

Sustainable Business Innovation and Technology Management in Gaming Industry: An Exploratory Study

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ABSTRACT: The global gaming market size was valued at USD 151.9 billion in 2019 and is expected to witness remarkable growth over the next five years. Experts forecast that the global games market will generate revenues of USD 256.9 billion worth by 2025, with a healthy year-on-year growth of 9.17%. Technological advancement, the burgeoning usage of smartphones, cheaper internet and continuous innovation in gaming platforms are becoming the key factors driving the market. As the demand rises from physical games to online games, technology management playing a vital role in attaining sustainability of the business by focusing on augmented reality, e-sports and virtual reality segments. The introduction of cloud platforms turned gaming into reality by enhancing gamer's experience and providing diverse consoles/platforms, such as Mobile, Xbox, PlayStation, PC consoles which are incorporated into one product. Moreover, technologies such as 5G are also driving the innovations in eSports, Virtual Reality and Augmented Reality games. 5G technology eliminates the latency and bandwidth issues in streaming high-quality VR game content with minimal hardware limitations. This study examines the Technology Management in Gaming Industry in the light of Sustainable business development and aims at proposing a robust model in the captioned lines.

I. INTRODUCTION

Video game systems consist of various types of consoles including home video game consoles, handheld devices, micro consoles, and dedicated consoles. Home consoles are portable and allowing gamers to carry and play at any time. It is preconfigured and has interactive appliances that directly connect to the TV to play video gaming. Examples include Sony's PlayStation 4, Nintendo Switch and Microsoft's Xbox One. Handheld game consoles are portable and smaller than home video game consoles. It contains built-in screen game controls and

speakers. Examples include Nintendo DS, PlayStation vita, Nvidia shield. PSP Go and Nintendo's Switch though it can also be docked to act as a console. Micro consoles can directly connect to a television set and can then use the television to play video games downloaded from play store. These are low-cost android based devices. OnLive Micro Console is the best example in this category. Dedicated console is limited to one or more built-in games and it won't support other additional games. These consoles were gradually replaced by ROM cartridges. Consumers can be categorized into Core gamers and Casual gamers. Core gamers are enthusiastic adopters of the different kinds of games, the latest advancements in games, and give value to high performance. Casual gamers are just who enjoy some games and online experiences in their free time. they will be easily satisfied with the existing system and mostly concentrate on free to play games.

Global gaming market is divided into APAC, MEA, Europe, North America, LATAM regions. Asia Pacific holds the largest market share. With more smartphone users and rapid internet growth in the emerging nations, APAC will witness the highest growth rate over the next few years. Ease of digital payment and increased paying capacity has also uplifted the revenue in the APAC region. China, South Korea, Japan are investing more to embrace the business opportunities by leveraging the advancements in technology.

Younger population, Technology advancement, entertainment seeking behavior, easier access to the internet and cheaper internet are becoming key factors driving online gaming in a country. The developing economies are becoming promising gaming markets of the future considering their huge younger population. The gaming industry in these countries could see an evolution in future and is likely to create a large market for the gaming sector.

China is the largest gaming market in the world:

In 2016, the total gaming industry earned revenue of USD 24.3 billion with 558.8 million gamers playing. 71 per cent of the online population play games across multiple devices. 36 percent of gamer(s) buy online games, considerably lesser than other developed gaming economies. An average paying gamer spends USD 122 once a year. Gaming accounts for 14 per cent of total media and entertainment spends, higher than in developed economies.

Developments in china include:

It Accounts for 22 per cent of global investments in gaming. Local companies dominate the market with two Chinese companies producing the highest playing 10 games. Difficult for foreign companies to enter due to strong regulatory framework.

USA is the second largest market:

In 2016, USA gaming industry earns total revenue of USD 23.5 billion with 178.8 million gamers playing, 61 per cent of online population play games across devices High propensity to pay for online games, as nearly 60 percent of online gamer(s) pay, spending an average USD 224 per annum. Gaming industry contributes four per cent of total media and entertainment expenditure.

Developments in the US gaming industry:

Over 850 developers and publishers account for nearly 25 percent of worldwide gaming investments. Large gaming companies have global distribution channels. In a separate report, the All India Gaming Federation (AIGF) projects that there'll be 300 million online gamers by the top of 2019. "The evolution of digital and online gaming models is resulting in a surge within the number of online gaming players over the last few years," AIGF explains.

Nearly three-fourths of the market is occupied by online and mobile gaming platforms. Online gaming, as a segment, is estimated to be a \$1.1 billion opportunity by 2021, according to Google-KPMG. By then, India is expected to have more than 628 million gamers.

Latest happenings and opportunities:

Increasing popularity of gameplay streaming via eSports, Twitch, and YouTube Gaming is a good marketing opportunity to widen the appeal of gaming beyond its current user base. While most popular in South Korea and the US and gaining popularity in Europe and China, eSports is not developed in Japan, one of gaming's largest

markets. • Facebook also introduced a Gaming Creator program in early 2018 to livestream and monetize gameplay video

Virtual reality (VR) and augmented reality (AR) have been perpetually a year or two away from mainstream adoption. Better quality devices from Oculus (Facebook) and HTC garnered attention, but were generally considered too high a price and required too expensive additional PC hardware. • Video game systems as dedicated VR rigs show promise as the popularity and good reviews of Sony's PlayStation VR add-on. Microsoft's HoloLens could be an AR add-on, but the company has announced no specific plans

Prices coming down on 4K resolution and high dynamic range (HDR) television sets creates an upgrade path for video game systems to provide higher quality, more photo-realistic games. • Along with demographics, better broadband availability via fiber to the home and 5G networks also illustrate potential upgrade paths for where the better-quality video game systems will be most likely sold

Competitive Landscape:

The gaming industry became highly competitive as the ongoing demand for online games increased, technology advancement in gaming applications and ease in copying major gaming applications catering to immense competition in the gaming market. According to Mordor intelligence survey, Top 5 players are dominating the entire market holding the largest share in the gaming market by innovating and releasing next generation gaming consoles, continuous updates in existing games which make gamers addicted to their games. At the bottom of the market, it is highly fragmented and becomes highly competitive without any dominant players. Sustainability becomes a huge problem for game developers under these market conditions.

Major Players:

1. Sony Corporation
2. Microsoft Corporation
3. Nintendo
4. Tencent Holdings Ltd
5. Electronic Arts Inc.

II. LITERATURE REVIEW

Cloud Gaming:

Cloud gaming, gaming as a service, is a new way to run high-quality games on remote servers and streams them to the user's device from anywhere and anytime. It is more likely playing a game remotely from a cloud server. Gaming

software designed such that it will run a powerful server in data centers, game scenes are streamed to players over the internet in real-time, and gamers no need to use high-end compatible hardware to play these games. It became trending technology in the gaming industry due to the proliferation of high-speed networks and cloud computing.

Cloud servers will be running on single or multiple data centers in cloud gaming platforms. These platforms run gaming programs categorized into two main components. Game logic that converts gamer commands into in-game interactions and rendering scenes that generates game scenes in real-time. Recent advances in cloud technology have turned the idea of cloud gaming into reality.

Simply, cloud gaming provides an interactive gaming application remotely within the cloud platform and sends rendered scenes as a video sequence back to the gamer over the internet. This is often a plus for fewer powerful computational devices that are otherwise incapable of running high-quality games. While developers still improve games' graphics, the hardware is, in fact, recuperating, too. But the main question is will it be the new trend is high-quality games without hardware?

Gaming Anywhere:

Cloud gaming could also be a promising application of the rapidly expanding cloud computing infrastructure. All existing cloud gaming systems are closed source with proprietary controls, which sets the bars high to fix testbeds for the cloud game experiencing. During this paper, we present a whole cloud gaming system, called Gaming Anywhere, which is to the best of our knowledge the first open cloud gaming system. Additionally, to its openness, we design Gaming Anywhere for top extensibility, portability, and reconfigurability. We implement Gaming Anywhere on Windows, Linux, and OS X, while its client is often readily ported to another OS's, including iOS and Android. We performed extensive experiments to measure the performance of Gaming Anywhere and compared it against two well-known cloud gaming systems: StreamMyGame & OnLive. Our research results show that Gaming Anywhere is efficient and gives high responsiveness and video quality. For instance, Gaming Anywhere yields a per-frame processing delay of 34 ms, which is 3+ and 10+ times shorter than OnLive and StreamMyGame, respectively. Our research results also reveal that all these performance improvements are achieved without the expense of higher network loads. The

new gaming system can be employed anywhere for setting up cloud gaming testbeds, which may simulate to do more research innovations on cloud gaming systems.

Google Stadia:

Google offers a cloud-based platform under the name of 'Google Stadia' which offers distribution through a new cloud gaming capability and allows developers to use a wide range collection of tools and services. It also offers integration with YouTube for streaming, content, creator tools and user acquisition. Google aims to offer an end-to-end solution that supports game developers, gamers and YouTube creators on one cloud-based platform.

Microsoft laid out an identical vision with Microsoft Game Stack and EA has done an equivalent with Project Atlas. It is likely that both Tencent and Amazon will imitate with similar strategies. Cloud is that new platform dynamic for the games sector and can be where the longer-term competitive landscape resides.

Google has strengths but isn't the best placed of the cloud service providers for cloud gaming. Google has a lot going for it in cloud gaming. It operates a collection of very successful consumer facing platforms and services which are related to games – YouTube, Google Play, AR Core and Daydream VR, Android (and Android TV), Chromecast and Google Chrome – and also has a global presence in the cloud services market with Google Cloud. Like Microsoft and Amazon, it offers a selected set of tools tailored to the games industry alongside Google Cloud.

IHS Markit data shows that there have been an estimated 71 million Chromecasts active within the market at the top of 2018. Additionally, IHS Markit expects there to be over 80 million Android TV-based device shipments in 2019, although a majority of these will be shipped into mainland China without Google Play.

In essence, Google is well positioned to create a cloud gaming business and can be ready to use the audiences on its various platforms and its device to interact with a wide number of consumers. But it's one key weakness – first party and exclusive content. Meanwhile, Tencent Holdings and Microsoft are having a strong infrastructure and gaming content. Content availability and exclusivity are the large question marks over Google's cloud gaming potential.

Google announced its new first-party studio 'Stadia Games and Entertainment'. While this is a step in the right direction for Google to build its own content exclusives, it will still need to

negotiate timed exclusives with third-parties to start to compete more significantly with those with major games portfolios. If Google is serious about competing, the likelihood that the corporate will acquire studios or maybe a publisher must be considered high.

Google's cloud gaming approach is unique, could reduce latency and opens up the market to more users. Google's novel approach to include wireless connectivity in its game controller so that it can communicate commands directly back to the cloud server is an interesting solution to both aid connected device compatibility and reduce latency. Rather than connect the controller through Bluetooth and open up a return channel from the connected device, an immediate reference to the web removes some latency and also enables controller support for connected devices that do not have Bluetooth.

Is Google's cloud gaming service a threat to consoles?

The game console market remains an outsized and significant part of the general games market opportunity. \$128 billion console market spends 25 per cent share on content and services as per 2018 IHS market data. In addition, world consumer spending on console hardware reached \$14.7 billion bringing the general console market opportunity to \$47 billion.

Most significantly, console gaming is still dominated by three incumbents; Sony, Microsoft and Nintendo, and this sector wasn't significantly disrupted by the last wave of technology centred on mobile devices and app stores. With the shift towards cloud gaming this status quo is likely to be impacted. All three console manufacturers are embracing cloud gaming to a greater or lesser extent and this inevitably means a slowly decreasing reliance on client hardware, but also an opportunity for these companies to succeed in new users, while also catering to the normal console gamer. As this transition takes place, there is also an opportunity for new market entrants to disrupt the existing platforms and build their own services. This opportunity extends to a cross-section of companies including games publishers building direct-to-consumer businesses, cloud service providers and telecom companies.

It costs \$120 to get the early edition Founder's pack, which includes a Stadia controller, a Chromecast Ultra, a short USB-C-to-C cable, a Destiny 2 game download, and three months of a \$10-per-month Stadia Pro subscription service needed to take advantage of all of Stadia's online features. Also, you would like to shop for the particular games at their regular prices albeit you

cannot download them. A cheaper Stadia play service is launching in 2020, though details are unclear. It all looks like tons to buy a "console less console." within the UK, you'll get the Premiere Edition with equivalent features. Stadia doesn't yet appear to be available in Australia but the worth converts to about AU\$130.

Research Methodology

We have conducted secondary research by referring to several articles about gaming industry and the rise of cloud gaming. Data was collected by referring through a lot of company websites related to the major industry players like Google, Sony, Tencent etc. We also gathered reviews of the above-mentioned gaming platforms from technology blogs.

We have referred to research reports published by KPMG and Frost and Sullivan to understand the industry growth and the future forecasts which was broadly derived from sources including:

- Tech company websites
- Blogs
- Reports
- Gamers reviews
- Gaming editors - dan Ackerman

Research outcomes:

Data centers or servers:

Infrastructure plays a crucial role in launching cloud gaming for any company. It can also act as a barrier to entry for new players into the market as the cost of setting up the infrastructure is very high. Gamers would only get the real feel of cloud gaming if the experience of the game is similar or better than they would play it offline. They should not experience any downtime, technical glitches or latency when accessing the game.

Players using the cloud gaming of Nvidia service i.e. GeForce Now has reported downtime and technical issues in several situations over social media. There were instances where the whole server was down and made the gaming platform inaccessible. There were also some instances in which specific games faced technical issues. Several users reported the following message as viewed on the platform "The following games are offline due to technical issues.

Since, Nvidia was in manufacturing of computer chips, It had to partner with SoftBank Corp and also LG Uplus Corp to set up its cloud infrastructure. In Spite of doing this, intermittent issues seemed inevitable for the company's platform.

Cloud infrastructure:

The distance between a server and the player is crucial to achieve minimal latency. Presence of high latency will directly reflect on the gamer's experience and the success of the cloud platform. Generally, the cloud introduces about 100ms - 250ms of latency.

Hence, it is important to place the servers near to the geographical location of the market which the company is catering to. The Chinese gaming giant Tencent aims to cut down these problems by improvising its technical functionality at the IaaS layer. Through national edge computing data centers, it achieves the objective of reduction of distance between the players and the servers. This achieved at very low - cost network services. Redistribution of GPU resources has also proved a very good way to reduce server costs for the gaming solution.

Some companies are also exploring the option of outsourcing the building and maintenance of the cloud infrastructure to established players like IBM. A Polish startup named RemoteMyApp has adopted the IBM cloud services to scale up its cloud gaming platform named Vortex. Platform as a Service can be of great leverage in setting up the cloud gaming platforms.

IBM on this front provides numerous cloud services ranging from data storage to original design manufacturers (ODMs). It also supports several connected devices such as smart TVs, tablets and phones to download and play the game instantly.

Supporting services and other applications:

When venturing into the cloud gaming industry what is observed from many players is the presence of an ecosystem around the whole platform. A simple cloud gaming platform supported with strong data servers would not do sufficient to compete in the current industry. Streaming services, consoles, Augmented reality support and many other such services have become the latest trend.

Google has launched its cloud gaming platform Stadia. It also boasts about a wide variety of supporting services to integrate with Stadia to complete the user gaming experience. YouTube, its video streaming platform is being leveraged here to stream live games to all the other players. Google Play which houses millions of games, music, books etc. is being used as the gaming store for downloads for android.

Google Chrome the widely used browser is used for accessing and running the cloud gaming. Chromecast which acts as a connection to the TV

and the internet is being shipped along with a basic package of the stadia which was launched initially. ARCore and DayDream VR are other services to support the latest augmented reality gaming using the cloud.

Nvidia unveiled its cloud gaming platform of GeForce NOW along with SDK. This is an open platform which provides support for both the existing games and in-game purchase systems. It encourages other developers to build on the platform thereby increasing the availability of games and building a robust Play Store.

Existing User base:

Expanding on the existing user base and growing organically is seen as a good strategy for companies entering into the cloud gaming industry. Cross-selling can be done to the existing customer base.

Many established companies like Sony, Microsoft, Tencent are already seeing a huge advantage on this front. Microsoft is creating an extension to their prominent product XBOX to support cloud gaming along with it. Although not fully released, Microsoft with its platform of Project xCloud is trying to compete with the Google Stadia.

It acts as an extension to its line of Microsoft's consoles. This reduces the burden of the player to purchase new equipment as well. Xbox Series X will support this feature. It also comes with unlimited storage space thereby providing the players with access to the Xbox games without actually downloading them. without having to download them -- a major benefit.

Console applications:

Gaming is fun and a better experience with the use of consoles. The three players leading in the console gaming industry are Sony, Microsoft and Nintendo.

In cloud gaming, consoles can also act as a device to relay the user response faster to the cloud using a console. Google used the same approach when it released Stadia. It comes with a wireless connected game controller. Without an intermediate device, it will relay the users input directly from the console to the cloud server and back. The response from the cloud is fetched by the laptop or the TV and relayed on the screen. In this way, the connected device compatibility is achieved and latency between the cloud server and the player is reduced.

The novel approach of connecting the controller with the Bluetooth to the display device

which receives the input and then transmits to the server will create a lot of latency due to additional channels in between. Google also achieved the compatibility of connected devices that do not support Bluetooth connection.

Existing console manufacturers are witnessing an advantage to monetize this opportunity of cloud gaming. Several reports already predict that the consoles will dominate cloud gaming. Sony and Microsoft hold huge distribution networks in consoles. Hence, they are leveraging their existing user bases to create an alternate source of revenue by grabbing this opportunity. They are getting a chance to augment their product capabilities with cloud gaming.

The rise of AR and VR gaming:

Many companies are seeing this as a promising way to attract new players or non-gamers to their platform by the use of AR and VR gaming. With the merger of Artificial Intelligence in gaming combined with the virtual headsets is seen as an attractive opportunity for the company. These games go across different age groups and demographics to encourage audiences from new categories.

The selling of the virtual reality headset has also turned out to be a good source of revenue for new players. With the advancement of technology, we are also witnessing that the cost to develop a new game is coming down drastically.

Multiple device compatibility:

Gamers often use multiple devices ranging from TVs, laptops and mobile phones to enjoy the gaming experience. So, multiple device compatibility is an important feature which the companies are providing. The companies are also not limiting themselves to multiple device compatibility but also going beyond to achieve cross device seamless gaming experience. The gamer will be able to shift instantly at any point of time from one device to another without much disturbance.

Stadia in the same way works with devices like TVs, laptops and their flagship Pixel phones as well. The Stadia controller is also equipped with this cross-device compatibility where a Pixel phone can also be connected with the controller by using an extension wire provided along with the Stadia kit. Swapping between the devices provides seamless experiences. The game saves and resumes instantly when connected to a new device.

III. CONCLUSION

- The cloud gaming companies entered the market with a major target segment being the casual and the non-gamer. The professional gamers are the ones who are continuous players and who own consoles, purchase / download games. They own various sets of hardware including gaming mouse, graphic cards, cooling pads, large monitors and GPUs.
- While the casual gamers and non-gamers are the players who are intermittent and do not own consoles. So, cloud gaming bridges this gap wherein the casual gamers or non-gamers no longer need to limit themselves due to the lack of hardware capacity to with them to play the games. Without much hardware setup they can go ahead and start playing
- The gaming content should also be developed keeping this in the perspective to support the new emerging market of players. Companies can also introduce shorter versions of story-oriented games.
- Lack of a clear business model has been a deterrent to small and medium sized companies to enter the cloud gaming industry. This trend was seen firmly after the official launch of OnLive.
- A clear revenue stream should be planned before entering the market. As the costs are very high and out of reach especially for small and medium sized companies it is more important for such companies to have an attractive monetizing model.
- To attain a sustainable growth, the players should keep in mind that technology management plays a crucial role. Resolving of latency issues, cloud resources management, response time minimization are some of the performance related prevalent issues currently seen.
- On the video gaming experience front we see open issues like video encoding, console handling and other issues related to the overall quality of experience.
- One serious threat to sustainable growth in the gaming industry is illegal copying / cloning of games. The small and medium sized companies are known to come up with slight modifications to the original game and release the game into the market.
- With cloud gaming as there is no need of downloading the game manually onto a device, it is close to impossible for developers to clone the games so easily as they used to do previously. This will help in bolstering the

growth of a company in the cloud gaming industry.

- The development effort of the cloud games have also been reduced to a large extent. The reason being that the game is being run on the servers and need not be tested for its performance on all the devices. This reduces the testing effort involved to run it on every possible device which the player might use to play the game.
- We will soon be seeing a rise of established players like Amazon, Tencent, Sony, IBM trying to capture this space. They are at a greater advantage than many other firms in terms of the infrastructure of cloud servers and also an existing user base.
- Collaboration with complementary companies will also be seen as a rising trend. For instance TV companies can collaborate with Stadia to provide the cloud gaming kit of 120\$ along with the purchase.

Scope for Future Research

- Understanding the geographical strengths and limitations which will play a crucial role in the growth of cloud gaming.
- One such factor we can see is the rise in the penetration of internet speed and it's services which led to the rise of cloud gaming initially. Hence, it is important to analyze such factors in greater detail. 5G technology can add wings to the growth of cloud gaming.
- Research on the demographics, psychographic profiles of the players will also help us understand the current target market. It will also help us in reaching the new untapped market and widen the industry as a whole.
- A detailed study on the cost of setting up of the cloud infrastructure to support the cloud gaming can be performed. This can help identify the places of optimization to bring down the costs.
- A long-term comparative analysis of two situations which are outsourcing the infrastructure by opting for Platform as a Service or by owning the complete infrastructure should be done. The cost benefit analysis will bring out very good insights.

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Annexure

Market Concentration



Source: Mordor Intelligence



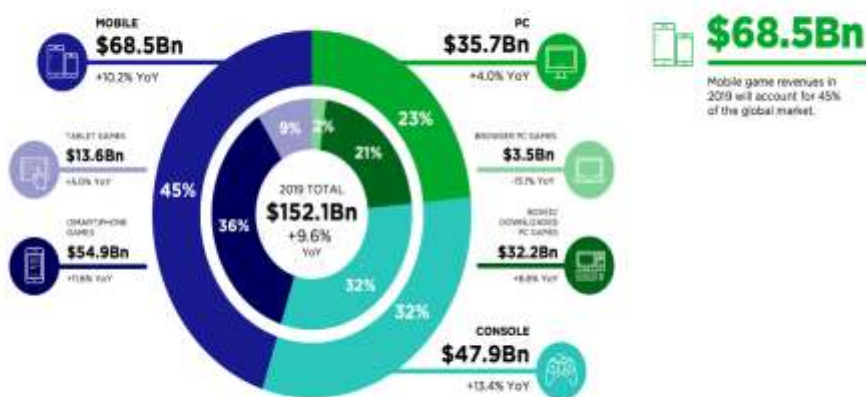
2019 GLOBAL GAMES MARKET
 PER REGION WITH YEAR-ON-YEAR GROWTH RATES



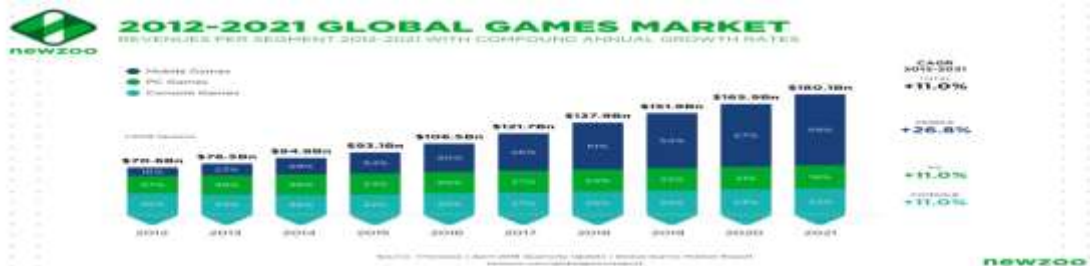
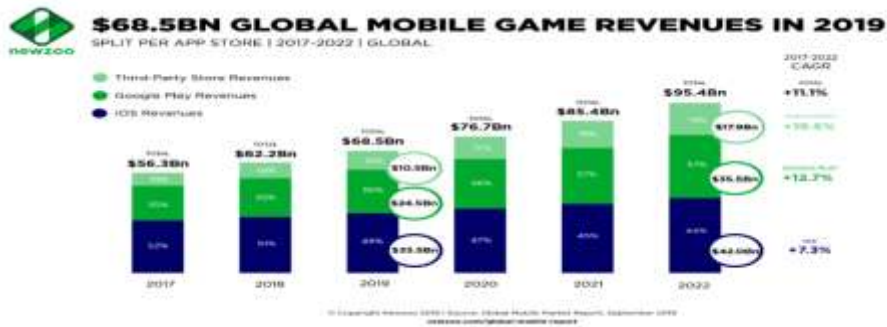
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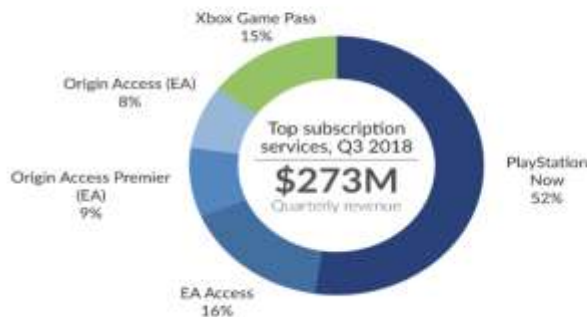
2019 GLOBAL GAMES MARKET
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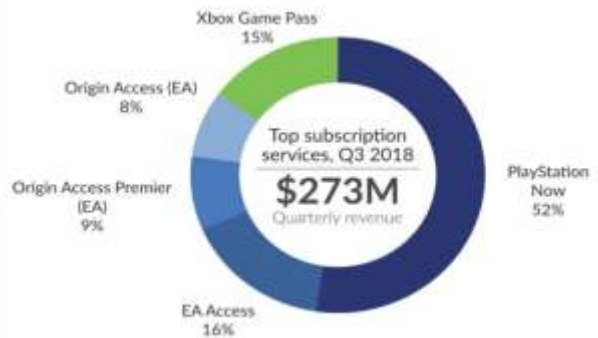
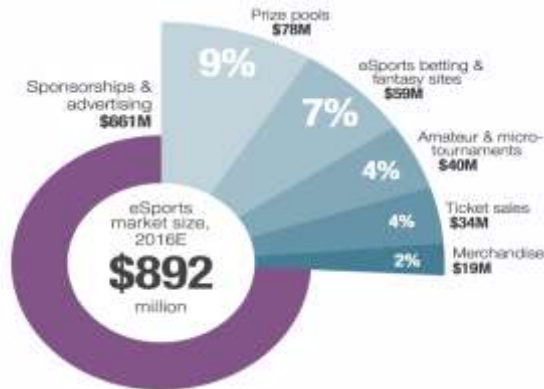
Major publishers are experimenting with Netflix-style business models



Top game publishers are betting on subscription services as a way to generate dependable recurring revenue. Services like PlayStation Now, Xbox Game Pass, and EA Access let players access a library of premium-price games for a monthly fee. The top three subscription services contributed 6% of the overall premium PC and premium console revenue in Q3 2018. This number is expected to grow as more high-profile titles become available on subscription services.

Media consumption in the US is shifting toward subscription services. In the US, 74% of digital video consumers pay for subscription services like Netflix and Hulu while only 37% still purchase content a la carte. Similarly, 62% of digital music consumers pay for subscription services like Spotify compared to 51% who purchase songs or albums directly through storefronts like iTunes.

Unlike video or music, game subscriptions can make additional revenue through in-game content. For example, in Xbox Game Pass titles like Forza Horizon 4 and Rocket League, players can purchase in-game cars.

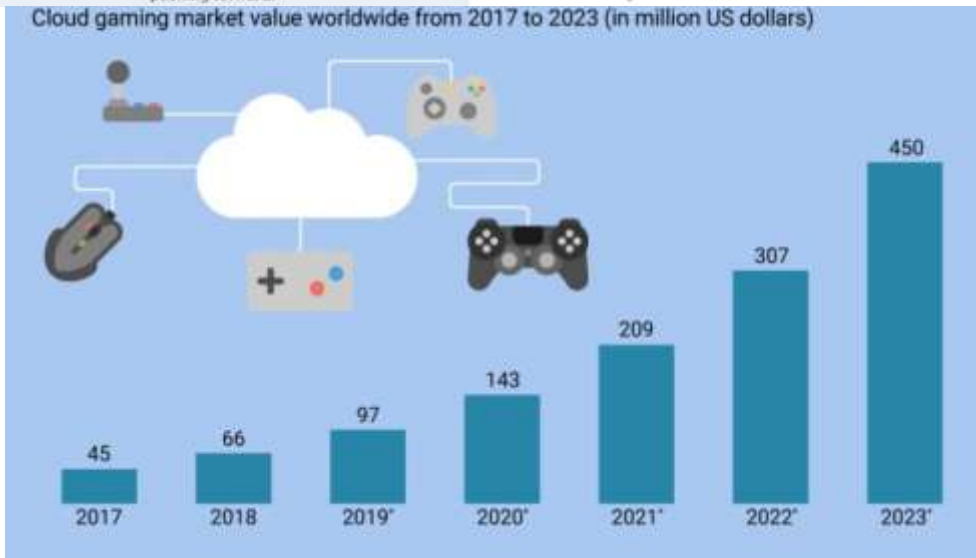


Intensity of Rivalry

Situation	Analysis	Effect on EA
Numerous competitors of equal size	Companies like Blizzard, Ubisoft, and 2k Games are similar size and power.	Threat
Industry growth is booming	Video game industry grew 10% from 2005-2009.	Opportunity
Exit Barriers are High	It is very tough for anyone to exit this industry.	Threat
Rivals are committed and seek market leadership	Blizzard Entertainment is the biggest company here and will keep pushing forward.	Threat



Cloud gaming market value worldwide from 2017 to 2023 (in million US dollars)



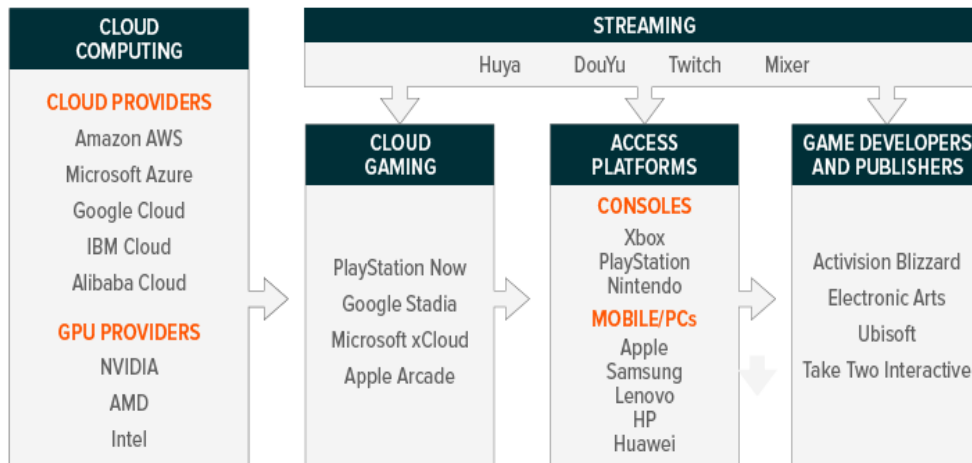
Breakdown of Primary Participants



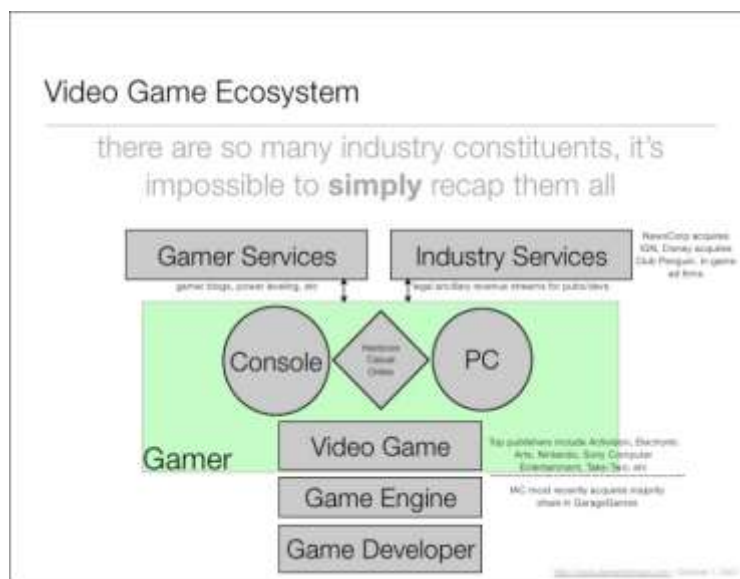
Note: C-Level executives include Chief Executive Officers (CEO), Founder, Chief Marketing Officers (CMO), and Chief Technical Officers. "Others" includes sales managers, marketing managers, and product managers. The 3 tiers of the companies are defined on the basis of their total revenue as of 2018: tier 1 = >USD 1 billion, tier 2 = USD 10 million - USD 1 billion, and tier 3 <USD 10 million.

CLOUD GAMING ECOSYSTEM

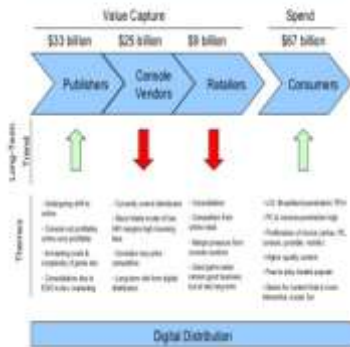
Source: Global X Research.



Note: The companies above are examples and do not constitute the entirety of these segments.



Video Game Value Chain



TELCOs/COSPs VYING FOR A LINK IN CLOUD GAMING VALUE CHAIN
 FOUR REASONS WHY GAMING IS AN ATTRACTIVE CONTENT OFFERING

- 5G upsell**
Higher data consumption inspires customers to upgrade their plan.
- Carrier billing**
Receive a platform-provider cut from in-game purchases.
- Reduce Churn**
Gaming packages can be bundled into premium packages to increase retention.
- New Revenue Streams**
Existing infrastructure investments can be leveraged to maximize revenue with minimal investments.



PlayGiga and Intel have entered into a collaboration to bring a cloud gaming solution to telco/core service providers and reach consumers, powered by PlayGiga's proprietary streaming solution and Intel's cloud architecture.

