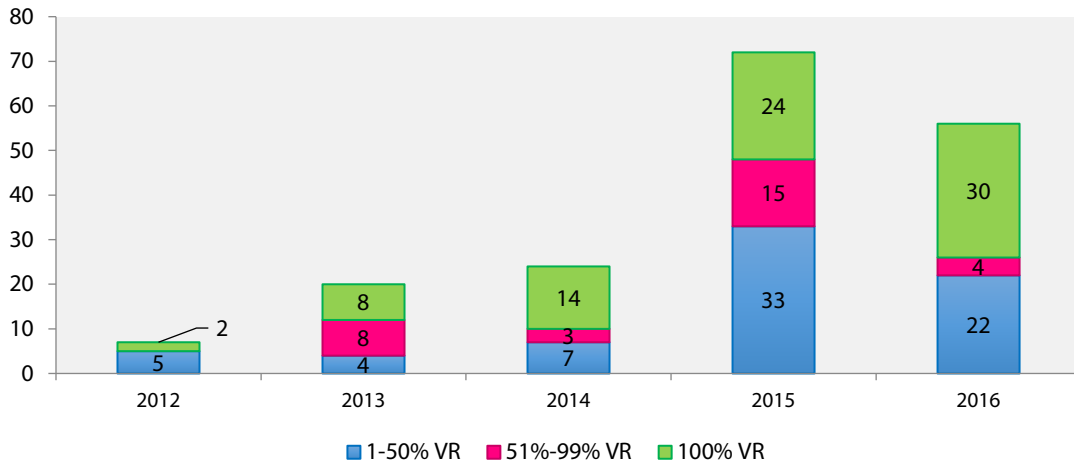
n=178
Source: Nordicity Pulse on VR survey (2016)

- There are clear spikes in new company VR engagement between 2012 and 2013 and again between 2014 and 2015.

- New companies tended to be either 100% VR-focused or less than 50% focused in VR (as measured by VR-focused employment).

As the preceding charts have illustrated, many of the companies sampled have VR as one of several lines of business. A closer look at the distribution of employment in key target jurisdictions further clarifies this picture. To that end, the following chart shows the level of employment at respondent companies active in VR across Canada, split by the focus on the work (VR vs. all other types of work).

Figure 6: VR employment and total employment (by jurisdiction, focus of employee)
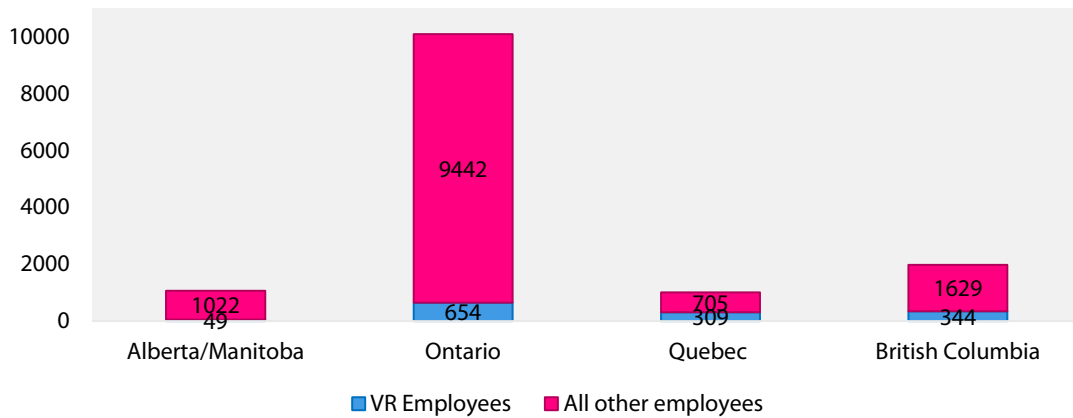
n=211
Source: Nordicity Pulse on VR survey (2016)

- At 654 people, Ontario had the greatest number of VR employees and also much higher *total* employment than other jurisdictions. In part, this result simply reflects that a greater number of Ontario firms responded to the survey (49% of total responses). As well, Ontario is home to many large media entities, such as broadcasters, who may have some minor involvement in VR development within a much larger employment footprint.

- BC and Québec companies in total reported a similar number of VR-focused employees, with 344 and 309 respectively, while Alberta/Manitoba reported 49 VR-focused employees.

To look at this same information, but in another form, the chart below presents VR employment as a percentage of total employment in every jurisdiction.

Figure 7: VR employment as a share of total employment
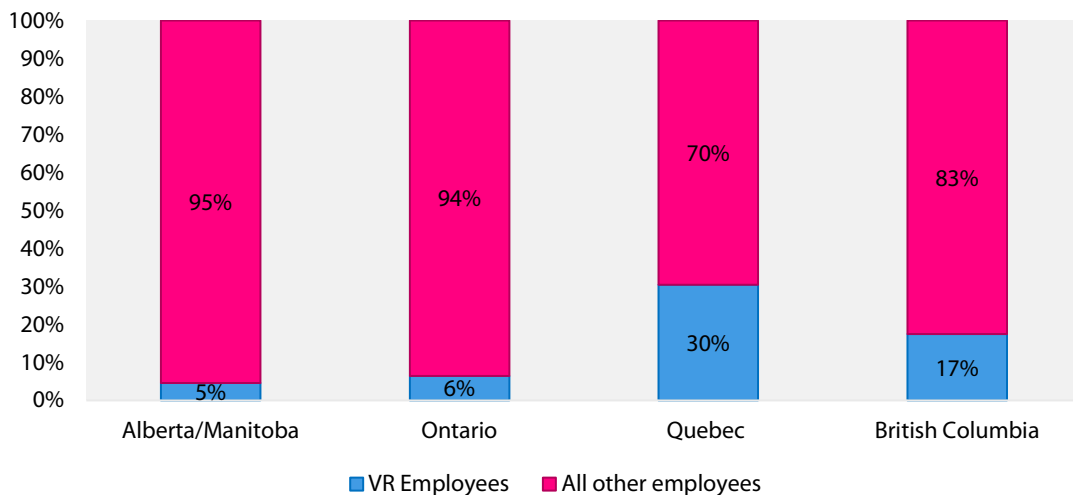
n=211
Source: Nordicity Pulse on VR survey (2016)

- Despite having the largest raw number of VR employees, Ontario's VR employment as a share of total employment was relatively low, again likely due to the presence of large media

entities such as broadcasters that may have very small VR involvement as compared to their total employment.

- From this viewpoint, Québec had a higher share of VR employees per company, and so may be home to more companies that are more exclusively focused on VR.

- As an average for companies across the survey, VR employment amounted to 10% of total employment.

2.1.2   VR Product and Services

Once a company engages with VR (and assigns employees to work on the development of various VR products/services), they must choose which types of VR products/services to make. Our initial research suggested that because the VR market is relatively nascent, gaps existed in the value chain required to take a product to market (e.g., tools to create VR content). As such, we posited that companies were forced to innovate and iterate technologies internally, to successfully develop and distribute their own commercial products.

Accordingly, respondent companies were asked to identify the products/services they have developed (or are developing) for two types of use:

1. For **internal use**, such as internally-developed applications, tools, software, hardware or technology that enabled companies to get their own products to market, and

2. For **commercial use**, or products and/or content for sale to external customers (be it another business or consumer/end user).

In the end, of the 212 Canadian VR companies who responded to the survey:

- About half, 110 (52%), indicated they work on VR products for <u>internal</u> use.

- Some 181 (85%) reported they make VR products for <u>commercial</u> use.

- Nearly half of companies, 104 (49%), indicated they work on products for both internal and external use.

Looking first at the share of companies that reported working on products for internal use, the chart below shows their involvement across various industry components:

Figure 8: Share of companies by VR products developed for internal use
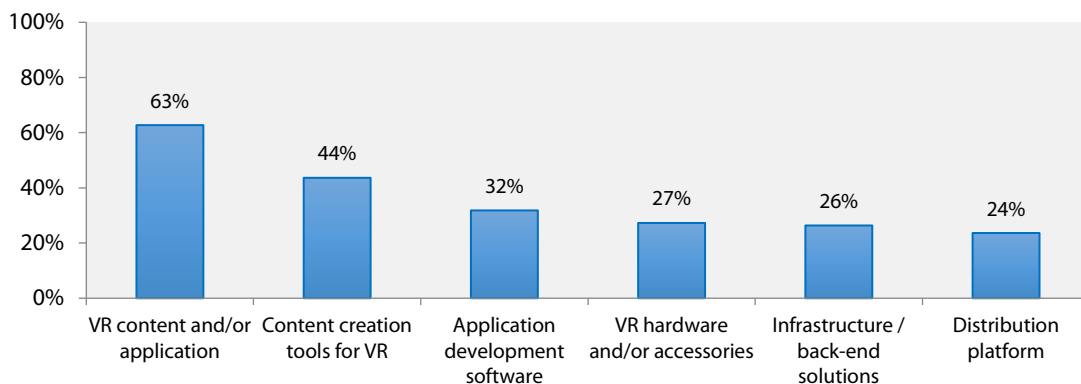
n=110
Responses do not sum to 100% as the question is check all that apply
Source: Nordicity Pulse on VR survey (2016)

- A majority (63%) of VR companies working on products for internal use, reported working on VR content and applications while nearly half (44%) were actively working on content creation tools for VR.

- Overall, company involvement tended to be relatively evenly spread across product types, particularly from application development software (32% of companies) to distribution platforms (24% of companies), suggesting that gaps and/or the need for internal products stretch across product types.

The distribution of company activity regarding products developed for internal use was much more even than the involvement in products for commercial use, as can be seen from the next chart.

Figure 9: Share of companies by VR products developed for commercial use
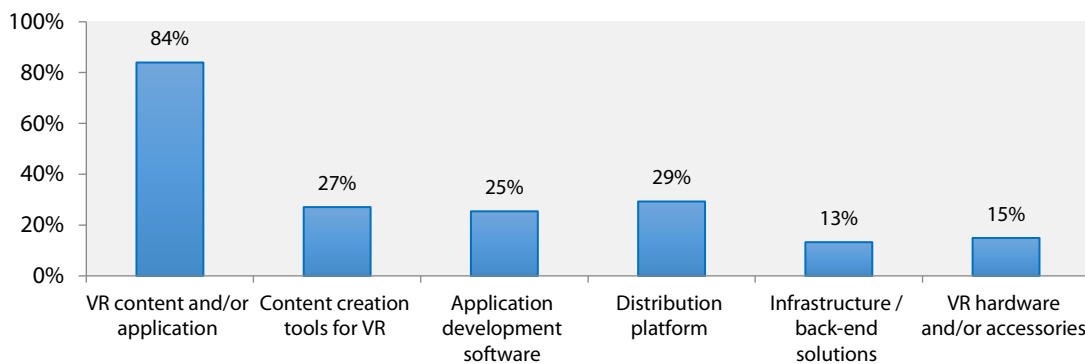
n=181
Responses do not sum to 100% as the question is check all that apply
Source: Nordicity Pulse on VR survey (2016)

- A sizeable majority (84%) of VR companies working on products for commercial uses, were focused on VR content and/or applications indicating that when it comes to the VR market and/or ecosystem, Canadian VR companies are mainly involved in and focused on VR content creation such as games and video content.

- VR content and/or application aside, responses across the remaining product types were relatively even with approximately a quarter of companies working on content creation tools (27%), application development software (25%) and distribution platforms (29%).

Just because a company is working on a product/service, does not mean that it is in the marketplace generating revenue. Indeed, the following chart shows the development stage of the most advanced product that companies have in production across all product types (e.g., VR content and applications, content creation tools for VR, application development software, distribution platforms etc.).

Figure 10: Development Stage across all product types
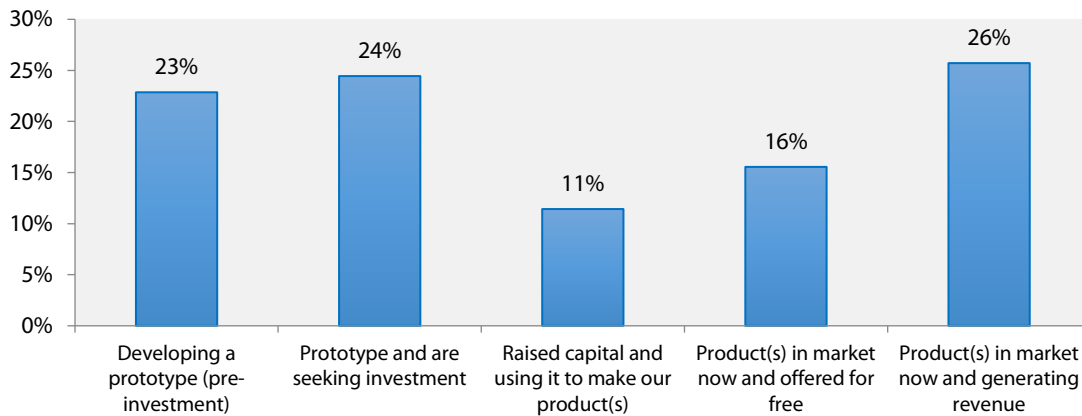
n=315
Source: Nordicity Pulse on VR survey (2016)
The n-value for this question is larger than the total sample size of companies because, in principle, it is possible for a company to have up to seven active product types (the total number of available options).

- Slightly less than half (47%) of all "most-advanced" products were still in the prototype stages, suggesting a younger industry as far as maturity in this respect.

- A slightly smaller share (42%) reported having products in market and being offered either for free (16%) or generating revenue (26%).

To further complicate the matter, a given company may develop several VR product/services. To that end, the chart below shows the number of total product types in which each company was "active" (having reached prototyping stage). A 'zero' answer indicates that the company in question currently had no products that had reached that stage.

Figure 11: Number of active product types per company
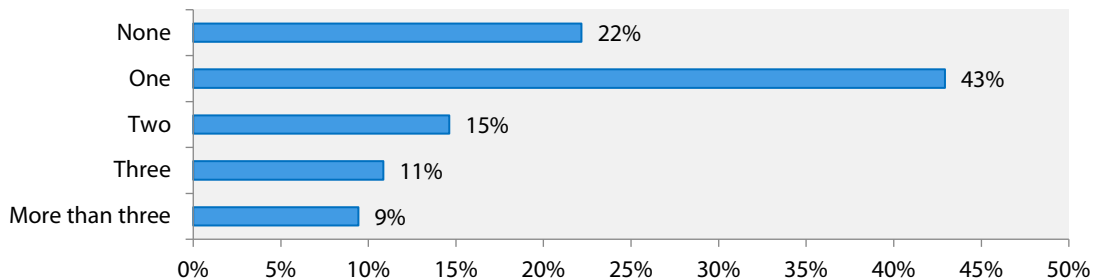
- While the greatest share (43%) of companies are focused on a single active product type, approximately 9% of surveyed companies were active in more than three product categories.

To dig a little deeper into the development stages of various types of VR product, the following chart gives a breakdown of the information in Figure 10 (above) by product type.

Figure 12: Development stage by VR product type

Product type	Developing a prototype (pre-investment)	Prototype and are seeking investment	Raised capital and using it to make our product(s)	Product(s) in market now and offered for free	Product(s) in market now and generating revenue
VR Content/ application (137)	18%	23%	13%	18%	27%
Content creation tools (35)	37%	26%	3%	11%	23%
Application development software (38)	13%	29%	16%	21%	21%
Distribution platform (43)	26%	33%	2%	16%	23%
Infrastructure/ backend solutions (20)	40%	5%	10%	10%	35%
VR Hardware / accessories (23)	17%	17%	30%	4%	30%

n=315
The value in brackets (next to the product type) indicates the total number of responses in each category (a company may have many products at various development stages).
Source: Nordicity Pulse on VR survey (2016)

- The most common type of VR product (137) among sampled companies was VR content and applications, which aligns with our understanding of the main activities pursued by Canadian VR companies.

- As of 2016, the product types with the largest share (45%) of products in market were VR content and/or applications and VR infrastructure and back-end solutions. Though the sample size of infrastructure and back-end solutions is much smaller than for content, companies are having similar success advancing into the marketplace.

- While a small number of products, a large (30%) share of VR hardware and accessories products were reportedly in the "Raised capital and using it to make our products" stage – suggesting a potential product type to watch as far as Canadian companies.

To some degree, the stage of product development also varies by target jurisdiction. The chart below shows the distribution of VR companies' products by development stage for each jurisdiction.

Figure 13: Development stage, all products, by jurisdiction

Jurisdiction	Developing a prototype (pre-investment)	Prototype and are seeking investment	Raised capital and using it to make our product(s)	Product(s) in market now and offered for free	Product(s) in market now and generating revenue
Overall (315)	23%	24%	11%	16%	26%
Ontario (138)	26%	24%	17%	14%	20%
Quebec (70)	24%	20%	10%	16%	30%
British Columbia (87)	18%	26%	5%	20%	31%
Alberta/ Manitoba (9)	11%	44%	22%	0%	22%
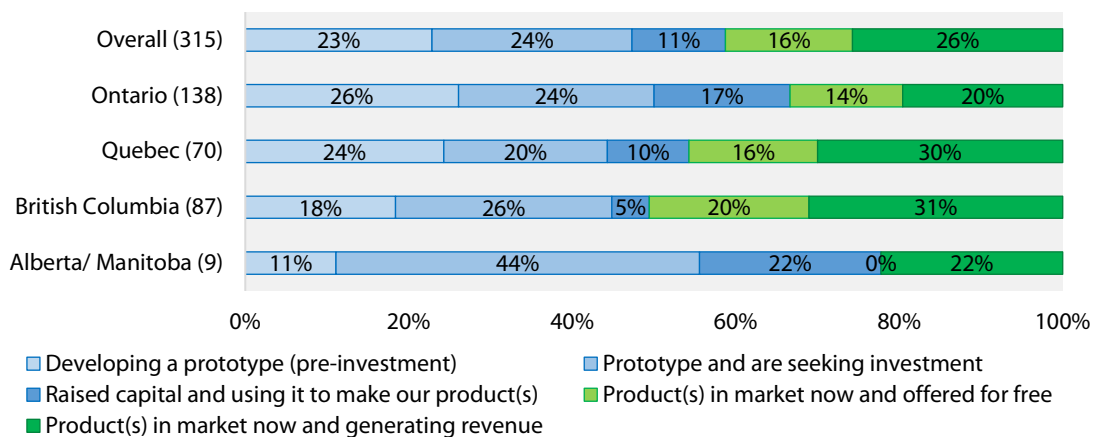
n=315
Source: Nordicity Pulse on VR survey (2016)

- Though Ontario has the largest number of products in development, they tend to be less advanced through the development pipeline than the overall average.

- British Columbia has the highest proportion of VR products that have reached the market stage (51% in market, either free or generating revenue), followed by Quebec. This fact may relate to the maturity of the video game ecosystems in those provinces, where companies may have the established networks, funders and relationships to advance their VR products.

2.2   Summary of VR Ecosystem

When considering Canada's VR ecosystem there are a number of key facts to consider:

Companies and Employment

- Engagement with VR for many of the companies sampled was relatively recent, with major upticks observed between 2012 and 2013 and again between 2014 and 2015.

- Of the over 1,300 VR employees captured in our sample, the majority were working in Ontario.

- In all jurisdictions, the clear majority of employees among sampled companies do not work (directly) on the development of VR products and services, which suggests that VR is commonly one of several lines of business for many "VR companies."

Products and Services

- Most of the Canadian VR companies sampled were focused on creating VR content and/or VR applications for commercial use – that is to say, content for sale in the marketplace.

- Many companies sampled create VR products/services for internal use, suggesting that there are gaps in the value chain (e.g., regarding content creation tools and/or application development software).

- As far as development stage, nearly half of the "most-advanced" products for the companies sampled were still in the prototype stages.

- As such, the industry may be poised on the brink of seizing the market potential of its products, or may be seeing less demand or market adoption than anticipated.

3. Understanding the VR Workflow

Core to the research objectives of this project was the goal to better understand how VR experiences were being made and distributed, on what platforms, with which software tools and with which partners. In other words, what is the overall workflow for the creation of VR products/services?

In this section, we provide a snapshot of the predominant and emerging types of experiences, applications, software and devices being used by Canadian VR companies in 2016 and who they are partnering with along the way. Before diving into the individual elements of the workflow, the graphic to the right illustrates, at a high level, how the VR workflow works.

3.1 VR Content and Applications

This sub-section deals with companies active specifically in the creation of **VR content and applications** such as linear video and interactive games. As illustrated in Section 2.1.2, these companies form the largest share of our survey sample, and so we are able to look at the survey results in more granular detail.

As we allude to above, there are different types of VR content being created by companies in our sample. Accordingly, the chart below shows the proportion of VR content companies that make various types of VR experiences.

Figure 14: VR Content (by experience types)

Active VR experiences: 75%
Passive VR experiences: 55%
Hybrid VR experiences: 55%
Other: 14%
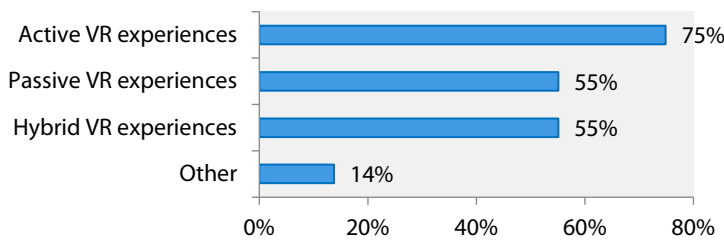
n=167
Source: Nordicity Pulse on VR Survey (2016)

- "Active VR experiences" can be thought of as being "interactive." The user is an active participant in the story, exploring the virtual world to his or her own volition.

- "Passive VR experiences", while three dimensional and may surround a viewer for 360-degrees, mainly limits interaction to looking up, down and around. The passive experience may be more immersive than going to the movies, but ultimately not as interactive as with Active VR.

- "Hybrid VR experiences" combines active and passive elements.
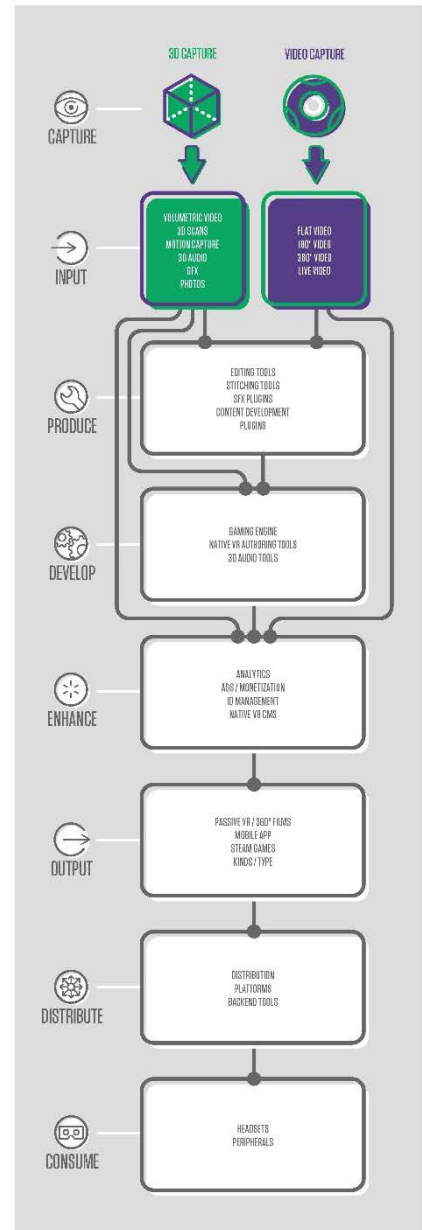
- Three quarters of companies (75%) who indicated they are active in VR Content creation create active VR content, such as games and other interactive experiences.

- Responses in the 'other' category included VR/AR (augmented reality) hybrid experiences, virtual travel experiences, and virtual data visualization experiences.

Given the prevalence of "Active VR experiences," we can look more closely at the kinds of VR products being created by sampled companies. To that end, the following chart illustrates the percentage of those companies that make various types of active VR experiences.

Figure 15: Active VR Experiences (by product type)
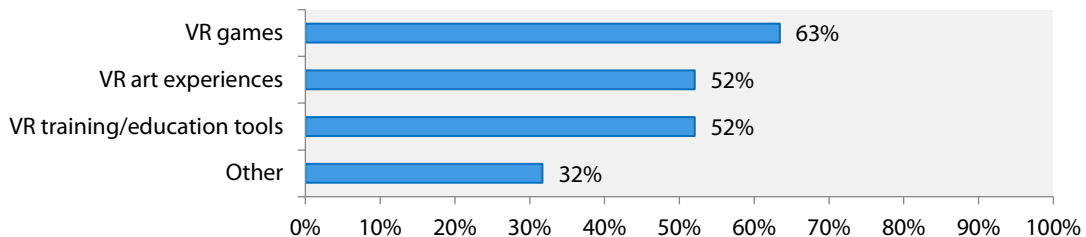
n=123
Source: Nordicity Pulse on VR Survey (2016)

- Among those companies that produce active VR experiences, almost two thirds (63%) are involved in the creation of games. Slightly more than half (52%) create either VR art experiences or educational tools.

- Many of the 'other' responses were a combination of VR art and training/education; e.g., interactive museum exhibits, VR archaeology content, or VR tours of historical sites. VR marketing was also mentioned.

The chart below shows the types of passive VR experiences created by the 55% of companies that reported creating such content.

Figure 16: Passive VR Experiences (by product type)
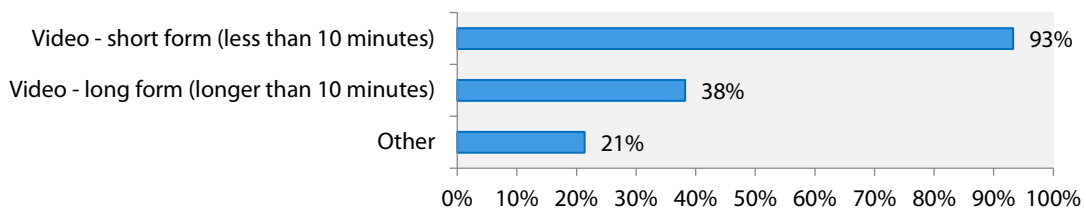
n=89
Source: Nordicity Pulse on VR Survey (2016)

- Almost all companies indicated they are working on short form video content (93%), while 38% indicated they work on content that stretches beyond ten minutes.

- 'Other' responses included explorable immersive VR environments and VR exhibitions/presentations which are not necessarily time dependent.

Companies active in VR Content make use of many tools to create their content. The following chart shows the share of companies by the content creation tools they reported using.

Figure 17: VR Content – Content creation tools used (by type of tool)

Tool	Percentage
3rd party 3D engines	83%
3rd party creation platforms or tool sets	55%
3rd party audio tools	52%
3rd party video stitching tools	50%
3rd party rendering plugins	45%
Our own internally-developed software	31%
Other 3rd party tools	11%
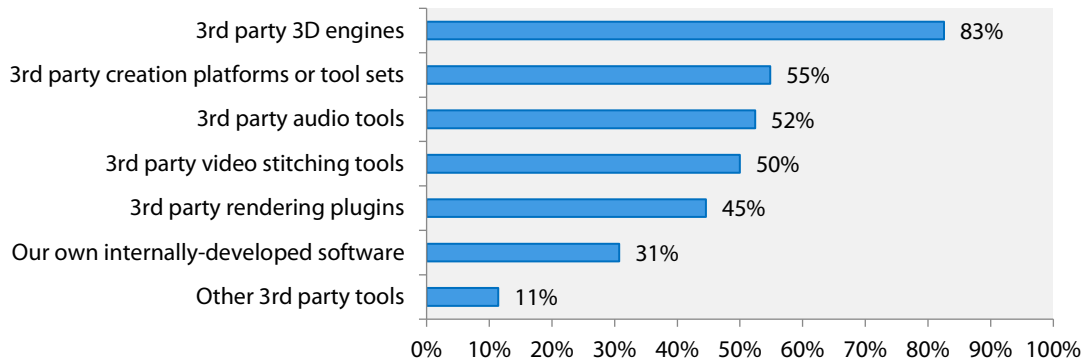
n=166
Source: Nordicity Pulse on VR Survey (2016)

- Content creators sampled are relying on a healthy ecosystem of content creation tools developed by dedicated 3rd parties.

- Most companies (83%) reported using third-party 3D engines in their content creation process, while more than half (55% and 52% respectively) used third-party creation platforms, tool sets and audio tools.

- Slightly less than a third (31%) reported using internally-developed software, indicating that not all of their creation needs are met by the available content creation tools.

- The most common response in the 'other' category was creation tools for 360 video content.

When it comes to software used for developing the broader VR *applications* (not just the particular content), companies use a wide variety tools from positional tracking tools to monetization solutions. Sampled companies active in VR Content creation have a lesser reliance on 3rd party application development software than is the case for content creation tools. The chart below shows the share of content creation companies by type of application development software used.

Figure 18: VR Content – Application development software used

Tool	Percentage
3rd party SDK/APIs	72%
Open source developer tools	55%
3rd party 3Dreconstruction/ stitching tools	51%
3rd party positional tracking tools	39%
Own internally developed tools	39%
3rd party user engagement analytics tools	30%
3rd party ad/monetization solutions	21%
3rd party identity managment tools	15%
Other	7%
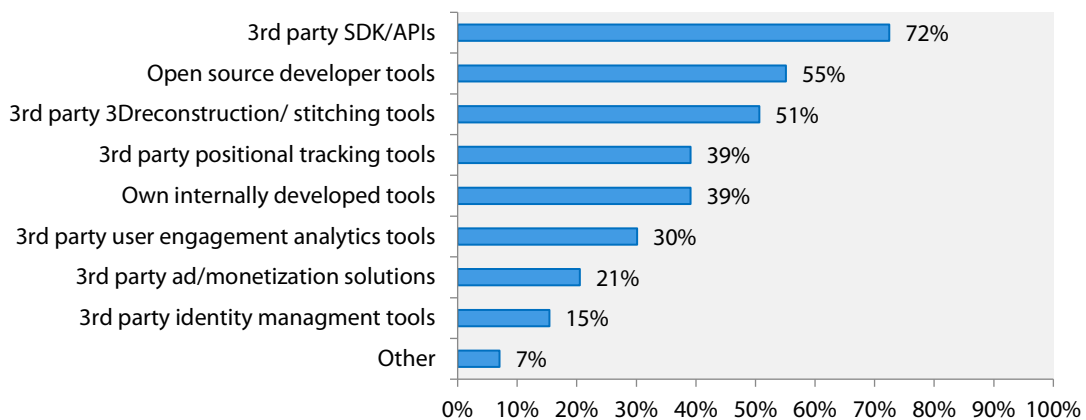
n=156
Source: Nordicity Pulse on VR survey (2016)

- Third-party software development kits (SDKs) and application program interfaces (APIs) were the most commonly employed tool, with 72% of respondent companies reporting using them.

- More than half (55%) of companies that used application development software, made use of open-source developer tools.

- Less common was the use of third-party user engagement analytics tools (30%), ad/monetization solutions (21%) and identity management tools (15%) which may relate to the development stage trend we saw earlier. A sizeable share (45%) of VR Content products was reported to be pre-market. These types of tools are mostly relevant for in-market products and applications (or demand would rise with a greater share of content in market).

Once the content is created and functionality has been added, the product must find its way on to one or more VR platforms. The following chart shows the devices that VR content producers are creating content for.

Figure 19: VR Content – devices for which content is created
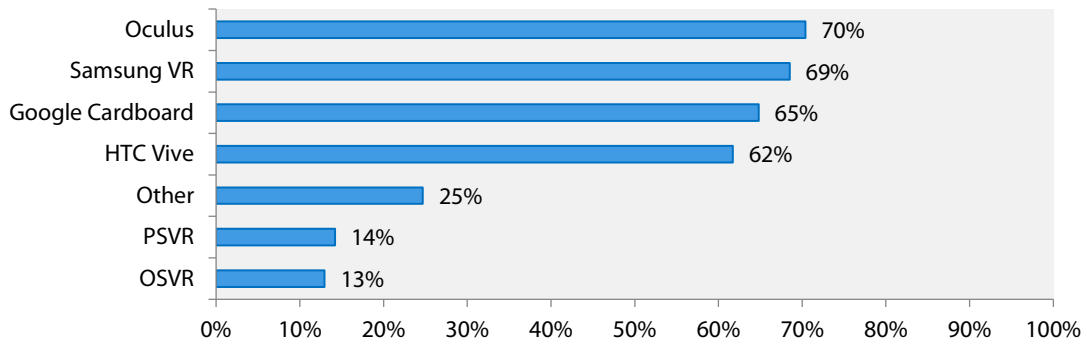
n=162
Source: Nordicity Pulse on VR survey (2016)
"PSVR" is PlayStation VR and "OSVR" is Open Source VR

- Oculus (70%) and Samsung VR (69%) were the most common devices companies were creating content for in 2016, followed by Google Cardboard (65%) and HTC Vive (62%).

- These four devices currently dominate the content production market, though no clear winner has yet emerged from among them.

- Just 13% of content creators were creating content for Open Source VR ("OSVR") devices.

- In the 'Other' category, the only prominent device was Microsoft Hololens.

Once a product is on a platform it must then be discovered by its audience. As such, VR companies are using a variety of distribution methods to accomplish that task, as illustrated by the following chart.

Figure 20: VR Content – methods of distribution used

A proprietary app or website: 56%
Online distribution portals: 53%
App store of a device marker or partners: 52%
3rd party apps: 19%
Other: 20%
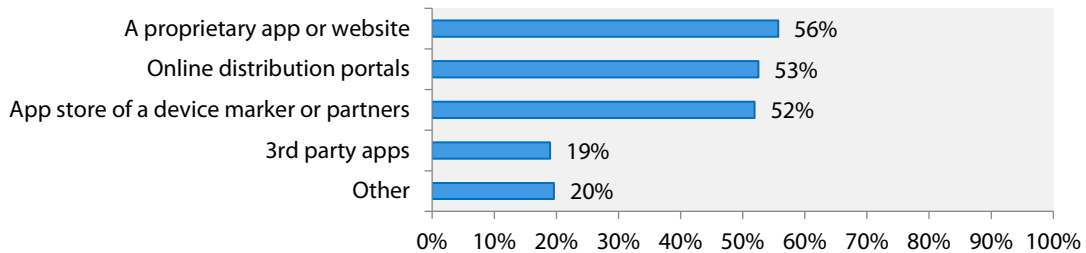
n=158
Source: Nordicity Pulse on VR survey (2016)

- The distribution of VR content by content creators sampled is considerably less reliant on third-party software or applications than is the case for content creation tools or application development software.

- Proprietary apps/websites (56%), online distribution platforms (53%) and partnerships with app stores and device makers (52%) are all used by more than half of companies involved in VR Content creation.

- Only 19% of companies employ third-party apps for this purpose.

- Given the parity between the three most common distribution methods, it does not appear that the sampled VR content creators have found a prefered pathway to the market.

3.2   VR Tools, Applications and Hardware

In this sub-section, we examine the activity of VR companies engaged in making products that enable the creation and distribution of VR content, namely:

- VR content creation tools (e.g., editing, stitching),

- Application development software (e.g., developer SDK/APIs, user analytics),

- Distribution platforms (e.g., app store, virtual worlds, online distribution etc.),

- Infrastructure and back-end solutions (e.g., data, security, cloud service enabling etc.),

- VR Hardware and accessories.

In general, "**content creation tools**" are software that enable the creation of the VR content itself, such as editing, video stitching, rendering and audio software. The following chart shows the kinds of VR content creation tools created by the companies in our sample that reported being active in those activities.

Figure 21: VR Content Creation– tools created

Category	Percentage
Creation platforms or tool sets	58%
3D engines (e.g., Unreal 4, Unity)	43%
Video stitching tools	35%
Rendering plugins	30%
Audio tools	25%
Other	22%
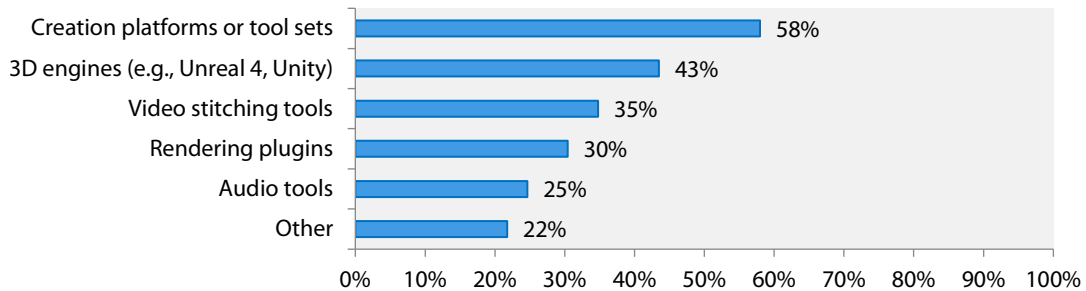
n=69
Source: Nordicity Pulse on VR survey (2016)

- Of the sampled companies that reported working on VR Content Creation Tools, a slight majority (58%) are making creation platforms or tool sets (i.e., the solutions or plug-ins that enable content creators to make content), followed by 3D engines such as Unreal and Unity (43% of companies).

- Just 25% of companies reported making audio tools though this field is growing in importance across the ecosystem and may be an expertise to monitor.

Whereas content creation tools make the final VR product, **VR applications** either enable the development environment or add functionality to the final product (e.g., the ability for users to pay). The chart below describes the kinds of software created by VR application developers sampled.

Figure 22: VR Application Development - software created

Category	Percentage
SDK/APIs	75%
Positional tracking tools	32%
User engagement analytics tools	26%
3D Reconstruction and stitching tools	23%
Open source developer tools	19%
Identity managment tools	12%
Ad/monetization solutions	12%
Other	32%
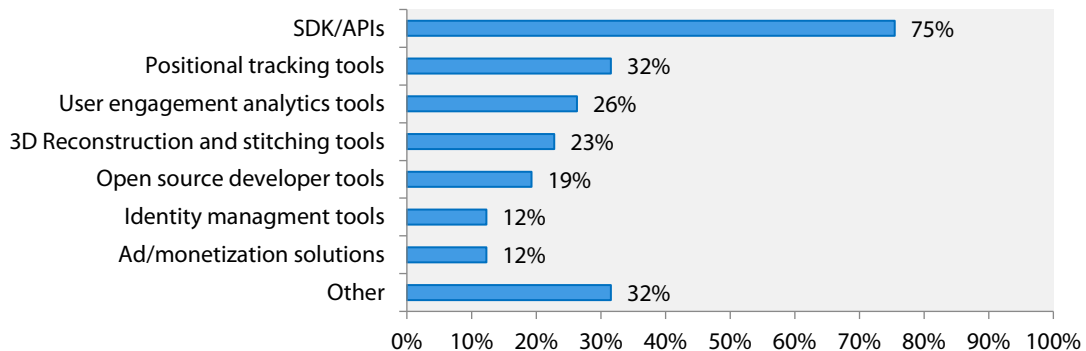
n=57
Source: Nordicity Pulse on VR survey (2016)

- The most common type of VR application developed is software development kits (SDK) /application programming interfaces (API), which 75% of developers reported having created.

- All other tools are created by less than a third of companies.

Among **distribution platforms,** some specialize in particular types of experience. Where previously we asked content creators what types of content they *create*, the chart below shows the responses from companies involved in VR distribution platforms, in terms of what types of content they *host*.

Figure 23: VR Distribution Platforms – VR content types hosted

Category	Percentage
Active VR experiences	67%
Passive VR experiences	63%
Hybrid VR experiences	61%
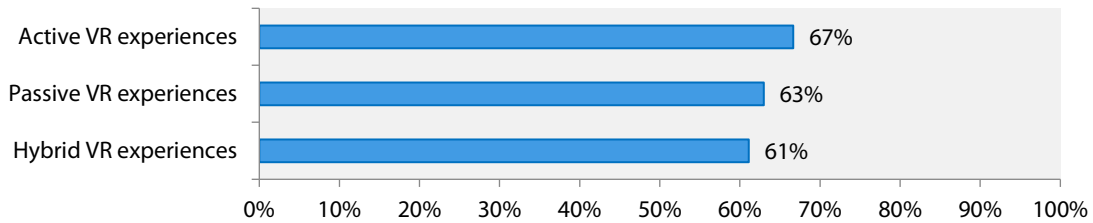
n=54
Source: Nordicity Pulse on VR survey (2016)

- Distribution platform companies were fairly evenly split in the types of content they host. Active (67%), passive (63%), and hybrid (61%) VR experiences are all hosted with roughly the same frequency.

- As such, there are no observable trends in the types of VR experience hosted by sampled VR platforms.

Some of the companies sampled develop software that can be used to support the overall IT environment in which VR content (or tools) is created. The chart below shows the types of **infrastructure or back-end solutions** created by those companies in our sample that reported working on such technologies:

Figure 24: VR Infrastructure/backend solutions

Category	Percentage
Cloud service enablers	64%
Data storage services	61%
Data security tools	12%
Other	24%
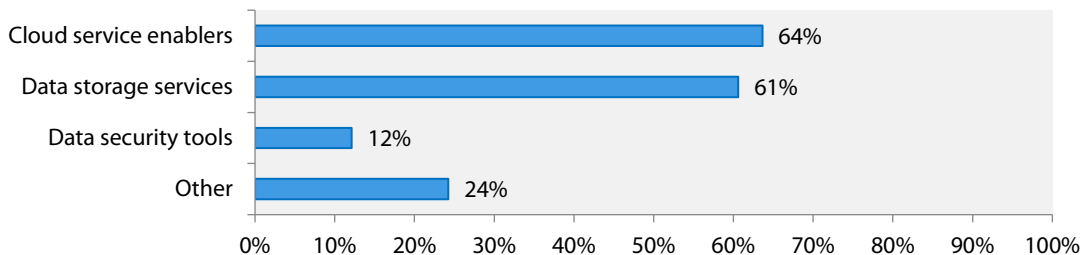
n=33
Source: Nordicity Pulse on VR survey (2016)

- Providers of VR infrastructure and backend solutions are mainly involved in enabling cloud services (64%) and in providing services related to data storage (61%).

- Examples in the 'other' category included blockchain technology (for securing electronic currencies) as well as content management and analytics.

Finally, some of the sampled companies make hardware on which VR experiences are consumed. The following chart shows the types of VR hardware and peripherals being made by the share of our sample companies working in those fields.

Figure 25: VR Hardware/peripherals

VR cameras	48%
Position/room trackers	38%
Motion sensors	38%
Controllers	36%
Haptic feedback devices	33%
VR headsets	24%
VR displays	21%
3D lenses	12%
Other	21%
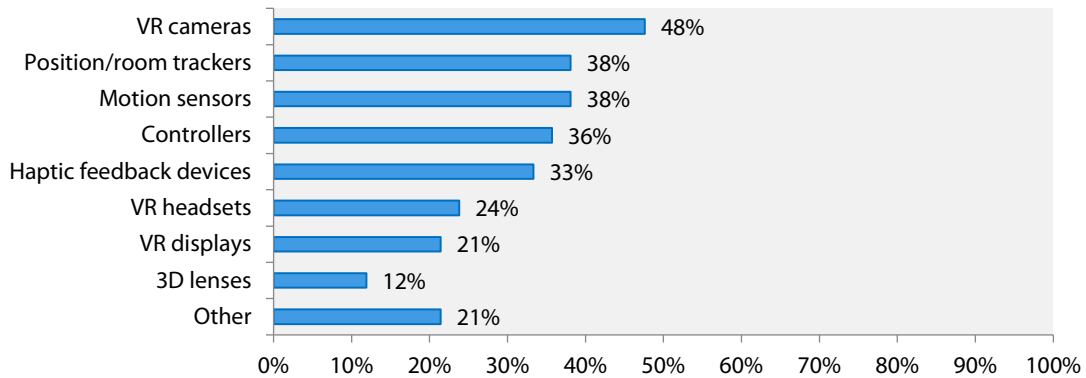
n=42
Source: Nordicity Pulse on VR survey (2016)

- VR cameras were the most commonly made type of hardware (43%). A relatively similar share of companies reported working on by position trackers (38%), motion sensors (38%), controllers (36%) and haptic feedback devices (33%).

- Few hardware companies are involved in making headsets (24%) and VR displays (19%), likely related to the dominance of the larger hardware companies (see Figure 19).

3.3 Collaboration in the VR Ecosystem

Given the relative novelty – and thus uncertainty -- of the VR ecosystem, companies may have to partner to share knowledge and knowhow. Indeed, the following chart shows the percentage of respondent companies who indicated they work with some partners.

Figure 26: Incidence of work with partners

	Yes	No
Overall	82%	18%
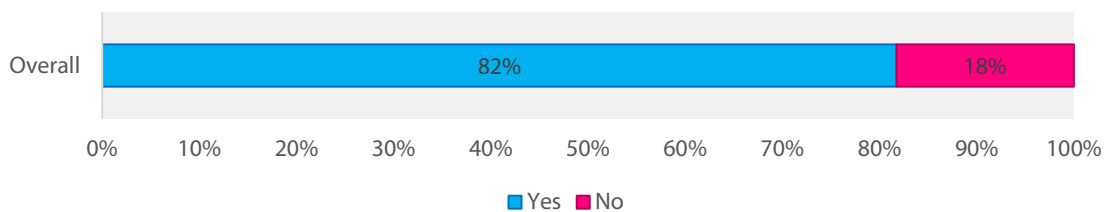
n=192
Source: Nordicity Pulse on VR survey (2016)

- 82% of VR companies work with other partner organizations.

- This fact was reinforced by interviews done for case studies with Canadian VR companies, many of whom cited partnerships (e.g., with major device makers) as critical to their growth and success.

However, partnerships can come in many forms. The following chart shows the share of companies by types of partners they indicated having worked with.

Figure 27: Types of partner organizations

Type	Percentage
VR start-ups	52%
Film/TV production companies	51%
Large technology companies	44%
VR hardware and/or peripheral makers	35%
Brands and corporate entities	33%
Games developers/publishers	32%
Marketing and/or ad agencies	31%
VR content distribution platforms	30%
Application development software makers	26%
Infrastructure / back-end solutions	18%
Other	19%
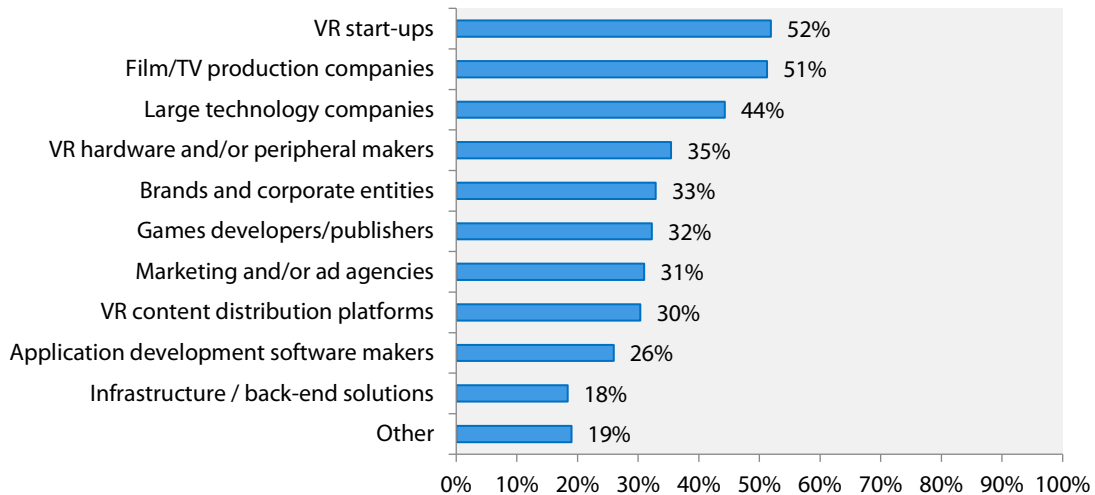
n=158
Source: Nordicity Pulse on VR survey (2016)

- Of those companies that work with partners, more than half work with other VR start-ups (52%) or film/TV production companies (51%). Large technology companies were also important partnerships, with 44% of companies reporting that they counted on at least one.

- About one third-of companies reported having connected with all other types of partner aside from infrastructure and back-end solutions - just 18% of companies had such a partner.

3.4 Summary of VR Workflow

In considering the VR workflow, one can make the following key observations:

VR Content Creation

- Three quarters (75%) of VR content companies create active VR content.

- Among those companies, almost two thirds (63%) are involved in the creation of games. Slightly more than half (52%) create either VR art experiences or educational tools.

- Of those companies creating passive VR experiences, almost all (93%) indicated they are working on short form video content.

- Content creators sampled are relying on a healthy ecosystem of content creation tools developed by dedicated 3rd parties.

- Third-party software development kits (SDKs) and application program interfaces (APIs) were the most commonly employed tool, with 72% of respondent companies reporting using them.

- Oculus (70%) and Samsung VR (69%) were the most common devices companies were creating content for in 2016, followed by Google Cardboard (65%) and HTC Vive (62%).

- It does not appear that the sampled VR content creators have found a prefered pathway to the market.

VR Tools, Applications and Hardware

- A slight majority (58%) of sample companies making content creation tools are making creation platforms or tool sets (i.e., the solutions or plug-ins that enable content creators to make content).

- The most common type of VR application developed is software development kits (SDK) /application programming interfaces (API), which 75% of developers reported having created.

- Distribution platform companies were fairly evenly split in the types of content they host. Active (67%), passive (63%), and hybrid (61%) VR experiences are all hosted with roughly the same frequency.

- VR cameras were the most commonly made type of hardware (43%).

Collaboration in the VR Ecosystem

- 82% of VR companies work with other partner organizations.

- Of those companies that work with partners, more than half work with other VR start-ups (52%) or film/TV production companies (51%).

4. VR Opportunities and Challenges

The promise of VR has been widely hyped. For example, one analyst has suggested that, by 2020, the VR ecosystem could be worth USD 30 billion,[5] while another predicted that by 2025, 136 million VR headsets could be in use.[6] For its part, Goldman Sachs predicted that by 2025, AR/VR could be a USD 80 billion market, with one third of its software value derived from video games, followed by professional uses such as healthcare and engineering.[7] Reflecting those market expectations, some industry investments have been staggering. For instance, in 2014 Facebook bought Oculus for over $2 billion.[8]

While the VR market may not yet have met these ambitious expectations, the opportunities and potential use cases are nonetheless widespread. Accordingly, this section examines current and potential VR use cases experienced by VR companies in Canada (as understood by VR companies themselves). It also discusses the challenges faced by sampled VR companies in seizing those opportunities.

4.1   The Opportunity of VR

A big question on the minds of content creators, technologists, funders and investors (and, even the market itself) is when will VR become a mainstream medium? While not an entirely fair question, it is instructive to understand the perspective of Canadian companies in this regard. For context, one industry thought leader at EPIC, Tim Sweeney, is focused on the massive transformation he predicts will take place in the coming 12 years (i.e., by 2029) explaining that:

> And now, the exciting part, is that over the next 12 years we're going to see VR scale down from a huge helmet to something the size of your glasses, which has a display for each eye that's higher quality than any display you can buy now, and cheaper, because it uses very little material. And that's going to revolutionize all forms of entertainment. Instead of having televisions and monitors and smartphone screens, you're going to have this VR device to project imagery wherever you want.[9]

We asked companies how long they predict it will take will be until VR is considered a mainstream medium. Our sample was slightly more ambitious than Sweeney:

---

[5] Digi-Capital, "Augmented/Virtual Reality revenue forecast revised to hit $120 billion by 2020," (January 2016). Retrieved from: http://www.digi-capital.com/news/2016/01/augmentedvirtual-reality-revenue-forecast-revised-to-hit-120-billion-by-2020/#.WIYsElMrI0Q.

[6] Greenlight VR and Road to VR, "New Greenlight VR Report Says Virtual Reality Making Gains on Path to Mainstream Adoption" (April 2016) Retrieved from: http://greenlightinsights.com/vr-making-gains-mainstream/

[7] Goldman Sachs, "Profiles in Innovation: Virtual and Augmented Reality – Understanding the race for the next computing platform" (January 2016).

[8] Brian Solomon, *Forbes*. "Facebook Buys Oculus, Virtual Reality Gaming Startup, For $2 Billion," (March 2014) Retrieved from: http://www.forbes.com/sites/briansolomon/2014/03/25/facebook-buys-oculus-virtual-reality-gaming-startup-for-2-billion/#7798fbe04222

[9] Suellentrop, Chris, "The creator of Unreal Engine describes his vision of the world-changing metaverse that's just 12 years away" Glixel.com (January 8, 2017).

Figure 28: When will VR be a mainstream medium?

A bar chart showing: This year 1%, Next year 4%, In 2-3 years 44%, In 4-5 years 37%, In 6-10 years 11%, More than 10 years 3%.
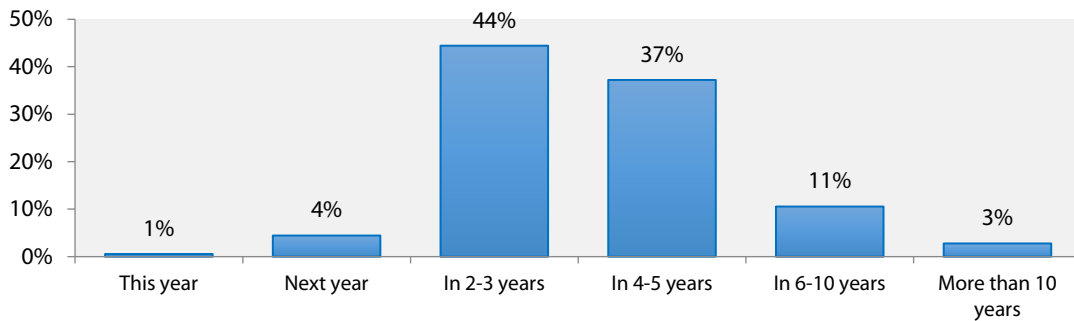
n=180
Source: Nordicity Pulse on VR survey (2016)

- Most respondents (86%) anticipated this would be the case in fewer than five years from 2016(i.e., before 2021).

- Almost half (49%) thought that VR would be mainstream in fewer than three years (i.e., before 2019).

Returning to the present, VR companies across Canada currently work with a variety of clients and audience types around the world. The chart below shows the share of companies by the types of clients they had in 2016.

Figure 29: VR Clients

A horizontal bar chart showing: The general public 67%, VR content enthusiasts (core users) 47%, Business users of VR products 35%, Marketing and/or ad agencies 35%, Large consumer brands 31%, Large technology companies 26%, VR start-ups 26%, Other 22%.
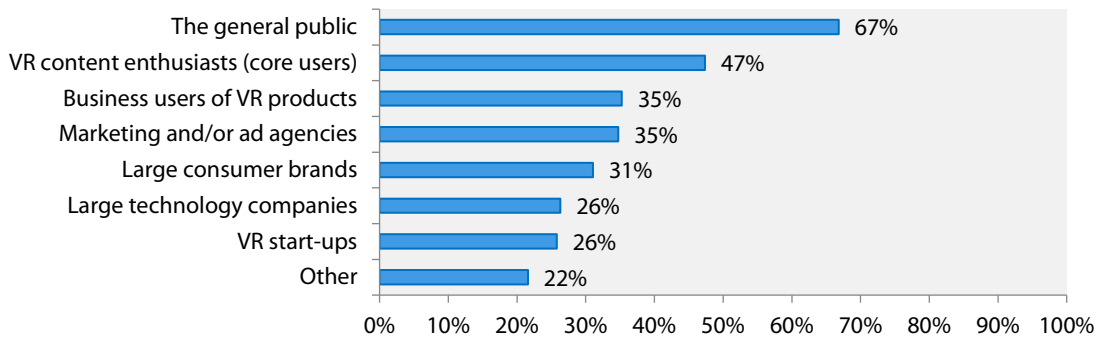
n=190
Source: Nordicity Pulse on VR survey (2016)

- Two thirds (67%) of all VR companies create VR product/services eventually destined for the general public, and nearly half (47%) work with the existing core of VR content enthusiasts.

- Just over one-third (35%) of companies are focused on Business to Business (B2B) products/services, targeting clients such as marketing and advertising agencies.

The type of end user (client), however, only tells part of the story. One must also consider what the client is using the VR experience for. As such, the chart below compares companies' current and predicted future use cases across all VR product types.

Figure 30: Current and future use cases (all product types)

Entertainment — Current 83%, Future 53%
Live events — Current 26%, Future 49%
Tourism/hospitality — Current 22%, Future 37%
Education (K-12) — Current 22%, Future 54%
Real estate — Current 21%, Future 34%
Professional development / Job training — Current 18%, Future 42%
Healthcare — Current 17%, Future 34%
Retail — Current 13%, Future 30%
Financial services — Current 6%, Future 24%
Other — Current 11%, Future 11%

■ Current ■ Future

n=163 (current), 148 (future)
Source: Nordicity Pulse on VR survey (2016)

- The current use case for VR products is dominated by the entertainment sector. Some 83% of VR companies indicated that they are currently active in this industry domain.

- The companies themselves may be quite optimistic seeing that for every industry but entertainment (itself already perceived to be a market), there is a perception of potential future growth. For example, around a quarter (26%) of companies currently count live events as a market, but nearly one in two companies (49%) deem it to be a potential future market for VR.

- K-12 Education takes the largest share of companies predicting or anticipating future VR use case.

In such a nascent industry, both current and future use cases can be opportunities. In fact, in our interview with Unity's global communications lead Marco Sanchez, he remarked that, "we don't even know the most compelling use cases yet" for VR. Nonetheless, it is clear that that VR companies see growth potential for VR in a wide variety of industries.

There is some variation in the perceptions of respondents of the current and future use cases of VR technologies based on the kinds of products they develop (for commercial use). The following charts show these variations among those commercial activities where the variation is strong enough to merit examination.[10]

---

[10] For example, this difference is negligible in the case of companies who produce VR content, and so no version of that chart appears below.

The chart below looks at current and future use cases as predicted by companies involved in **content creation tool making**.

Figure 31: Current and future use cases, (VR Content tool creators)

	Current	Future
Entertainment	83%	39%
Live events	32%	63%
Tourism/hospitality	34%	42%
Education (K-12)	29%	53%
Real estate	34%	42%
Professional development / Job training	24%	47%
Healthcare	17%	50%
Retail	20%	47%
Financial services	7%	39%
Other	10%	13%
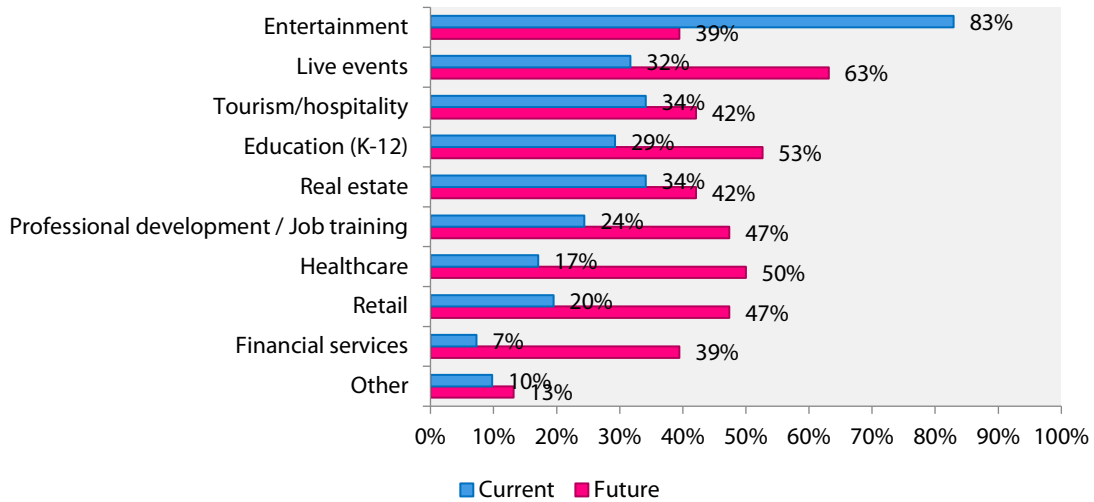
n=41 (current), 38 (future)
Source: Nordicity Pulse on VR survey (2016)

- In the present, VR Content tool creating companies see significantly higher opportunity in real estate (34% vs 21%) and tourism/hospitality (34% vs. 22%).

- In terms of future opportunities, live events is seen as the most promising area among companies active in VR content tool creation (63% vs. 49% overall).

The following chart shows the current and future perceived use case for VR technology among companies that create **application development software**.

Figure 32: Current and future use cases (Application development software creators)

	Current	Future
Entertainment	76%	43%
Live events	32%	63%
Tourism/hospitality	35%	63%
Education (K-12)	24%	68%
Real estate	38%	48%
Professional development / Job training	24%	53%
Healthcare	21%	53%
Retail	26%	55%
Financial services	9%	53%
Other	18%	20%
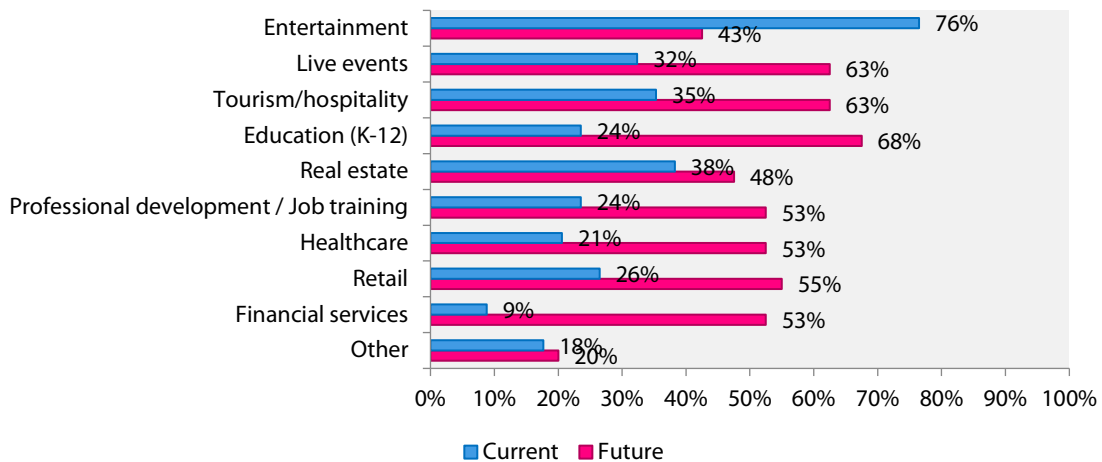
n=34 (current), 40 (future)

Source: Nordicity Pulse on VR survey (2016)

- Application development software companies see greater opportunity in the present for real estate (38% vs. 21%) and tourism/hospitality (35% vs. 22%) than the overall average.

- Looking to future opportunities, application software developers have a rosier outlook than the average across almost all categories, but especially so for tourism (63% vs. 37%), financial services (53% vs. 24%) and retail (55% vs. 30%).

- Companies engaged in making these kinds of products appear to see a role for their work across a much bigger segment of the larger economy.

Finally, the chart below presents the perspective of **distribution platforms** on the current and potential use cases for VR.

Figure 33: Current and future use cases, (Distribution platforms)
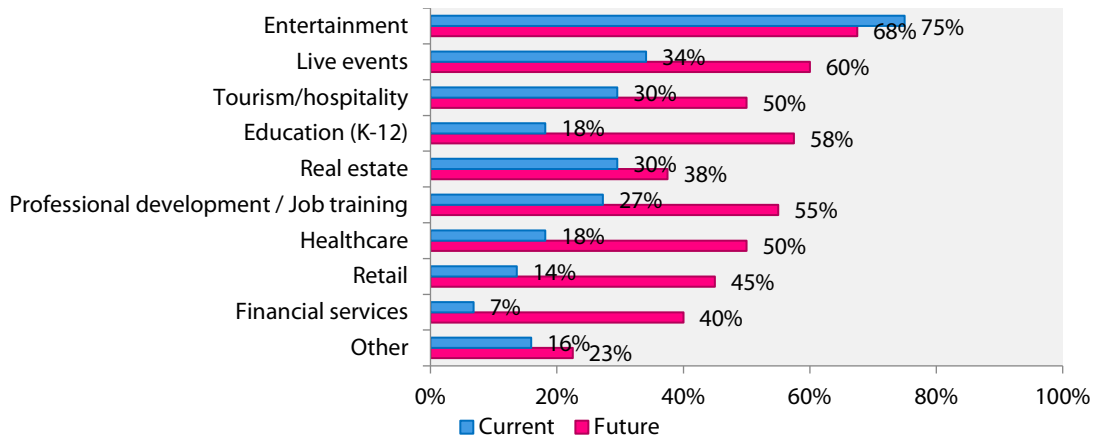
n=34 (current), 40 (future)
Source: Nordicity Pulse on VR survey (2016)

- The above product category was the only one for which the current and future outlook for VR technology lines up on entertainment, with 75% of companies engaged in making distribution platforms for VR seeing a current use case, which drops to only 68% for future opportunities.

Given how many different types of "Professional Development / Job Training" there may be, respondent companies were asked to indicate the types for which training VR would be used. The chart below shows the industries targeted by sampled VR companies.

Figure 34: Industry targets for professional development and job training
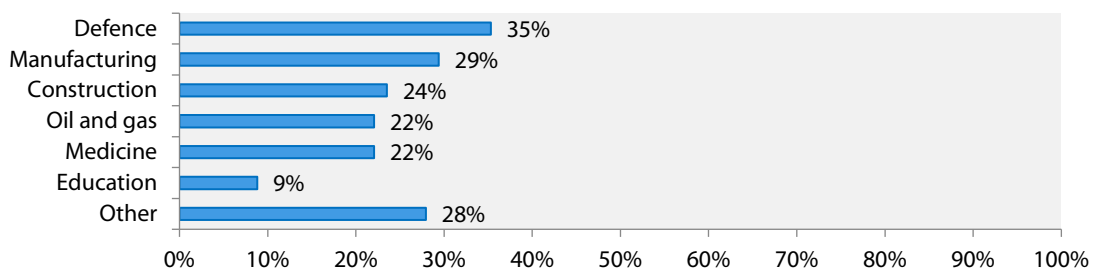
n=68
Source: Nordicity Pulse on VR survey (2016)

- Overall, defence (35%) was the most frequently selected industry as a target for professional development and/or job training opportunities, followed by Manufacturing (29%).

4.2 Challenges of the VR Ecosystem

While VR presents a host of opportunities, it is also a relatively challenging environment in which to operate, as illustrated by the following chart.

Figure 35: Challenges faced by VR companies

|	
Maturity of the VR market	2.19
Availability of financing (private)	2.13
Availability of funding (public)	2.09
Rate of consumer adoption	1.74
Availability of trained/experienced staff	1.74
Access to the right partner(s)	1.56
Awareness of VR technology and its uses	1.54
Nascency of the technologies	1.48
Form factor of VR hardware	1.34
Complexity of the technologies	1.25
Capacity of your company's infrastructure	1.23
Presence of a "killer" app or use case	1.21
Other	1.89

Challenge level: Not a challenge Minor Challenge Critical challenge

n=174
Source: Nordicity Pulse on VR survey (2016)

- The maturity of the VR market was the most significant challenge reported by VR companies responding to the survey, followed by access to both private finance and public funding.

- Rate of consumer adoption and availability of trained staff were equally weighted challenges in fourth place.

- "Other" challenges include:
    o VR hardware availability (or lack thereof)

    o "Novelty" or "gimmick" investment (for marketing), as opposed to sustained, long-term investment (for real product/market development)

    o Too much competition for too little market space

    o For public uses of VR (Museums, educational, tourism): hygiene concerns and steep learning curve in use of equipment

The following chart gives a more detailed breakdown of how sampled VR companies assessed the various challenges facing their firms.

Figure 36: Distribution of industry barriers to success

Barrier	Not a challenge	A minor challenge	A challenge	A critical challenge
Availability of well-trained/experienced staff	18	41	32	77
Availability of funding (public)	9	23	55	68
Maturity of the market (in which to sell VR products)	9	20	73	66
Availability of financing (private)	7	27	68	62
Access to the right partner(s)	25	56	28	60
Awareness of VR technology and its uses	32	48	31	60
Nascency of the technologies	24	59	23	60
Rate of consumer adoption	23	39	43	57
Complexity of the technologies	33	72	12	51
Form factor of VR hardware	30	64	18	48
Capacity of your company's infrastructure	44	62	18	45
Presence of a "killer" app or use case	47	43	18	40
Other	3	4	9	1

n=174
Source: Nordicity Pulse on VR survey (2016)

- Despite being ranked fifth overall in terms of average challenge score, the 'availability of well-trained/experienced staff' received the largest number of 'a critical challenge' responses, suggesting that when staffing is a challenge, it is one crucial to the success of a VR company.

Companies were also asked to reflect on what was needed in order for VR to thrive and many responses focused on knowledge share and development. From a "whitepaper on best practices" to the need for "Some kind of VR content creation hub, to facilitate knowledge share and access to both office and studio space" – more education was a recurring theme.

When asked in interviews, two other core themes emerged as the access to sustained capital and a greater tolerance for failure:

- "**Accessible and sustained capital.** It doesn't have to be public or private funding. It could be access to a network of customers and/or partners who are interested in incorporating VR into their organizations, and would be open to having VR developers and enthusiasts provide solutions for them. These solutions could be anything from an entertaining film, to a complete videogame, to a job training program. We need the industries to help tell us how VR could be of use to them, so an actual VR ecosystem could be built from those who provide the tools and infrastructure, to those who focus on products."

- "At this point, **more experimentation** and content creation with less of a concern for driving revenue. It's not only the tools and technologies that are in their infancy, it's the conceptual changes in the type of content being created. Currently (and by necessity) most people are adapting extant storytelling methods to VR, but in order to be truly successful and carve out a genuine niche, we're going to have to develop ways of telling stories that are as different

from TV and Film as TV was from Radio (or Film is from a novel). It's going to take a lot of money, experimentation, and tolerance for failure."

The most important challenges for VR companies exhibited some variation across jurisdictions as can be seen in the chart below:

Figure 37: Challenges by jurisdiction

n=174
Source: Nordicity Pulse on VR survey (2016)

- **In Ontario,** the availability of well-trained staff was reported as a less significant challenge than in other jurisdictions. Availability of public and private financing and the maturity of the VR market were the most significant challenges faced by Ontario VR firms.

- **In Quebec,** the rate of consumer adoption was perceived to be a more significant challenge than the availability of either experienced staff or public funding, reaching 3rd place among Quebec VR companies overall. 'Awareness of VR technologies and their uses' and the 'Form factor of VR hardware' were also more significant challenges in Quebec than in other jurisdictions.

- **In Alberta and Manitoba,** challenges related to the capacity of company infrastructure and to the availability of well-trained staff were significantly higher than in other provinces.

- **British Columbia** did not exhibit any strong variations from the overall average, or in comparison with other jurisdictions.

4.3 Summary of VR Opportunities and Challenges

Looking at the opportunities – and challenges – presented by the VR market, one can make the following key observations:

Opportunities (Use Cases)

- Most respondents (86%) anticipated VR would be a mainstream medium in fewer than five years (i.e., before 2021).

- Two thirds (67%) of all VR companies create VR product/services eventually destined for the general public.

- Just over one-third (35%) of companies are focused on Business to Business (B2B) products/services.

- The current use case for VR products is dominated by the entertainment sector. Some 83% of VR companies indicated that they are currently active in this industry domain.

- K-12 Education takes the largest share of companies predicting or anticipating future VR use cases.

- Companies engaged in the development of different kinds of VR products/services have slightly different views of current and future opportunities:

  o VR Content tool creating companies see significantly higher opportunity in real estate (34% vs 21%) and tourism/hospitality (34% vs. 22%).

  o Application development software companies see greater opportunity in the present for real estate (38% vs. 21%) and tourism/hospitality (35% vs. 22%) than the overall average.

- The Defence industry was the most frequently selected as a target for professional development and/or job training opportunities, among those firms that view training as a key opportunity for VR.

Challenges (Company Needs)

- The maturity of the VR market was the most significant challenge reported by VR companies responding to the survey, followed by access to both private finance and public funding.

- Despite being ranked fifth overall in terms of average challenge score, the 'availability of well-trained/experienced staff' received the largest number of 'a critical challenge' responses.

- There are some regional variation among challenges:

  o **In Ontario,** the availability of well-trained staff was reported as a less significant challenge than in other jurisdictions. Availability of public and private financing and the maturity of the VR market were the most significant challenges facing Ontario VR companies.

  o **In Quebec,** the rate of consumer adoption was perceived to be a more significant challenge than the availability of either experienced staff or public funding.

- o **In Alberta and Manitoba,** challenges related to the capacity of company infrastructure and to the availability of well-trained staff were significantly higher than in other provinces.

5. Company Showcases

Below we present the company showcases for the following companies:

1. **Secret Location**;
2. **Subpac VR**;
3. **Lens Immersive;** and
4. **Retinad**.

This selection of showcases is complemented by those case studies found on the [Pulse on VR website](#).

5.1 Secret Location

Company Name: Secret Location

Type of Company: Content studio for emerging platforms; VR tool developer

Established: 2008

Locations: Toronto; Los Angeles

Company size: 60

Websites: https://secretlocation.com/, https://www.vusr.co/

Interviewed: Co-founder & Executive Producer James Milward; Co-founder and Chief Product Officer Ryan Andal

Company Story

Secret Location was founded in 2008 by James Milward, Ryan Andal and Pietro Gagliano as a digital content studio producing interactive apps and websites for an array of international media and brand clients, including Fox, PBS, CBC, Syfy, Sony, NBC, NFB, Los Angeles Philharmonic, World Economic Forum, Red Bull and many more. The quality of Secret Location's work has been steadily recognized by industry leaders and peers, including Webbies, Cannes Lions, and the first primetime Emmy for a VR experience in 2015 for "Sleepy Hollow: The VR Experience." The Secret Location team began experimenting with VR in 2013 with the release of the first Oculus Rift development kit and produced its first VR project in 2014 for VICE and the Columbia School of Journalism with a look at the Israeli-Palestinian conflict, which was followed by other VR projects, including "Sleepy Hollow." In 2016 the Toronto-based global media company eOne wholly acquired Secret Location, having made an earlier equity investment in 2014.

Content-focused Business Model

Secret Location has now shifted its business model away from client/service fees to the creation and monetization of original intellectual property for sale in the global market – or, as Milward put it, "Content for sale, rather than work for hire." The shift began as the Secret Location team began to realize that they were in demand for both storytelling and technical capabilities, leading to more content-based partnerships instead of agency-style engagements. The eOne investment has provided the resources to accelerate this shift, with funds available to invest in teams and original content. The company is betting on a model based upon talent, IP, story, technology, ability to finance and customers to buy in a global market for VR and other emerging platforms. In addition, Secret Location now serves as an internal incubation unit for eOne's sizeable content business. Today, a slate of more than 20 projects is underway at different stages, though not all of them will survive

and go to market. Secret Location is using range of financing models, including private investors, exclusive partnerships, studio deals, and self-financing of product for direct sale to consumers.

Technology as Product

Secret Location is well positioned with both creative and tech teams, enabling them to develop their own solutions when required. Some are freely shared within the community – like Secret Location's approach to storyboarding for VR production. In at least one other case, Secret Location is productizing an internal solution, with the launch of their VR distribution platform VUSR. Like all VR producers, Secret Location had to confront a fragmented VR consumption market with multiple proprietary standards. To reach audience at scale, producers must deliver content to a daunting array of devices and platforms. Andal's team built Secret Location's internal pipeline for VR distribution to move VR sound, video, data, and interactivity to work on every platform -- iOS, Android, Facebook, YouTube/Google, Oculus, Vive, Playstation, etc. Soon it became clear that other publishers with the same problem might pay Secret Location for software to manage their own branded VR portal. Thus was born VUSR – "immersive publishing made easy." VUSR is the white-label platform powering all of the VR content from The New York Times, an early pioneer in the production of VR journalism, and is being marketed to other premium publishers in the VR industry. Andal notes that Secret Location's roots as a producer has been an advantage in developing their publisher-friendly system, compared to competitors whose roots are mainly as technologists (LittlStar and the now-defunct VRideo for example).

Challenges

A big challenge today is camera resolution. To avoid giving users a headache, video for VR applications should stream at 4K resolution. The problem is, many VR screens (and the rest of the workflow) do not support 4K video. Secret Location is developing a method to concentrate pixels in the main area of the screen to achieve the required resolution – what Andal called "field-of-view rendering."

This is a step towards the goal of delivering real-time rendered VR content with full interactivity and full volumetric capture. Today's 360-video capture doesn't allow much engagement, motion or interactivity, but this will come with the emergence of high-end light-field video cinematic capture being developed by Lytro, Google, HypeVR, Intel and others. These systems generate an immense amount of data in order to create positional depth -- what amounts to a computer-vision replica of the video capture. Manipulating these huge files will require new solutions for production, post-production, and distribution.

Finally, to grow and compete in the global VR market, Canadian companies are challenged by the dominance of investment capital being concentrated in California and China. Smaller markets like Canada simply do not compete. The result may be out-migration of companies, or, as Secret Location has found, acquisition.

Canadian Advantage

Both Andal and Milward attribute their success in part to the unique Canadian media environment. Secret Location has received significant government support, which has enabled them to experiment at the earliest stages of technology development before the existence of the commercial market. "We are lucky to have government funding programs to support companies in the mid-term as their monetary structure can be developed," said Milward. Andal noted, as well, the huge impact on the Canadian gaming and visual effects industries, which have produced a world-class talent pool upon which VR, indeed, all digital media companies can rely.

5.2 Subpac VR

Company Name: Subpac VR

Type of company: VR hardware and/or accessories – haptic feedback devices

Established: 2013

Year began working in VR: 2014

Location(s): Toronto, Palo Alto, San Francisco, Los Angeles, London

Company Size: 11-50

Website: http://subpac.com/

This global firm, with a head office in Toronto and other HQs in Palo Alto, San Francisco, Los Angeles and London began as a shared vision between two friends who realized that the future of music and sound would be immersive and tactile.

Company origins

In 2011, friends and musicians, Todd Chernecki and John Alexiou quit their jobs in law and banking to experiment with the very technology that forms the backbone of SubPac full-time. Working with engineers and mentors, music producers and sound designers, Chernecki and Alexiou spent three years refining the tactile audio technology that they believed would accelerate full physical immersion in VR experiences.

As a wearable audio system (in other words – a slim and stylish backpack or vest), SubPac allows the wearer to experience the subtleties of sound and music with his or her body. From a gust of wind to the feeling of someone tapping your shoulder, SubPac aims to unlock the potential of bringing the body into the experience. Today, the kit seems as appealing to gamers as is it is to DJs and music fans (it can also be embedded in the seats in theatres and cars).

Pursuing growth

As the product has taken shape, so too has the potential market developed. For now, SubPac seems to enjoy something of a first-mover advantage, having identified only a few Kickstarter projects with tangentially relevant offerings. But the demand from the ecosystem is strong. For everyone from content creators to advertisers, optimizing the VR experience is a top priority. And SubPac is transforming physical immersion in VR, an essential part of storytelling experiences and believability. Alexiou envisions that SubPac's product should appeal as much to those creating VR experiences as it does to the end users or customers of that experience. Today you can buy SubPac readily in stores around the world from the UK to Switzerland, South Korea to Chile (and Amazon of course). The backpack retails from between $99 to $350 USD.

Key success factors

One success factor for SubPac was its ability to be flexible. Alexious cautions VR industry companies from trying to define a path too soon or assume too much about the landscape in case they may miss the target as the rest of the ecosystem unfolds. In this context, industry knowledge and staying current on the latest developments, trends and needs has been crucial to the company's strategic thinking and resource allocation. That's not to say the company has remained cautious or risk averse. In fact, Alexiou and Chernecki recognized right away that, in addition to its Toronto office, SubPac would need to invest in physical locations in LA, San Francisco and London both to tap into key market segments and cultivate relationships with potential partners, influencers and mentors.

Looking ahead

What lies in store for SubPac? As it grows its music and screen-based business, and boasts users from Oculus, Samsung, NBC Universal, Lionsgate, Felix & Paul to Marshmallow Laser Feast - it is also pursuing exciting new verticals and applications. SubPac is exploring use cases in healthcare and accessibility (i.e., particularly for the deaf and hard of hearing community) as well as the automotive and aerospace industries.

And what of Canada's VR Landscape? According to Alexiou, Canada is usually at the forefront of innovation and VR is no exception to that trend. His thought is that Canadian companies would benefit from greater partnerships to accelerate and amplify growth. These partnerships could be with people (e.g., experts/though-leaders), start-up or established companies, academia or government and can be enormously beneficial during a company's early development process – particularly as the VR landscape is still uncertain and undefined. Alexiou's concern is that when it comes to VR, Canadian companies can tend to underestimate strength in numbers and the benefits of sharing knowledge.

5.3   Lens Immersive

Company Name: LENS IMMERSIVE

Type of Company: video streaming infrastructure and VR distribution platform

Established: 2015

Locations: Sydney, Australia (offices in Waterloo ON; New York City)

Company size: 11-50

Website: https://lens-immersive.com/

Company Origins

LENS was founded in Sydney by Yan Chen and Travis Rice, Americans with backgrounds in Hollywood visual effects, technology, motion picture production, and experimental fine arts. In working with cutting edge artists, Rice kept returning to visualizations of the future from science fiction, which came together as the VR world emerged. Chen, fresh off running the digital pipeline for "Happy Feet 2," had created a video streaming platform for a video-on-demand company in Australia. The core thesis for the new company LENS was the coming of a new format for film consumption – immersive VR cinema.

 In 18 months since founding, they have built a streaming infrastructure and VR distribution platform supported by three core pillars:

- TORII: Proprietary video encoding for digital content (TV, mobile, VR, AR) that provides high resolution streaming at double the speed and a quarter of the cost of industry leaders.

- LENS: VR Streaming platform supporting live video, DRM, advertising, custom portals and a payment gateway on all existing VR devices. Scalable, White-label and AR ready. LENS Immersive is an online streaming content delivery system, specific and unique to virtual reality hardware, including, but not limited to Sony Playstation VR, HTC Vive, Samsung Gear VR, Oculus Rift and Google Cardboard VR.

- PIONEER AR/VR Studio: Executive production, development and acquisition of new format, AR and VRPlus content.

Competitive advantage

The company's core technology streams high resolution content at twice the speed and a quarter of the cost – they are currently able to stream 4K VR content to a headset over a platform that functions like a Netflix video-on-demand store, complete with rights protection and electronic payment systems enabled. They hope to increase resolution to 8K in the near future. At present, they have a 16-20-month lead in the distribution of VR in resolution and price. They are in search of mainstream studio and content library customers with VR or other high resolution content to distribute utilizing the platform "white-label" basis to launch their own VR and/or other high-resolution content stores and networks. To illustrate their vision of high-resolution VR cinema, they have launched their own content studio and have produced the first episode of a proposed VR series called "Remember".

Global vision includes Canada

Through one of its seed-stage investors based in Canada, LENS located its development team in Waterloo, Ontario, headed by Canadian David Fedirchuk, who also leads the company's international business development effort. They have found Waterloo to be a strong center for engineering and R&D talent. To capitalize on the fast-growing Chinese VR market, LENS is establishing a joint venture in China as part of the company's Series A investment strategy. Having teams located in different time zones across the globe also enables 24-hour operations to maximize efficiency.

Content vision

The team believes that much of the VR content in the market is still in the "test phase." LENS is focused on creating content that people come back to on a regular basis, just like television. To get the level of viewer involvement, LENS is developing a hybrid VR/cinematic content form they call VR-plus that incorporates techniques from the decades of cinema like soft focus, close-ups, editing, and other things that are difficult to achieve in the VR paradigms that have emerged to date. During production they shoot both 360-degree and conventional cameras and blend them in post-production. Other camera formats can also be integrated, including stereoscopic 180, and even smaller than 180. The finished VRPlus production delivers two pieces of marketable content – one is VR video, from which perhaps 80% of the content can be formatted in traditional 16x9 rectangular media and distributed through conventional channels.

Theirs is a very different content vision, then, focusing on "cinematic VR" or "immersive content" rather than either 360 video or VR game-type content. They mix live action content shot with actors on location and sets with computer graphics and visual effects type imagery. The live action is captured with a range of cameras, including conventional digital high-res, 360 spherical, 180 stereoscopic, and even less. This minimizes the amount of stitching in post-production. They wind up with a processed 360 VR version, as well as a 16x9 linear show that includes extracted shots from the 360 segments.

This hybrid approach is needed until VR consumption catches up with VR demand, which is fueled by the need to sell headsets. "We are trying to build towards that crossover point where VR and traditional format television start to have some kind of axis that they are both operating on," he said. "We want to bring what happens in television and film into the VR space."

Partnerships

LENS's entry into China has stimulated a series of meetings with many technology partners. They are in conversations with major technology partners about a set top box and some TV manufacturers and mobile phone manufacturers about supporting the TORII codec and LENS platform. They've had meetings with China-based casinos, who actually run a form of televised e-Sports for various forms of casino gambling.

Future needs

On the technical side, LENS is focused on its own IP, which is central to its business and growth. Given their focus, they do see a need for a high end stereoscopic 180 or 360 camera at the level of a RED camera, which is dependent upon the evolution of sensor technology, but this is not a focus for their company. Growth will ramp up following Series A financing with new hires in Waterloo, Sydney and China and a focus on sales and business development. They have no plans to expand to Silicon Valley. They feel that the center of gravity in VR is China.

5.4   Retinad

Type of company: Infrastructure / VR Analytics

Established: 2014

Year began working in VR: 2014

Location(s): Montréal, presence in San Francisco

Company Size: 5 Employees

Website: retinad.io

This Montréal-based firm believes that deep analytics will be increasingly vital for the VR and immersive content eco-systems to prosper globally.

Company Origins

Retinad was initially exploring the premise of bringing advertising to VR. Instead, the firm recognized a crucial market gap in VR analytics. Retinad spent over two years building its analytics software and describes its mission to, "help make virtual reality compelling through data."

Pursuing Growth and Success Factors

Retinad's small team of team of five has successfully raised about two million dollars in total and has a solid pipeline of international clients and brands. Retinad explains brands, agencies and filmmakers are their target customer since they are the most in need of being able to test and measure the performance of their experiences.

Early on Retinad made the firm decision to not customize its product to any one client. A key benefit of the software is that it can crossover to any market vertical and on any application – it is "cross-platform and cross-sector" and can support anyone in the VR space. While not customizable, Retinad solicits feedback from customers and, as a result, continuously improves the product itself.

Retinad acknowledges that analytics can be commoditized and in that sense, any tracker it builds has the potential to be replicated and deliver similar results. In this respect, Retinad has an aggressive market strategy, going after the best customers quickly and effectively, showcasing itself to be the easiest and fastest platform integration. Retinad will have a presence at Upload VR and constantly monitors new entrants into the VR space that may benefit from its products and services. As well, it provides excellent customer support to maintain and grow its roster of clients.

Looking to the future, the Retinad team is pleased with the pace of VR's growth. They had thought it could take another two or three years to get to the viable, mature pace and traction that is evident today. Montreal has already established itself as a serious contender in the VR market with studios like Felix&Paul, hardware companies such as VRVANA and the plethora of video games companies ripe to build VR experiences.

6. Conclusions

Based on the responses of more than 200 VR companies located in Canada (representing more than 1300 employees), we can draw some broad conclusions -- understanding, of course, that ours is not a truly comprehensive view of Canada's VR industry.

Perhaps most obviously, it seems that Canadian VR companies are currently predominantly focused on creating **(inter)active VR experiences**, though some are finding success with other VR product types and technologies. In turn, these products are currently (mostly) geared for the **general public for entertainment purposes**.

To get these products made, VR companies combine internally-developed and 3rd party tools and applications – and are **almost always partnering with other companies**. The relatively high level of use of internally developed tools – along with the fact that companies are creating product for internal (non-commercial) use suggests both that there are **gaps in the workflow**, and that companies are still **experimenting with their workflow processes**.

That said, companies indicate that only a minority of the products on which they are working have made their way to the market – as **most are in a pre-market phase of development**. When those products do get to market, the 'upside' of the VR industry – often touted by analysts – is predicted (by respondent firms) to be in the educational/training market.

The pathway to that success will also include some significant challenges. Indeed, companies most often selected the **maturation of the market itself** as a barrier to their success. As with most creative industries, **access to adequate financial resources** (be they from public or private sources) is also seem by the sampled companies as a key issue.

These challenges aside, companies sampled see VR as a source of major growth – and expect the medium to have made it to the **mainstream within the next five years**.