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IMPACTS OF THE USER-LED INNOVATION IN VIDEO GAME INDUSTRY

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Impacts of the User-Led Innovation in Video Game Industry
Kullanıcı Odaklı Yeniliklerin Bilgisayar Oyunları Endüstrisine Etkisi

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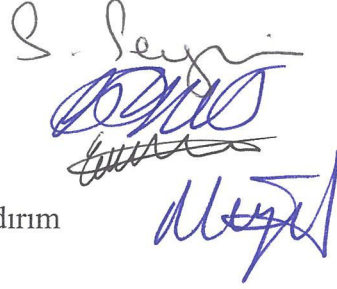
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- 3) Data Mining
- 4) WEKA Clustering Method
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ABSTRACT

This thesis aims to explore the impact of user-led innovation and to present a model of practice to be utilized in identifying the potential users to be included in open innovation processes in the video game industry. The motivation of this research topic is rooted from the fact that there is only limited studies on user involvement in game development and game industry and even no studies about crowdfunding intentions of users within user led innovation context so far. This study mainly explores the view of relation between the developers and video game players unlike others. Furthermore, this study identify the potential users that may involve in user-led innovation in video games.

In this study, firstly the video game industrial facts will be introduced. In the video game production section, the production process of a video game is presented and explained. This section contains how to developers approach pre-production, production and post-production process of the video game development. In the independent video game section, the importance of the Independent video games is described. Independent video games have been explained and it's impact in the industry explored. Aside a brief description of independent video games, data of their consumer demographics are defined. Also, the affects of user-led innovation techniques like crowdfunding described is in the crowdfunding section. In that section, description of crowdfunding and it's benefits are explained. In that regard, affects and future prospects of crowdfunding have been presented. Moreover, in this study user-led innovation mentioned as an innovation by the consumers rather than suppliers or producers.

In the methodology section, data mining technique was used to identify video game players via WEKA program. This study used data mining to examine the profile of the video game players who are in favor of or participated in crowdfunding projects before. These results may give accurate projections regarding the impacts of user-led innovation to the video game industry.

As the advancement of the user-led innovation with the involvement of the Internet, techniques like crowdfunding became much more important to

identifying the market needs. When developers take into account the voices of video game players, they could tune their design more precisely to their needs.

ÖZET

Bu tezin amacı, bilgisayar oyunları endüstrisinde kullanıcı odaklı yeniliklerin etkileri ve potansiyel kullanıcılarını belirlenmesini araştırmaktır. Bu araştırmanın motivasyonu bilgisayar oyun endüstrisinde, kullanıcı odaklı yenilikler hakkında az sayıda çalışmanın olması ve kitle fonlamasında kullanıcıların kullanıcı odaklı yenilikleri ışığında niyetini araştırılması bulunmaktadır. Bu çalışma temelinde, diğer çalışmalardan farklı olarak bilgisayar oyunu geliştiricileriyle oyuncular arasındaki ilişkiyi keşfeder. Ayrıca, bu çalışma bilgisayar oyunlarında, kullanıcı odaklı yeniliklere katılacak potansiyel oyuncuları belirler.

Bu çalışmada önce bilgisayar oyunları gerçekleri sunulur. Bilgisayar oyunları üretimi bölümünde, bilgisayar oyunlarının üretim süreci sunulur ve açıklanır. Bu bölümde bilgisayar oyun geliştiricilerin ön üretim, üretim ve üretim sonrası çalışmaları vardır. Bağımsız bilgisayar oyunları bölümünde, bağımsız oyunların önemi anlatılır. Bağımsız oyunlar açıklanır ve bilgisayar oyunları endüstrisine etkileri anlatılır. Bağımsız bilgisayar oyunlarının açıklamasına ek olarak, müşteri demografi verileri açıklanır. Ayrıca kitle fonlaması gibi kullanıcı odaklı yenilik teknikleri, kitle fonlaması bölümünde anlatılır. Bu bölümde kitle fonlaması tanımı ve yararları açıklanır. Bu bağlamda, kitle fonlamasının etki ve gelecek umutları özetlenir. Dahası, bu çalışmadaki kullanıcı odaklı yenilikten anlatılmak istenen aslında tedarikçi ya da üretici değil doğrudan müşteri tabanlı yeniliktir.

Metodoloji bölümünde WEKA bilgisayar programı aracılığıyla bilgisayar oyuncularını tanımlamak için veri madenciliği yöntemi kullanılır. Bu çalışmada veri madenciliği kitle fonlaması projelerinde daha önce yer almış oyuncuların profilleri incelenir. Bu sonuçlar bilgisayar oyun endüstrisine kullanıcı odaklı yeniliklerin etkisi konusunda doğru sonuçlar verir.

Kullanıcı odaklı yeniliklerdeki ilerleme Internet'in eklenmesiyle kitle fonlaması gibi tekniklerin pazarın ihtiyaçlarını belirlemede daha önemli oldu. Bilgisayar oyunları yapımcıları oyuncuların seslerini dikkate aldıklarında tasarımlarını daha iyi ayarlayabilir ve ihtiyaçlara kesin çözüm üretebilirler.

INTRODUCTION

Video game industry seems to be fragile, as it had faced a crash during 1983 and needs to be strengthened for preventing a similar downturn which recent decline of sales reflects serious concerns. As stated by Rossignol and Derrick (2016), the video game crash in 1983 happened because video game developers and console creators rushed a lot of sub-par video game and console titles during 1980s (Rossignol and Derrick, 2016). Video game industry was very profitable and in order to maximize profits, video game developers and console creators attack the market like a gold rush. To satisfy their needs to develop games or consoles to be in the race, many companies disregard the quality. Lack of quality was the reason as anyone could make a video game at that time and there were no control or checking with the standard. With lack of quality with every other video game, market lost its trust and led to Wall Street losing its collective cool, which led to demise of the video game industry (Rossignol and Derrick, 2016). However, Nintendo Entertainment System saved the industry with quality consoles and titles like Game Boy, Super Mario and Zelda (Rossignol and Derrick, 2016).

There is a debate that this disaster scenario will happen again. As many video game developers working under the harsh environments like overworking and long work hours without pay, they are quitting their jobs to create their own video games. Thus, many video games have been rapidly created and introduced to market in video game industry like the time in the 80s (TheNerdCritic (2016), Dickerson, Jamie (2016) , Gibson, Alex (2017). Moreover, as I observed during this researcher's research in the forums, social network and YouTube, many video game players are complaining about lack of quality in the recent years. Further, video game players disliked anti-consumer strategies like micro-transactions and pre-order deals that big companies made.

Crowdfunding has grown in the recent years especially with advancement of Kickstarter and similar web sites. With this improvement in the crowdfunding, the smaller video game development companies had been able to access funds to create their games (Gaskel, 2016). As most of the created independent video

games are for the niche markets in the industry, crowdfunding serves and helps growth in the video game industry.

Independent video games are targeting niche market due to significant demand for them from the players (Vidyarthi, 2011). As developing a video game is an extremely risky business, many big video game developers do not aim for the niche games. However, as the video game players are getting older as they have played games since 1990s, the vintage games of that era still carry their charm. Therefore, many independent developers either creates a successor of these vintage games or create a heavily inspired one. When independent video game developers create these games, they just do not use old designs as video game industry is an ever changing industry. Independent video game developers instead combine modern design elements with vintage video game design.

For instance in the 80s and 90s because of the limitation of video game design technology, many developers developed very difficult games for creating long lasting experience for the games as many vintage games were very short (Arcaila, 2013). However, developers lower the difficulty of their games to attract more players in the recent years because of the technological advancement. Although that approach had been successful, many old video game players of vintage games era caused disappointment due to low difficulty level of these video games. For that reason, some independent video game developers deliberately combine difficulty of vintage video games with modern design elements to attract that type of video game players.

Moreover, the number of video games released in the market has grown a lot compared to the past. Also, crowdfunding helps to spreading the video game market in the other regions as other video game companies outside of United State of America may find funds. As creating a video game is expensive and there are very few publisher outside of the USA and Japan.

Most of the Independent video game development teams consists of small teams (New York Film Academy, 2014). Therefore their teams have to do more than their assigned job like marketing and customer relation. Mainly, project director or game producer is the one to interacts with the video game players

hence this interaction is limited with announcement of features or answering simple questions. So, independent video game developers sometimes involve their players in their development process as testers or promoters. This process mainly is performed as public “beta testers” or promoters as “streamers” in YouTube or Twitch. Also, in this study more data about customers and limits between developers and video game players has been shared.

Video game players involved with development of the video games as various degrees like testers, promoters and modders. Furthermore this relationship between the video game players and developers are nothing new as video game industry is a demand pull industry. As the advancement of technology, video game players may involve post-production process as modders. This became much more important in recent years. So much so that some of the big budgeted games are dependent to the modders to extend the life expectancy of their games. For instance, Fallout 4, Skyrim, Dragon Age Origins, Vampire Masquerade Bloodlines and Newerwinter Nights have a large on-line communities of modders which is still active even though some of these games are more than decade old (Aoyama and Izushi, 2008). However, video game players involvement of video games mainly consist of post-production process. Many of the video games is not available to players to involve in the pre-production or production phrases in this times (Aoyama and Izushi, 2008).

The Objectives Of This Study

This thesis aims to explore the impact of user-led innovation and, to identify the potential users in the video game industry. The motivation of this research topic is rooted from the fact that there is only limited studies on user involvement in game development and game industry and even no study about crowdfunding intentions of users within user led innovation context is available so far. Most of the academic studies regarding to video games based upon the ways in which players engage with video games (Smith, 2014). This study mainly explores the relation between the developers and video game players unlike others.

Furthermore, this study identify the potential users that may involve in user-led innovation in video games and also their perceptions on crowdfunding for co-creation.

Contents Of This Study

In this study, firstly the video game industrial facts will be introduced. In this section there will be definitions of the video game industry, the scale of the video game industry regarding the whole of the entertainment industry, and business performance in terms of sales revenues of the whole industry in the recent years will be presented. Furthermore, there will be explanations about the history of the video game industry. With this data, the growth of the industry will be analyzed based on their revenues in their regions through the history.

Also, the general demographic information about the customers are shared in this work from the reliable resources like ESA (Entertainment Software Association) Essential Facts. Moreover, the impacts and interrelations of demographics of video game players (nationality, gender) and tendencies regarding playing games is given in this study.

In the video game production section, the production process of a video game is presented and explained. This section contains how developers approach pre-production, production and post-production process of the video game development. The development process of the video game industry is important to understand because it is unique in the entertainment industry as it combines the production process of both the movie industry and software industry. Also, development process of the design of the video game involves the phase of “learning the tendencies of the player.” This phase is about designing the video game regarding the video game players thought process in the game.

In the independent video game section, the importance of the Independent video games is described in this study. Independent video games are not new in the video games industry however, their importance has grown in the recent years. With the advancement of the technology for findings funds and available

platforms for distribution, independent video games became stronger more than ever. Their growing importance is attracting big console companies like Sony and Microsoft to sponsor small independent video games.

Regarding the funding of the video games, crowdfunding also became important in the video game industry. Therefore, crowdfunding is described in this study.

In the Independent section, independent video games have been explained and their impact in the industry is explored. Aside a brief description of independent video games, their consumer demographics are defined. As mentioned above, growth of independent video games and it's cause has been explained. Further, advantages and disadvantages of the independent video games have been discussed.

Also, the affects of user-led innovation techniques like crowdfunding described is in the crowdfunding section. In that section, description of crowdfunding and it's benefits are explained. In that regard, affects and future prospects of crowdfunding have been presented.

Moreover, in this study user-led innovation is mentioned as an innovation by the consumers rather than suppliers or producers. As the advancement of globalization, technology and Internet, innovation, development and consumption can be made by the customers. Therefore, customers may get a chance to customize their product according to their needs. This also, made companies to meet the demands of their customers much better than before.

Methodology

As mentioned above, in user-led innovation video game players are involved in production process via crowdfunding. Therefore, intention of this study is to identify cluster of video game player that participated in production.

As interviewing with developers may give more accurate results, this researcher attempted to send private messages to three video developers' accounts in their official forums for permission to an interview. However, two of the three

developers did not even replied and the only one denied that they are not allowed to give an answer. The result of attempting to use interview technique was not a major surprise as video game industry does not tend to share any kind of information with the public. Even the sales figures of video games are hard to find contrary to the movie industry.

Therefore, this researcher used data mining technique to examine the profile of the video game players who are in favor of or participated in crowdfunding projects before. These results may give accurate projections regarding of the impacts of user-led innovation to the video game industry. Since crowdfunding is a subset of user-led innovation, this study is based on data mining of this keyword to achieve precise results.

The best available resources for this data is residing in Steam Community. As a digital video game distribution platform for PC In 2005, This researcher examined and read all the threads and posts regarding crowdfunding in the Steam Community. This researcher gathered data of 51 video game players and categorized the attributes of nickname, hours played, number of games, membership years, activity level, preferred games, achievements, country and opinion. However, gathering data was not a smooth process as some of the video game players' accounts were hidden to the public view.

All the attributes were selected to define clusters in the data set of WEKA which is used to work with clusters. WEKA is a collection of machine learning algorithms for data mining task. The algorithm can either be applied directly to a data-set or called from your own Java code. WEKA contains tools for data pre-processing, classification, regression, clustering, association rules and visualization. It is also well suited for developing new machine learning scheme (<http://www.cs.waikato.ac.nz/ml/weka/>). The reason this researcher has used this application program of WEKA is that is well known clustering algorithm and It's easy use especially, compared to the other programs such as SPSS application program.

As mentioned above, the selected attributes are collected to create a database of the video game players. Crowdfunding" was used as keyword to search which

video game players discussed crowdfunding in the Steam Community. From the results, first 51 video game players who have been involved in a crowdfunding discussion were selected. This researcher used, clustering method of SimpleKMeans. Later in 2016 the number of data has been increased up to 151 video game players, in order to see if there is any change in the attribute values of our model. As same with above, all of those threads and discussions read in the Steam Community forum. Like the first model, the same clustering process has been conducted. The nearest neighbor technique is used for the precision and accuracy of the selected clusters. Also with the nearest neighbor technique, comparison between two data has been explored.

1. VIDEO GAME INDUSTRY

1.1 Definitions

The video game industry is the sector in the economy involved with the development, marketing and sales of video computer games to customers (Zackariasson, and Wilson, 2012).

“Jennifer Johns(2006), defines video games as interactive media. She argues products like games span a range of products not confined to the video or computer screen. Mark Wolf and Bernard Perron(2003) argue, that terms such as electronic software, electronic games, entertainment software and other referenced phrases used to describe video games are too broad and could include any game that has electronic components. They refer to Milton Bradley’s physical board games that often have electronic components, whose only electronic part is blinking light. They also argue that the 1979 board game “Stop Thief” and other board games use handheld computers to make sounds related to actions on board are fact computer games but not video games.” (Hinlan, 2011)

1.2 Disciplines

The video game industry have traditional disciplines from other industries like marketing and project leads. The participants from specific disciplines to the video games are include game programmer, game designer, level designer, game producer, game artist and game tester. Most of these professionals are employed in a video game developer company or video game publisher. However, some of these professionals create their own company also known as an independent video game developer or work as a hobbyist under the name of modder.

1.3 Value Chain

Briefly, Ben Sawyer of Digitalmill observes that the game industry value chain is made up of six connected and distinctive layers as;

- Capital and Publishing layer, which involved in paying for development of new titles and seeking returns through licensing titles (Flew and Humbhreys, 2005).
- Product and Talent layer, which includes developers, designers and artists, who may be working under individual contracts or as part of in-house development teams (Flew and Humbhreys, 2005).
- Production and Tools layer, which generates content production tools, game development middleware, customizable game engines, and production management tools (Flew and Humbhreys, 2005).
- Distribution or Publishing layer, which is involved in generating and marketing catalogs of games for retail and online distribution (Flew and Humbhreys, 2005).
- Hardware/Virtual Machine/Software Platform layer, which includes network infrastructure and non-hardware platforms such as virtual machines like Java or Flash or software platforms such as browser or Facebook (Flew and Humbhreys, 2005).
- End-users layer, which consists of players of the video game (Flew and Humbhreys, 2005).

1.4 Types Of Games

There are 3 types of platforms that video game player play their games. These are PC Gaming, Console Gaming and Mobile Gaming. Although, tablets are used for gaming, they are under the Mobile Gaming. Also, most of the handheld games like Nintendo's Game Boy are under the Console Gaming as handheld electronic devices are considered as a console platform.

1.4.1 PC Gaming

Personal computer video games are played on a computer mainly through mouse and keyboard. These games are characterized by a lack of controlling authority (like Sony and Microsoft) and a greater capacity for input, processing and output (Martin, 2015) (<https://www.cleverism.com/gaming-industry-introduction/>). PC Gaming is the most preferable platform that video game players to play. Only in Steam, which is the most used online distribution platform in PC gaming, there are over 125 million active users (Saed, 2015). There are many reasons for that. One of them is the price of the overall games. Although high budgeted video games' prices are the same for all the platforms, Independent video games' prices are lower in PC platform (Chacos, 2016). Furthermore, number of video game releases in PC games are more than other platforms. For this reason, more type of games are available to the PC gamers (Chacos, 2016). The other important reason for video game players to prefer PC platform is the strength of the hardware. Personal Computer's hardware technology are better than the consoles' hardware technology. Furthermore, video game developers utilize this difference and create much better graphics for the PC platform. Therefore, PC gamers experience much better graphics than the console and mobile video game players.

1.4.2 Console Gaming

A video game console is an electronic device that outputs a video signal or visual image to display a video game that video game players can play. Console devices include devices that can be played at home, handheld like Nintendo's Game Boy, microconsoles and dedicated consoles. In between 80s and 90s, there were a lot of consoles like Atari, Sega and GameCube. However, with 2000s development of consoles were decreased. Especially Sony's Playstation 2, which is the best selling consoles ever with 157 million (http://www.vgchartz.com/analysis/platform_totals/), the competition of the

console devices diminished in the video game industry. Nowadays, when console gaming is mentioned, it means gaming with Sony's Playstation or Microsoft's Xbox console devices. Not only, are they competing with PC platform, they are also in fierce competition with themselves. This is mentioned as "Console Battle" in the video game industry. So far, Playstation 4 has sold 56 million units and Xbox One have sold 29 million (http://www.vgchartz.com/analysis/platform_totals/).

1.4.3 Mobile Gaming

Mobile Gaming is a video game that is played using a mobile device such as smartphone or tablet. The first mobile games were "Tetris" on the "Hagenuk MT-2000" in 1994, following was "Snake" on the "Nokia" in 1997 (Martin, 2015) (<https://www.cleverism.com/gaming-industry-introduction/>). In the modern days, smartphones downloaded mobile game apps using an app store which, is embedded in the device. Compared to the consoles and PC gaming, a mobile game is developed in weeks or months with little budgets. Thus, there were many video games in the market. The number of mobile games developed a fierce competition that can not be seen even in PC platform. It is estimated that there were around 800.000 mobile games active in the market, which is more than PC and console games combined. With the number of games and their cheap prices, mobile games are on the rise in the video game industry. It is predicted that the gross revenue generated by app stores will grow to \$102 billion by year 2020 (Terekhova, 2016).

1.5 Growth Of The Video Games

The worldwide video game industry in 2007 was valued at \$44.9 billion. This number was expected to grow 9.1% annually to \$48.9 in 2011 and \$68 billion in 2012, making it the fastest-growing component of the international media sector

(Caron, 2008). In 2004, the worldwide industry generated more than \$25.4 billion (Barker, 2009) (<https://e2f.com/8544/>).

A decade before, the US retail video game market was worth \$7 billion (1994) (Markoff, 1994) and \$4.7 billion (1990) before that (Shapiro, 1991). This period coincided with the arcade renaissance, when US arcades generated \$7 billion in 1994 (California University (1994) Business Week 3392-3405.), thus the total US market was worth \$14 billion in 1994. The total worldwide retail video game market was worth \$20.8 billion in 1994 (Indiana University (1996) Statistical Yearbook: Cinema, Television, Video and New Media in Europe), equivalent to over \$32 billion with 2012 inflation (<http://book-med.info/addiction/37162>).

The worldwide PC-based game market is worth as much as \$10.7 billion as of 2008. This number includes retail sales, online revenue, digital distribution and relevant ad sales (Alexander, 2008). In 2011, the PC game market increased to \$18.6 billion, largely due to the rise of the \$6 billion Chinese PC gaming market (Usher, 2012). By 2015, analysts predict the global video game industry will reach \$91 billion (Nunneley, 2009) (<http://book-med.info/addiction/37162>).

The industry is at around \$93 billion for 2013 globally. Here is how it compares with other entertainment industries (Stamford, 2013) .

- Music industry - \$7 billion in US (Lewis, 2014) and \$15 billion globally in 2013 (Dredge, 2014).
- Movie industry - \$35.9 billion globally in 2013 (Mullich, 2015).
- Book industry - \$15.05 billion in US (Milliot, 2014) and roughly \$151 billion globally (Wischenbart, 2013).

Video Game Industry surpassed the movie and music industry in 2013 globally.

Table 1 Regional Video Game Industry Revenues

Region/County	2013	2012	2011	2010
Asia-Pacific	\$49.623 billion	\$44.063 billion	\$42.358 billion	\$38.77 billion
Japan	\$22.29 billion	\$22.29 billion	\$23.04 billion	\$21.13 billion
China	\$14 billion	\$9.8 billion	\$7.3 billion	\$6.9 billion
South Korea	\$9.64 billion	\$9.23 billion	\$9.082 billion	\$7.784 billion
Europe	\$20 billion	\$21.3 billion	\$21.3 billion	\$21.6 billion
United Kingdom	\$3.67 billion	\$2.6 billion	\$5.4 billion	\$3.812 billion
France	\$6.9 billion	\$4 billion	\$3.352 billion	\$3.416 billion
Germany	\$3.7 billion	\$3.36 billion	\$2.757 billion	\$2.659 billion
North America	\$22.8 billion	\$20.7 billion	\$20.7 billion	\$20.49 billion
United States	\$17.39 billion	\$17.1 billion	\$16.6 billion	\$18.58 billion
Canada	\$2.3 billion	\$2.773 billion	\$2.171 billion	\$1.682 billion
Latin America	\$3.9 billion	\$5.4 billion	\$5.4 billion	\$4.74 billion
Brazil	\$1.4 billion	\$2 billion	\$2 billion	\$391 million
Middle-East	\$2.6 billion	\$2.6 billion	\$1.983 billion	\$1.2 billion
Arab World		\$1.31 billion	\$1.31 billion	
Turkey		\$593 million	\$593 million	\$50 million

(<http://www.entertainmentbusiness.nl/sites/default/files/documents/2012/Video%20games.pdf>)

In last four years, video game revenue across the world increased except in Latin America and Europe which, have been decreased a little bit in 2013. This increasing trend was very big in the regions like Middle-East which, has been established video game industry a few years ago. Furthermore, the increasing

trend of revenues in Middle-East shows how profitable the video game industry may become in their respective countries. Even though the video game industry centralized itself in United States, California, Japan's revenue was more than whole North America region.

Table 2 History of worldwide video game industry revenues

Year	Video Game Industry Revenue (Nominal U.S dollars, without inflation)	Inflation adjusted revenue (2012 U.S dollars)
2013	\$76 billion	\$76 billion
2012	\$63 billion	\$63 billion
2011	\$65 billion	\$66.2 billion
2003	\$33.2 billion (worldwide)	\$41.43 billion (worldwide)
2002	\$37.84 billion (worldwide)	\$48.29 billion (worldwide)
2001	\$35 billion (worldwide)	\$45.4 billion (worldwide)
1993	\$29.3 billion (worldwide)	\$47 billion (worldwide)
1992	\$27.915 billion (worldwide)	\$46 billion (worldwide)
1991	\$12.73 billion (U.S & Japan)	\$21.46 billion (U.S & Japan)
1985	\$7.21 billion (U.S & Japan)	\$15.38 billion (U.S & Japan)
1984	\$6.82 billion (U.S & Japan)	\$15.07 billion (U.S & Japan)
1983	\$11.65 billion (U.S & Japan)	\$26.86 billion (U.S & Japan)
1975	\$22 million (U.S & Japan)	\$94 million (U.S)
1973	\$40 million (U.S)	\$207 million (U.S)

(<https://web.archive.org/web/20121005170537/>)

(<http://www.blackwellpublishing.com/grant/docs/11Videogames.pdf>)

(http://www.capcom.co.jp/ir/english/data/pdf/annual/2013/annual_2013_06.pdf)

(Sambe, 2009)

As it's shown in Table 2, the video game industry has been increasing with some problems through the history. In 1980s the video game industry grows to a millions to billions dollar worth entertainment industry. However 1980s with the crash of the video game industry in 1983, video game industry was very close to collapse before it matured. Luckily with the strong impact of Japanese consoles and games, the industry has been saved and it quickly grows again. In 90s video

game industry's growth became more than what it was before the crash. Moreover with the advancement of computer hardware technology, the video games became more affecting and influential to players' daily lives. In the Appendix as Figure 11, this table represented as a line graphic chart.

1.6 Video Game Consumer

According to the (Lofgren, 2015) %59 of the gamers are Americans. That means that over 150 million people with a vast variety of backgrounds, gender, ethnicity and socioeconomic status play games in USA. According to the Entertainment Software Association Essential Facts in 2015, There are an average of two gamers in each game playing U.S. household. Also, four out of five U.S. households owns a device used to play video games. %51 of U.S. households own a dedicated game console and %42 of the Americans play video games 3 hours or more per week (<http://www.theesa.com/wp-content/uploads/2015/04/ESA-Essential-Facts-2015.pdf>).

Moreover, ESA Essential Facts estimate that average age of gamer is 31. It is theorized that even the younger generation embrace the gaming, more of the older generation still play games. That can be seen as the growing number of Mature rated games are being produced as more gamers are over 50 than are under 18 in 2014. Only %29 of the gamers are under 18 which, means that video games are no anymore seen as toys or for children only. However, there are also reports from instructors that video games increase motivation and engagement of their students. That is why %74 of the K-8 teachers use digital games in classroom. Moreover, %56 of parents say video games positively affect their children (<http://www.theesa.com/wp-content/uploads/2015/04/ESA-Essential-Facts-2015.pdf>).

Video games purchaser are split by %50 of both genders (Romano, 2014) . However, female gamer percentage rises to %48 in 2014. Women age of 18 or older represent a significant greater portion of the game population with %33 than

boys age 18 or younger with %15 (Lofgren, 2015). Also, a recent study by Internet Advertising Bureau in UK shows that %52 of the gamers are women in UK with favorite game genre to be Trivia\Word\Puzzle (Jayanth, 2014). This study also shows that the influence of the recent rise of the smartphones as most of the respondents describe their phones as a gaming platform.

However, only %22 of the game work force is made up of females and %76 of them are men (<http://gram.gs/The22PercentProject.html>). Even though the number seems very low, it is double what we saw in 2009.

Also, 71 million people watch over competitive gaming worldwide (Mirani, 2014). That means that, more people is watching these games than the people who watch sporting events in USA. That number has increased 8 fold in the past four years. Moreover, YouTube gaming channels bring in more than 3.5 billion views each month (Dredge, 2014). As Swedish gamer and comedian PewDiePie's channel is the most subscribed channel of YouTube with 43,567,460 subscribers according to statsheep.com. (<http://www.statsheep.com/pewdiepie>)

According to ESA Essential Facts (2015);

- In 2015 the average of the most frequent purchaser age is 37 and %29 of the most frequent game players currently pay to play video games online. Also, %54 of the most frequent gamers play multiplayer mode weekly. Thus, recent rise of Massively Multiplayer Online Video games like World of Warcraft or Multiplayer games like Battlefield series are on the rise. Just in 2016, most of the most anticipated video games are the ones that prioritize or only multiplayer video games (<http://www.theesa.com/wp-content/uploads/2015/04/ESA-Essential-Facts-2015.pdf>).
- %56 of the most frequent gamers play with others including friends(%42), family members(%21), parents(%16) and spouses(%15). Moreover, %54 of most frequent gamers feels that video games help them connect with their friends and %45 of the gamers feels video games help them spend time with family

(<http://www.theesa.com/wp-content/uploads/2015/04/ESA-Essential-Facts-2015.pdf>).

- Furthermore, 47% of the most frequent gamers feel that computer and video games provide more value for their money compared to DVD(28%), going to movies(14%) and music(12%)
(<http://www.theesa.com/wp-content/uploads/2015/04/ESA-Essential-Facts-2015.pdf>).

31% of the most frequent gamers play Social Games(like FarmVille and Mafia Wars) and 30% both Action and Puzzle/Board Game/Game Card/Game Shows genre. Also, PC is the most chosen platform to play video games for frequent gamers with 62% and consoles come second with 56% and smartphones come third with 35%

(<http://www.theesa.com/wp-content/uploads/2015/04/ESA-Essential-Facts-2015.pdf>).

39% of the gamers who play video games are spending less time for watching TV than they did three years ago. The same study is true with 40% for going to movies and 47% watching movies at home. However, gamers who use their consoles for gaming also use them as other entertainment media. As 54% of the gamers use their consoles for watching movies and, 33% of the gamers use it to watch TV Shows and, 27% of the gamers use it to listen to music

(<http://www.theesa.com/wp-content/uploads/2015/04/ESA-Essential-Facts-2015.pdf>).

According to the ESA Essential Facts, Best Selling Video Games Genres by units sold in 2014 is Action (28.2%), Shooter (21.7%) and Sport Games (13.3%). However, Best Selling Computer Games (PC) by units sold in 2014 is Strategy (37.7%), Casual (24.8%), Role Playing (20.2%). Furthermore, Interesting story factor is the most important factor when gamers decide which games to buy with 22%. Which comes before price (15%), word of mouth(11%) and whether the game is continuation of a favorite game series(10%)

(<http://www.theesa.com/wp-content/uploads/2015/04/ESA-Essential-Facts-2015.pdf>).

In 2014, total consumer spending is \$15.4 billion on content, \$5.08 billion on hardware and \$1.93 billion on accessories in Video Game Industry which, in total \$22.41 billion spend by total consumer in the industry of the Video Games. Also, with the introduction of the cloud technology in video game industry, %71 of the physical format sales in 2010 decreased to %48 in 2014. However, %29 of the digital format sales in 2010 increased to %52 in 2014 (<http://www.theesa.com/wp-content/uploads/2015/04/ESA-Essential-Facts-2015.pdf>).

1.7 Video Game Production

Like in many other entertainment industries like movies, video games production follows the same process. Video games are not just an entertainment moreover, they are also a software program. Therefore, their production process contains a mix of software and entertainment industries which, is one of the rare or the only one to have this characteristic in the entertainment industry.

According to the The Video Game Revolution website, a video game production starts with a story idea in the pre-production process. Story ideas are not scenario like we encountered in the production process of movies. Story contains basically a summary of the scenario, features of the game and it's genre. Often story ideas of the video games comes up from game designers. However, other departments or outsider can come up with a story idea. Sometimes, story ideas even come up from the top administration of the video game developer company. Story ideas may contain original ideas unique to the developer company or an adaptation of movies, books or comics. Increasingly many of the story ideas come up from other video games who were successful both in terms of finance and customer satisfaction. Often, story ideas come from real life events or simulations which contain high level of realism (<http://www.pbs.org/kcts/videogamerevolution/>).

Before production phase can begin, developers will create a game design document to guide them to what kind of a game they are planning to do. Game

design document contains all the concept and the gameplay of the game in detail. Design document may also have earlier sketches or prototypes of the game. Design documents created as a living document which, changes in weekly or daily bases (Freeman (1997), Bates (2004), Oxland, 2004).

In preproduction phase of the video game, developers may use storyboard which consists of rough sketches and technical instruction sequentially organized to describe each scene of the game. Storyboards act as the visual reference for the designers, artists and writers. Also, developers may use prototypes which include gameplay ideas and features that designers and programmers can experiment with different algorithms and usability scenarios of the game. Generally, prototypes are used as the proof of concept for testing it with adding, removing or altering with the video game's features (Chand (2013), Bates (2004), Chandler (2009), Adams and Rollings (2003), Oxland (2004), Moore and Novak, 2010).

Production phase of the video game is the main stage of the video game. In this phase, development team is fully staffed and every department of the development team is starting to work. Game Designers will work on to improve the design of the game through the development process. Level designers will create and modify levels of the game. Meanwhile, programmers will be writing down codes and assets of the game like 3D models and sprites. Writers will create characters of the game and write down the dialogues of the entire game. In the same time, sound engineers will develop sound effects of the game and composers will develop music for the game (Chandler (2009), Bethke, 2003).

When the production phase is still going on and game is at the playable state, testers and quality assurance team will try to find the bugs and determine whether the game is ready to be shipped. In the beginning phase of the game, testers have nothing to do since the game is not even at a playable state. However, as the game is at the playable state, testers try to find bugs, test new and existing features. Testing is very important because a single change may have catastrophic consequences in the modern and complex games. Near the release date, testers put much more weight on the regression testing which, includes testing everything from the beginning to the end. When everything is ready then quality assurance

give a green code for the game, it will release on the release date to specific platforms.

During the production phase, there are several milestones that have to be achieved. These milestones can be put on by the publishers or the developers themselves. There are no industry standards for these milestones. First playable phase is the first milestone that has to be achieved. This phase contains the representatives of all the features and gameplay of the game which can be playable and ready to be tested for the testers. Alpha stage is the second stage where the key features are fully implemented and assets are partially finished. At this stage developers consider feedback and features may be revised or modifications are added. At this time, developers may add other small features depending on feedbacks. Community of the game have the most available chance to effect the features and gameplay of the game at this time since game is not ready and modification and addition may be implemented if the developers will listen to them (Chandler (2009), Bethke, 2003).

After the Alpha state, the game will reach to Code Freeze stage which, meant that there will be no code added anymore and only bug fixing take place. At the Beta state, all the features and assets of the game are complete and only bug fixes have remained. Compared to the Code Freeze stage, in this milestone there is no major bugs that prevent the game for shipping. However, at this stage many able persons from the community staffed as beta tester for giving the final feedback to release the game. Many of the features won't be changed but several small features may be implemented like a small interface change. Unlike Alpha stage, community does not have a chance the effect the features and gameplay of the game (Chandler (2009), Bethke, 2003).

As the Beta stage is finished, Code Release stage begin which, means that game is ready to be released for console manufacturer to review. Gold Master stage is the final milestone which means the final version of the game is ready to be released (Chandler (2009), Bethke, 2003).

After the game is released, a small part of crew begin to work on the maintenance. These patches aim to fix the existing bugs and may be add or

remove small parts of the game for balancing or depending on the feedback of the players. Maintenance period has never existed in the past but the decreasing number of platforms and advancement of the internet made it possible to patch the game after the release (Moore and Novak, 2010).

Much of the marketing of a game is handled by the publisher of the game. As game cost can be as high as 30 million dollars, marketing becomes the very important aspect of the game production since it will affect the sales. After the publisher's marketing team have chosen a target market for their game, they advises to their development team to get into contact with their market via forums, trade shows and conventions which are all around the globe. The game is then advertised and it's concept is used as promotional material in magazines, TV or online. The success mostly relies on the relationship between marketers, developers and community (Bates, 2004).

1.8 Independent Video Games

Independent Video Games are video games which, were created by individuals or small teams without a financial support from video game publishers. Without a financial support from video game publishers, independent video games rely on innovation design and digital distribution. Independent Video Games are often referred as indie games in the video game industry (McLean, 2017).

As an independent companies, indie game developers do not have controlling interest and do not need publisher approval (Szepesi, 2014). Thus, they do not have any limitation for the innovative and creative designs for their games. Because indie games do not possess allocated budget, indie games have a limited graphic technology. However, indie game developers tend to use both classic design concept and innovation to compensate their limits. Therefore, many indie games have poor quality and may have not made for profitability (Thomsen, 2011).

As the video game distribution is shifting towards the digital distribution such as Steam and Origin, indie developers tend to choose on-line marketing (DellaFave, 2011). Moreover, on-line marketing is much more profitable and more readily available than retail marketing. Shifting of the distribution method of the video game industry create a huge opportunity for the indie game developers. Developers who once need video game publisher to put their games on shelf, can self publish their video games via digital distribution. Thus, this opened a new wave of independence and creativity to the independent video game industry (Irwin, 2008).

Furthermore, according to the Chris Swain, an assistant professor at the University of California's School of Cinematic Arts, digital distribution is important because problems like used games and shelf space is non existing in digital distribution. Also, publishers earn %17 of the retail price from the retailers like Best Buy. However, with the digital distribution, publisher can retain %85 of the retail price and they can get creative and do smaller, more risky games because they don't have to send it to every retail store (Irwin, 2008).

According to Juan Grill, head of the production of the Joju Games, independent video game consumers can be categorized to four categories (Grill, 2008). One of them is the Cult Gamer, who is very well informed about games and trends. This type of gamer is always looking for games that are different and not part of what the masses play. The Casual Video Gamer is the gamer, who play games on the web and maybe downloads some at their PC or console. Their first exposure to the games are when they were young (probably in the late 90s). The Ex-Hardcore Gamer is the gamer at 25 or older, who played a lot of games. Because of their family or job, they can only have 15 to 30 minutes per sitting to play games. They are aware of the new trends at gaming however, they rarely play most of the new retail games, unless it is a party game. Game Industry Professional or Academic Gamer is the smallest portion of the consumers and needs to very impressed by the gameplay of a game to play it. They are hardcore version of the cult gamer (Grill, 2008).

Indie Games have a story since 1980s but recent developments on digital distribution and new funding opportunities boomed the industry in the recent years. Thus, indie games have become more important than ever for the video game industry for both PC and consoles. Nowadays, video game industry has indie games with unique experiences which, are totally different than blockbuster triple A games have. This effects the industry as nothing before. One of these effects is the number of the video games released in a year. However in the past, the first year or two of a new generation of consoles generally have very low video game releases. This resulted to have a small library during the early phases of the new generation consoles. This have caused problems as it stops people to buy consoles early on and it leads to the complaints of the lack of video games for the new generation consoles (Vanderhoef, 2011).

Because of their independence of their publisher as mentioned before, independent video games can focus on forgotten genre of the industry that publishers ignored for so long. Many of these developers actually are the same ones who have worked on the same genre or the game in the 90s. For example, the forgotten jewel of the CRPG genre is going to be on the rise with the “Torment: Tides of Numenera” which is developed by the same developers of the Planescape Torment that was released in 1999.

Furthermore, indie games are cheaper then most of the retail games. Most mainstream and blockbuster triple A games have a price around \$60. However, as indie games used old technology like pixel art or 2D and they have much smaller developers teams, they can sell their games under \$20. Thus, they reach a more wider audience who are wanting to play nice and refreshing without being cautious of money spending.

In the 80s and 90s, game developers couldn't make the detailed and longest games possible. Therefore, they used very difficult games to prolong the games for the consumer to counter their technical handicaps. However, today games includes auto recoveries, multiple shields, instant recoveries and many lower difficulty design that make it hard to die in the game anymore. Many indie games

use the old difficulty designs with a modernized style that made their games more nostalgic for their consumers.

According to the Kevin Cortez's *The Importance of Indie Games*, video games are an art form but it is hard to see that with the mainstream or blockbuster triple A games. But indie games with their smaller teams, you can see the personal touch more clearly. Indie games are an interactive canvas used as an outlet for their developers to convey complex messages or simple ideas to the larger audience that photography, illustration and music can't achieve (Cortez, 2014).

Adam Boyles, Sony VP of developer and publisher relations, has described that indie games are the heartbeat of the video game industry. As promoting creativity and new ideas are the most important thing for the industry. Video game industry need high creativity therefore, creative games that inspired the whole industry is very important for the video game industry (Te, 2014).

During the PS3 and Xbox 360 era, consoles are all about exclusives game titles such as God of War and Halo. However in the recent years aside from the exclusive titles, independent games became important for the consoles (Rose, 2013). PC and Mobile development is dominated by the self publishing small studios and those few that succeed made important money. Thus, consoles approach the Steam like model which, have an ever larger selection of cheaper, digitally self published games alongside the exclusive titles. Furthermore, consoles provide their own kit for the indie developers to fully create advantage in their hardware like Kinect (Stuart, 2013).

Also, independent games are often the places where the new ideas and innovative designs originates from. Therefore, they became the place where experimentation flourishes rather than being crushed under the heel of huge risk companies. Independent games can afford to be ambitious, unconventional and technically imperfect.

Markus Persson, creator of the Minecraft, said that part of the label of "indie" is that you make games for the sake of making good games rather than just make money, so there is an inherent will there to be experimental and original. Also, he mentions that if you just want to express yourself or affect people, you shouldn't

waste time trying to make business deals. Some of the time you just get lucky and find something new and exciting, but many times you just end it up alienating the players unless you are very careful at exactly how you break the conventions (Wendy, 2013)

(<https://software.intel.com/en-us/blogs/2013/12/11/developers-of-indie-games-continue-to-gain-important-ground>).

A survey conducted by Game Developer Conference of more than 2500 North American game developers who have attended the popular game conference in 2012 or plan to attend in 2013 offered some insights on independent game development outlooks. According to that independent game developers are making steady gains. 53% of them identify themselves as “indie developers” and 51% of them developing games less than two years (Nunneley, 2013). Also, 46% of the respondents working with small teams of ten people or less (Nunneley, 2013). Around half of those worked with a known publisher on their last project. Smartphones and tablet are the platforms they are working on, with 55% of the respondents creating games for these platforms (Nunneley, 2013). 58% plan to release their new project to these platforms (Nunneley, 2013). Furthermore 48% of the developers are creating games for PC and 49% are planning to their next game for PC (Nunneley, 2013).

One of the most important challenges for indie games is the resources (Reichert, 2012). Because they have less resources than big studios, they have much smaller teams, low budget for technology and marketing. Of course, these also affect the time for the developers. With less resource they simply need more time to develop their games. Other most important challenge for the independent games is their lower brand recognition compared to big studios. There are a lot of games both as an app for smartphones or for PC and consoles. To be recognized by consumer among these many is not easy. There are a lot of very good games that are not sold well because of their low brand recognition (Reichert, 2012).

Forums are providing a space for players to congregate and discuss tangential and often wayward topics (Pedersen 2014). Independent games can sometimes be tangential to the community like art sections and conversation threads or as active

as tournament hosting threads (Pedersen 2014). In these forums, community is created by the regulars who are the most loyal and frequent players. These regulars are most beneficial for the independent developers as they are the most vocal and most active part to bringing involvement from other users. Online social presence allowed indie games to transcend beyond play and stray. They made a reason to keep playing for years and continuing still (Pedersen 2014).

Justin Pedersen, co founder of Sandboxd Inc, described that showing the fringe stuff in developer oriented communities is no doubt great way to learn successes, pitfalls and problem areas of your game., but imagine leveraging a viable gaming community that results in developer meeting users. We could all attest to the notion that there is no harsher critic than our own fans, and meeting them face to face could create an interesting social economy that could change the very nature of game design, perhaps large scale democratic design or the virality of an otherwise overnight experiment game to test the super cool idea you thought would be neat to see (Pedersen, 2014).

Furthermore, the most important thing for developers is all about accountability and the relationship with customers. Adam Boyles said that it is so important that you have to be transparent and honest and forthcoming with what you are planning and how you are interacting. It is indeed important due to the social media, blowback over a controversial policy or action can surface immediately. If anyone had a bad experience, they are going to share it with everyone else. Therefore, developers teams always are monitoring social gatherings to get a raps on how community feel about certain issues (Te, 2014).

1.9 Crowdfunding

Crowdfunding is the practice of funding a project or venture by raising many small amounts of money from a large number of people mostly via the Internet (Prive, 2012). Simply, crowdfunding is to process where people can pledge money to a project. Some of the numerous crowdfunding platforms are; Kickstarter, RocketHub, Indiegogo and investment platforms like 1000 Angels.

While each platform offers its their unique features, the general concept is the same. Entrepreneurs can create a profile and short video which, contains introduction to their projects, a list of rewards per donation type and some images (screenshots) to elaborate (Prive, 2012). Kickstarter is the most well known site that players can pledge money to their new game project. Crowdfunding is an alternative source of finance, which has emerged outside of the traditional financial system. However, for independent games, crowdfunding is the main financial system that support their game project. The inputs of the player in the crowd trigger the crowdfunding process and influencing the outcome of the process. Each player acts as an agent of the offering, selecting and promoting game projects that they believe. Players may play as donor role oriented towards providing help on games due to nostalgia or their genre preference. Recently they can buy equity and contribute the development and growth of the offering (Prive, 2012).

There are some benefits for the indie developers regarding crowdfunding. As a compelling video game project can raise developers profile and their reputation (DeMers, 2016). Likewise, developers can show there is an audience and market for their project. In case of unsuccessful campaign, they can provide at least a market feedback. Furthermore, crowdfunding creates a community where developers can engage with their audiences (DeMers, 2016). Players can also engage with the development process, following process through updates and sharing feedbacks. Also, offering early access release to the content provides developers with instant access to good market testing feedback (DeMers, 2016).

On the other hand, crowdfunding contain certain risks and barriers. For instance, failure to meet campaign goals results as negative reputation for both developers and their game project. Also, reaching goals but not successfully releasing the game cause a severe negative reputation. Many developers are reluctant to share details of the project before production process to protect themselves from idea of theft and plagiarism. However, developers have to engage in crowdfunding are required to release features and content information of their game during the early phases due to get financially support to their game,

expose themselves to the risk (Agrawal, Catalini and Goldfarb, 2014). Furthermore, there is also a risk that if the same network of supporters has reached out multiple times, that network eventually cease to supply necessary support. Lastly, many gamers are concerned that without a regulatory framework, the likelihood of scam or an abuse of funds is high. This can become a barrier to interact with the players.

Building a community for a video game project is a crucial thing to do for the developers. It can affect the game outcome as without a community development team can not understand their mistakes (Lien, 2014). Indie game developers should not just know how to design a video game, they should also know how to engage with their community (Lien, 2014). The problem with the developers is most of them worked in blockbuster triple A games which, their work is very specialized. However, indie game developers have to engage more than their jobs, especially in community development. According to Simon Darveau, a developer in the Spearhead Games, the more discussion they have, the more brains that can get involved, the more people they have talking about that, that's how something can go further, become better and better be understood by everyone (Lien, 2014).

According to Bart Stewart, avid game design theorist, experienced game programmer and software project manager, a commercial game has additional needs. In particular, it has to persuade people to part with their money. Also, developers need to make this persuasive case repeatedly not just once (Stewart, 2009).

Customer satisfaction does not mean that if a video game sells a lot, customers have to be satisfied. Without customer satisfaction, a video game can be a big hit but it does not produce long standing relationship with their customers. In order to succeed customer satisfaction should not be an after affair, it should be integral part of the organization's culture that no one even notices anymore (Stewart, 2009).

Generally customers are satisfied as to what to expect from a developer, and if they get what they expected (Stewart, 2009). Therefore, an effective business will take special care to define customer expectation properly, and meeting these

expectations consistently. Bart Stewart describes that, there are four expectations that are common to all customers. Customers expect accuracy as visible bugs are fastest and easiest excuse for rejecting your game. Therefore, developers should not give them this excuse. Customers expect availability especially in online games, developers providing a service in a competitive marketplace (Stewart, 2009). If players can't access this service when it is convenient for them, they will turn to some other game. Customers expect partnerships as players who signed up for a service want you to value their experience and listen to their opinions regarding the game. Customers expect to advise as players tend to object to feeling forced to do anything in the game. However, they expect from the developers to help them to find the content that matters to them (Stewart, 2009).

As functional gameplay, art, sound or "thank you" screen at the end of the game is not enough (Stewart, 2009). Because every other game is doing the same thing. Therefore, a memorable game which their developers were consciously focused on customer satisfaction is the one that has been made just a little better in every single feature. There is a term for this as plussing, which comes from Walt Disney after they have acquired creative minds as Pixar and Industrial Light & Magic (Stewart, 2009). It is a proven tool for achieving customer satisfaction because it doesn't take customer for granted. Plussing as a corporate policy is an understanding that players will notice and appreciate extra effort. As plussing is practiced by developers, it will so deeply be embedded to corporate culture that developers actually compete to see who can effectively plus their contribution to every game, customer notice (Stewart, 2009). Players may not recognize individual developer contributions, but product as a whole will shine and players will notice it. As the game meet the players functional expectations, players will remember that developer when considering whose future games are likely to meet their expectations and that they will get value for their money (Stewart, 2009).

The ultimate responsibility of developers making a commercial game is to increase customer satisfaction. And every developer in the group can contribute to that goal by committing to make everything they do just a little better than it has to be (Stewart, 2009).

Crowdfunding sites like Kickstarter offer independent game developers the opportunity to get funding directly by gamers. However, unlike traditional investors, backers don't receive any equity in the company until recently. Fig websites, which is the brainchild of game developer Justin Bailey and backed by Spark, allows crowdfunding backers the chance to purchase equity. Equity investment is open to accredited investors now and will be able to be available to the unaccredited players later. Joost van Dreunen, CEO of SuperData Research, said that offering a greater degree of ownership may re-incentivize the players that have gotten turned off, now that its novelty has worn a bit. Crowdfunding will continue to play an important part role in the game industry, especially now that more players are playing with the game by modding and creating videos. Committing a few dollars to a project that gamers believe fits well into a mindset (Gaudiosi, 2015).

1.10 User-led Innovation In Video Games

User innovation is an innovation by the consumers rather than suppliers or producers.(Bogers and Bastain, 2010) There are many products and services that are actually developed by consumers, at the site of implementation and use. These ideas are then moved back to supply network. Because products are developed to meet the consumer's widest possible need. When individual consumers face problems that majority of the consumer do not, they have no choice but develop their own modifications or customization to the existing or new products to solve their problems. Frequently, consumers will share their ideas with the producers in hopes of producing the product, a process called free revealing. (von Hippel, 1986)

User innovation is one of the notable outcomes of innovations using the internet. For some products, production process has become increasingly interactive. With the internet, a corporate entity is no longer necessary for product development but rather has become optional. These days, innovation, development and consumption can be organized by the consumers. Consumers

can now engage in customizing product to suit their demands (Aoyama and Izushi, 2008).

This kind of user innovation increasingly involves peer to peer interactions communal efforts among consumers. For instance by Linux, the internet offers opportunity to connect previously disconnected individuals around the world to engage in a common project. The open source project is essentially a creation of a regulated commons, which communal collaborative efforts can take place with any user from any part of the world who can access the Internet (Aoyama and Izushi, 2008).

As mentioned before, video game industry comprises big studio manufacturers, video game publishers and developers. Because of this complexity video game industry demands a variety of skills, like programming, script writing and graphic artistry. As the video game industry's profitability is shifting towards hardware to software, community based content development has become central to the industry (Aoyama and Izushi, 2008).

Nowadays, numerous of players have created video games which, exist with various degrees of user involvement. Modders may create simple rearrangements to complete conversions and may post tutorials to share techniques among themselves. Sometimes some players create their own content, using the tools released by the game developers. In Table 5 above provides some examples of video games that have successfully involved users in varying degrees (Aoyama and Izushi, 2008).

User involvement in video game industry is nothing new. As the industry has been archetypical, it can be described as demand pull industry. Players and modders have always been the foundations of video game production, in fact. The video game industry emerged from the community of players and modders, who are now connected through the internet and are provided tools to engage in product development, modification and adaptations across distance. With the level of user involvement en masse may be unprecedented in the era of Internet, the evolution of the video game industry suggest that user incentives had existed

much in the same way as a key driver of user involvement and communal effort in innovation process (Aoyama and Izushi, 2008).

Nowadays, MMOG (Massively Multiplayer Online Games) help the growth of user communities by facilitating interactions among players. MMOG player are enthusiast by any measures. Such as, they spend an average of 22.85 hours per week. Also, players have five factor model of user motivations which includes relationship along with other four factors like achievement, immersion, escapism and manipulation (Cole and Griffiths, 2007). Furthermore, players derive meaningful relationships, as well as salient emotional experience and real life leadership skills, from these virtual environments. Moreover, Cole and Griffiths (2007) examine the social in interaction that occur both within and outside of MMOGs through an analysis of survey data with 912 self selected players from 45 countries. Cole and Griffiths (2007) find that these players are highly socially interactive environments providing the opportunity to create strong friendships and emotional relationships. Also, this study demonstrates that the social interactions in online gaming from a considerable element in the enjoyment of playing and high percentages of players making life long friends and partners. Thus, the enthusiasm of players results in a strong demand for advanced online game functions and quality online games (Cole and Griffiths, 2007).

Also, multiplayer video games are becoming important for video game industry as more player preferred that type of games. Not only these types of video games offers an entertainment they also provide a platform for video game players to socialize between themselves. As the growth of the multiplayer video games continues, competitive multiplayer game events like Esports have established in all around the world which, are competition of multiplayer video game events that was participated and spectated by thousand of video game players. These events attracted thousand of video game players and offers a platform to companies to interact with them as they were sponsored around \$150 million (Myers, 2017). Moreover, as importance of Esports has risen, these events became very important to interact with the video game players. Since, Esports have been included at 2022 Asian Games as a medal sport.

Table 3 User-led Innovation In the Pre and Post Internet Era

	Pre Internet	Post Internet
Venues of Information Exchange	Internal to the company, feedback to R&D, product development teams of customization	Can be external to the company Online(websites)
Types of users	Industrial Users (b to b) Consumers (b to c)	Hackers Programmers Modders
Types of Information Exchanged	Technical Solutions Market Trends	Codes Programs
Modes of Communication	Customer feedback (b to b, b to c) Focus Groups (b to c)	Peer to peer Forums User innovation tool kit
Type of Outcomes	New Products Adaptation/Customization for existing products	Software Digital Contents Customer Service Technical Support
User Incentives	Desired to expand product offerings/variety in the market, desires to expand consumption option/effectiveness of product purchased	Desires to engage in a collective efforts for commercial/non commercial outcomes; reputation

(Aoyama and Izushi, 2008)

There are three major implications for the operations of firms and the economy at large on the changing role of the user in the age of the Internet. First implication is the boundaries between producers and consumers are being redefined with the emergence of open-source development. For instances, peer-to-peer interactions on the Internet began to rival products which have otherwise required a corporate entity for production. Second implication is the boundary between common property and private property regimes when it comes to knowledge is being seriously questioned. Lastly, maybe the biggest impact the Internet has had on the market is ability to dislodge the previously concrete boundaries between public good and private goods. The culture of the Internet converted certain private goods to be not only publicly shared, but also collectively innovated. In Table 3 Yuko Aoyama and Hiro Izushi have attempted to characterize the potential changes in the role of the user in the pre- and post-Internet eras (Aoyama and Izushi, 2008).

Table 4 Unpacking User Incentives in Product Development

Types of Characteristics	Description
Market Characteristics	<p>Demand-pull rather than supply-push market</p> <p>A high level of heterogeneity in demand</p> <p>A high level of demand for customization</p> <p>A high level of product turn-over</p> <p>A high level of uncertainty in demand</p>
User Characteristics	<p>A high proportion of aficionados/fans/modders among users.</p> <p>Identifiable player community where reputational capital is built and recognized.</p> <p>Where user to user reciprocity exists.</p>
Information Characteristics	Easily shared /disseminated
Benefit Characteristics	<p>Direct benefit to the user</p> <p>Indirect benefit to the community</p> <p>Benefits to public good above and beyond private good.</p>
Product Characteristics	<p>Product with a high cultural content</p> <p>Product with a high entertainment value</p> <p>Product with a high level of specialization/customization</p>

(Aoyama and Izushi, 2008)

In Table 4 below unpack various characteristics that relate to user-incentives for product development. User incentives are assumed to be higher in a market where it is characterized as demand pull rather than supply push, where demand is

heterogeneous and customization is high. Further, product life is short and there is a high level of product turn over. Information that can be easily shared or disseminated further facilitates the ease in user involvement. Moreover, the types of users who have high degree of user incentives are for those products with a high proportion of dedicated enthusiasts, in which user-to-user reciprocity exists and building of reputation is probable. Mainly, products with a high level of specialization tend to have above mentioned characteristics (Aoyama and Izushi, 2008).

Table 5 Examples Of Games That Allow User Involvement In Product Development

Games	Genre	Description
Shadowbane	MMORPG(Massively Multiplayer Online Role PLaying Game)	<p>Players create characters and worlds.</p> <p>Shadowbane Vault(interest group) instruct players how to create cities in game.</p>
Neverwinter Nights	Role Playing Game	<p>Players create worlds, monsters, characters.</p> <p>Fan created content can be downloaded online.</p> <p>Fan created tools such as DM's Helper also available for download.</p>
Furcadia	Role Playing Game	<p>Customizable, player driven contents, Offers intuitive building tool to build player's own world.</p> <p>Online Community called Beekin Program directly assist in game design/development.</p>
Second Life	MMOG, Virtual Worlds	<p>Incorporates simulation software with ability to design and resell 3D Contents.</p> <p>Tringo, created and distributed on Second Life, has recently become a highly successful user created game distributed through Game Boy.</p>

Spore	God Game, Life Simulation	Players can change look and behaviour of creatures and customize the city's objects, buildings and vehicles.
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(Aoyama and Izushi, 2008)

Binary logistic regression results about user characteristics of the preference Wii to PS3 and XBOX 360.

Table 1 Binary Logistic Regression Results About User Characteristics Of The Preference Wii to PS3 and XBOX 360

Dependable variable: "Do you prefer Wii to PS3 and XBOX 360?" (No: 0 ; Yes: 1)					
	Coefficient estimate	Standard Error	Wald chi-square	sig.	Odds ratio
Intercept	0.90	0.86	1.09	0.30	
Gender(Male: 0; Female 1)	2.12	0.63	11.36	0.00	8.36
Hours of play per day	-1.15	0.46	6.26	0.01	0.32
Do you like action/shooting games? (No:0; Yes 1)	-1.19	0.61	3.74	0.05	0.31

(Aoyama and Izushi, 2008)

Note: The variable “hours of play per day” takes the following values: less than 2 hours: 1; 2-5 hours: 2; 5-8 hours: 3; over 8 hours: 4. Backward stepwise selection is employed. Variables removed in the selection are: “Age”; “Years of game play experience”; “Do you like fighting games?”; “Do you like role playing games?”; “Do you like real time strategy games?”; and “Do you like simulation games?.” Interpretation of odds ratio is as follows: for example, the odds ratio for gender (8.36) means that the values of the other variables in the model being equal, a female user is 8.36 times more likely to prefer Wii to PS3 and Xbox 360 than a male user. To take another example, the odds ratio for hours of play per day (0.32) in the model means that the values of the other variables in the model being equal, the odds of the preference of Wii to PS3 and Xbox 360 decrease by 68% with each additional value of the variable “hours of play per day.” The results are obtained by analyzing survey data collected by Ya (2007) (Aoyama and Izushi, 2008). This publication of Aoyama and Izushi is among the rare examples that attempt to categorize and relate users with products in game industry.

According to John Banks who, is a senior lecturer and researcher in the Creative Industry faculty, Queensland University of Technology, many video game developers weren't sure whether they are getting financial or commercial benefit from their interactions with the fans. However, he claims that this co-creativity activity grew as developers involved video game players in design and development feedback via online and offline marketing methods. This situation creates a reliance to the user generated content as it became a core for designing a video game (Jenkins, 2014). Furthermore, co-creative in video game industry can be contributed by data analytic techniques to create a design for a video game. As video game designers can capture metrics of video game players and using that data to design a gaming experience. However, John Banks describes the lack of a single perspective on how to use data as developers approach on the data varies between each of them (Jenkins, 2014). Thus, developers are not united in their support for their co-creative production.

2. METHODOLOGY OF THE RESEARCH

As mentioned above, in user-led innovation video game players are involved in production process via crowdfunding. Therefore, intention of this study is to identify cluster of video game player that participated in production.

As interviewing with developers may give more accurate results, this researcher attempted to send private messages to three video developers' accounts in their official forums for permission to an interview. However, two of the three developers did not even replied and the only one denied that they are not allowed to give any answer. The result of using interview was not surprising as video game industry do not tend to share any kind of information with the public. Even the sales figures of video games are hard to find contrary to movie industry.

Based on the researcher observations and experience, using a survey to asking video game players about user-led innovation, takes a lot of time. Since many video game players do not show any interest in video game industry except the news about their games, it is very hard to include them to fill a questionnaire. The few who, has often contributed to their communities out of kindness are too low numbered to get a satisfactory results. Furthermore, surveys do not always give the precise results as participants may not give true answers. Especially, video game players tend to hide their bad experience as they are very competitive. For the same reasons, focus groups were not viable for this study.

Therefore, the researcher has used data mining to examine the profile of the video game players who are in favor or participated in crowdfunding projects before.

Data mining is the process of searching through large data sets to identify patterns and establish a relationship between them to solve problems (Hughes, 2017). The advantages of data mining is the ability to find patterns and relationships in the data which, may be used to make prediction that impact related business.. Hence, it is an appropriate tool for studies like this.

Data mining parameters include Sequence or Path Analysis, Clustering, Classifications and Forecasting. Clustering is a method for predicting the instance class from pre-labeled instances. Moreover, clustering aims to find natural grouping of instances given un-labeled data (Stefanowski, 2008/2009). In order to grouping the data and identifying video game players that involved in user-led innovation, this study used clustering model.

As these results may give accurate projections regarding of the impacts of user-led innovation to the video game industry. Since crowdfunding is a subset of user-led innovation, this study is based on data mining of this word to achieve precise results.

The best available resources for this data is residing in Steam Community. As a digital video game distribution platform for PC platform, Steam has the most numerous membership numbers in the market. Also, the other platforms do not have necessity data and very few numbers. Steam is a digital distribution platform developed by Valve Corporation to offer video games, multiplayer gaming, video game streaming and social network services. Steam provides video game players to installation and automatic upgrading of video games and community features like friend list and groups, cloud saving and in-game voice and chat functions. Also, steam provides a free software called Steamworks, which developers want to use to integrate many of the Steam's functions into their products such as networking, matchmaking, achievements, micro transactions and support for user created content with Steam Workshop. Steam is the largest digital distribution for PC gaming with 75% of the market space in 2013 (Edwards, 2013).

In 2005, the researcher had examined and read all the threads and posts regarding crowdfunding in the Steam Community. The researcher had gathered data of 51 video game players and categorized attributes of nickname, hours played, number of games, membership years, activity level, preferred games, achievements, country and opinion. However, gathering data was not a smooth process as some of the video game players' accounts were hidden to the public view.

All the attributes were selected to define clusters in the data set of WEKA which is used to work with clusters. WEKA is a collection of machine learning algorithms for data mining task. The algorithm can either be applied directly to a dataset or called from your own Java code. WEKA contains tools for data pre-processing, classification, regression, clustering, association rules and visualization. It is also well suited for developing new machine learning scheme (<http://www.cs.waikato.ac.nz/ml/weka/>). WEKA contains collection of visualization tools and algorithms for data analysis and predictive modelling, together with graphical user interfaces for easy use (Ian, Eibe and Mark, 2011). Advantages of WEKA include;

1. Free availability under the GNU General Public License.
2. It's portability, since it is fully implemented in the Java code and thus run on almost any modern computer platform.
3. A comprehensive collection of modeling techniques and data pre-processing.
4. Easy to use graphical user interface.

The reason the researcher used application program of WEKA is due to its well known clustering algorithm and It's use of easiness. Especially, compared to the other programs such as SPSS software.

2.1 The Method Used To Collect The Sample Data

The best resource available in the Internet for creating a data of video game players was residing in the Steam Community website. Steam is the platform for the video game players to purchase their game. Also, they can write reviews and feedback for each game according to their experience about the game. Meanwhile, Steam track each member statistics as how many hours of each player play certain games or how many games they have in their virtual library. As of now, Steam

have 13 million active users who play games in a day. Therefore, Steam became the resource as the most numerous and effective platform to create a sample data set.

2.2 Analysis and Findings

2.2.1 Selecting Attributes of Data Set

As mentioned above, the selected attributes are collected to create a database of the video game players. These selected attributes have been detailed as;

- Nickname- Nicknames of video game players in Steam.
- Hours Played+ - How many hours a video game player play each game.
- No of Games+ - How many games each video game player have games in their virtual library.
- Membership years- How many years video game players were involved in playing video games in Steam.
- Activity Level- Determines how much video game players are active in the Steam Community.
- Preferred Games- How often a video game player plays certain genre.
- Achievements- How many achievement a video game player earned from the video games.
- Country- Which country of origin each video game player is from.
- Opinion- Opinion of each video game player regarding to the crowdfunding. The positives are involved or want to be involved in a crowdfunding campaign. The negatives do not trust the crowdfunding campaign for fear of fraud.

The main reason to select these attributes is because they are the only data that may be found in Steam Community. Further data about video game players are hard to find as many communities did not even share that much data.

As mentioned above, “crowdfunding” keyword was used to search which video game players discussed crowdfunding in the Steam Community. From the

results, first 51 video game players who were involved in a crowdfunding discussion were selected. All these discussions were read and, from the profiles of these video game players, the researcher gathered the chosen attribute values and added to a excel file (Figure 1). However, “Country” attribute have to be removed as there were only few of them in the table. “Nickname” attribute was not used in this study because, every nickname is different from each other so it couldn’t be enumerated. In order to enumerated “Preferred Games” attribute, widest genre of video games were selected.

The users discussing crowdfunding were examined and only the important data is collected as attributes of the model. All the numeric attributes are selected to define clusters. In the giving data set, WEKA is used to work with four clusters as in Figure 1.

Figure 1 First Data

1	Nickname	Hours Played +	No of Games +	Membership years	Activity Level	Preferred Games	Achievements	Country	Opinion
2	Gunver	600	100	9	8	Online shooter	0	?	Positive
3	Remi	2000	100	2	43	Modder/Garrys Mod	0	?	Positive
4	Mermer	20	100	9	9	JRPG	0	USA	Positive
5	Bathroom_Boy	700	100	6	31	Horror/Online shooter	2100	France	Positive
6	Firespite	0	500	11	58	Action/Adventure	2600	USA	Negative
7	Christian (FES)	160	30	3	7	Simulation	0	USA	Negative
8	MarioFanatic XV	200	470	6	13	Card Games	0	USA	Positive
9	Kerrsguy	80	50	6	6	?	0	USA	Positive
10	Valley	5	200	5	10	Online shooter	0	Singapore	Positive
11	Rika	20	690	5	14	Open World/Adventure	0	USA	Positive
12	Culga	500	300	10	46	Multiplayer	0	Ireland	Positive
13	Zeron	930	950	4	45	Online shooter	0	Portugal	Positive
14	crua9	850	50	5	9	Early Access Games	0	USA	Positive
15	Dark Oucharka	80	40	5	24	Strategy	300	?	Negative
16	Internisus	20	2600	10	115	Top-Down shooter	3100	?	Positive
17	Kurtino	350	520	9	19	Multiplayer/Online Shooter	0	?	Positive
18	Eethal	100	180	3	29	Multiplayer	0	USA	Positive
19	Samus	0	330	11	14	Strategy/RPG	0	Belgium	Positive
20	GHKtruc	0	9	2	3	Truck Simulator	0	?	Positive
21	Lolan	100	470	5	11	Open World	0	USA	Positive
22	The King of Spades	500	60	1	20	Strategy/RPG	0	?	Positive
23	cfiend	70	240	8	20	Puzzle	4700	Pollland	Positive
24	Ezechiah Winterspoon	30	100	2	14	Indie	880	?	Positive
25	bobbyjack	1000	10	1	1	Strategy/Indie	0	UK	Positive
26	diji	40	950	10	20	Strategy/JRPG	0	?	Positive
27	tomthebearded	40	95	4	22	Strategy/Indie/ARPG	1130	?	Positive
28	Polar Bear	50	230	5	11	racing	0	?	Positive
29	schigara	150	10	5	4	racing	0	?	Positive
30	pauldalton	50	100	12	9	racing	0	?	Positive
31	Dave R	50	240	7	10	racing	0	?	Positive

1	Nickname	Hours Played +	No of Games +	Membership years	Activity Level	Preferred Games	Achievements	Country	Opinion
32	FM Lad	90	60	6	6	racing	0	?	Positive
33	Kickz	1970	1030	11	117	Horror	0	Ireland	Positive
34	Hardy <3 Hup	60	130	4	8	Strategy	0	Germany	Positive
35	Desperate man	1330	100	7	9	Strategy/Open world	0	China	Positive
36	Hatty	140	540	7	76	Online shooter	2700	Germany	Positive
37	adz133t	25	160	4	8	Open World/Shooter	0	?	Positive
38	scironex	1760	85	4	14	Indie	0	USA	Positive
39	qaopjll	10	140	8	8	Platformer	0	?	Positive
40	Aletheia	1100	760	8	26	Online shooter/Horror	0	?	Positive
41	MegaMan Trigger	100	460	7	68	Open World/Shooter	8400	USA	Positive
42	Yoda	410	210	3	4	Management/Strategy	0	?	Positive
43	Alancazain	290	95	4	23	Management/Strategy	590	Sweden	Positive
44	HeavyArms	400	130	5	48	Strategy/Online	0	?	Positive
45	RIP Gidget	140	110	3	11	Management/Strategy	0	?	Positive
46	le Duc	110	90	7	8	Management/Strategy/Indie	0	France	Negative
47	zerotown	40	410	6	17	RPG	1110	Netherlands	Positive
48	Marshall	550	290	6	20	Strategy/Open world/Shooter	0	Czech Republic	Positive
49	robinxz	50	70	6	6	Strategy/Sports	0	?	Positive
50	Thunderbolt	110	360	13	25	Management/Strategy/RPG	2360	USA	Negative
51	Fictional Hero	160	120	5	7	Management/Strategy/Shooter	0	USA	Negative
52	Ensign	140	90	9	11	Strategy/Open world	0	USA	Negative

2.2.2 Clustering The Data Set

The data that was mined and stored in excel sheet is examined with WEKA application program. The method the researcher has used, Clustering method of SimpleKMeans. This method is used for creating a general pattern. In this method

each attributed is investigated. Since the general information involved in the data set is known, four clusters are used to group the data.

We used WEKA application program because clustering algorithm is well known and used easily in the program, compared to other techniques or methods like SPSS application program.

2.2.3 WEKA Clustering

In order to use WEKA cluster in MacBook Pro .xlsx file stored as .csv. file. With text editor attributes were added and necessary coding was done to convert .csv file to .arffl file. Then, WEKA was started and the data was loaded from this .arffl file. Pressed Cluster button was pressed to start clustering. The researcher selected Choose and selected SimpleKmeans because, this is the preferred method of clustering. Number of clusters have been defined as four in order to get a most meaningful result. Unselected Nickname attribute via the “Ignore Attribute” button. Pressed “Start” button to proceed and create clusters.

These steps are as follows:

- Stored .xlsx file as .csv. file.
- With text editor add attributes and necessary coding to convert .csv file to .arffl file (Figure 2).

Figure 2 Arffl File Layout

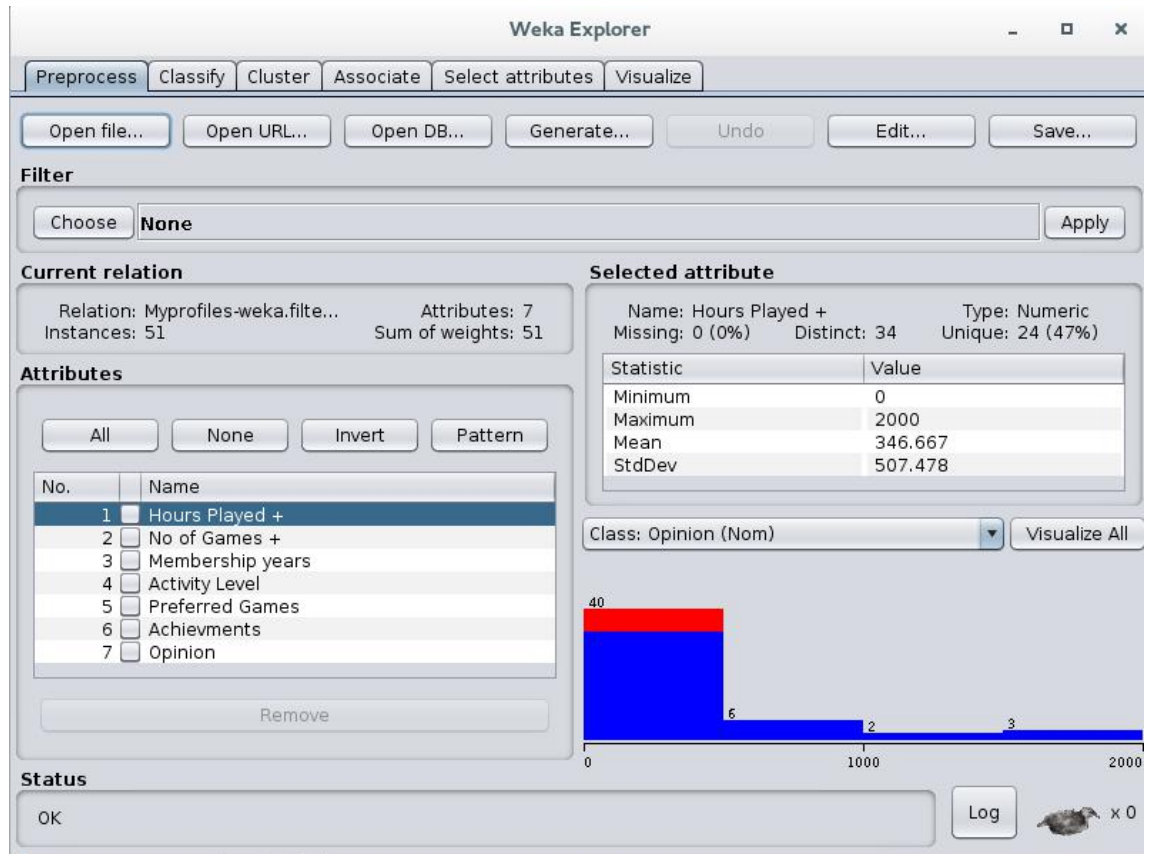
```
@relation Profiling_Players

@attribute Nickname string
@attribute 'Hours Played +' numeric
@attribute 'No of Games +' numeric
@attribute 'Membership Years' numeric
@attribute 'Activity Level' numeric
@attribute 'Preferred Games' {Action/Adventure,Card-Games,Early-Access-Games,Horror,Horror/Online-
shooter,Indie,JRPG,Management/Strategy,Management/Strategy/Indie,Management/Strategy/RPG,Management/Strategy/
Shooter,Modder/Garrys-Mod,Multiplayer,Multiplayer/Online-Shooter,Online-shooter,Online-shooter/Horror,Open-World,Open-
World/Adventure,Open-World/Shooter,Platformer,Preferred-Games,Puzzle,RPG,Racing,Simulation,Strategy,Strategy/
Indie,Strategy/Indie/ARPG,Strategy/JRPG,Strategy/Online,Strategy/Open-world,Strategy/Open-world/Shooter,Strategy/
RPG,Strategy/Sports,Top-Down-shooter,Truck-Simulator}
@attribute Achievements numeric
@attribute Country {USA,France,Singapore,Ireland,Portugal,Belgium,Poland,UK,Germany,China,Sweden,Netherlands,Czech-
Republic}
@attribute Opinions {Positive,Negative}

@data
Gunver,600,100,9,0,Online-shooter,0,?,Positive
Remi,2000,100,2,43,Modder/Garrys-Mod,0,?,Positive
Mermer,20,100,9,9,JRPG,0,USA,Positive
Bathroom_Boy,700,100,6,31,Horror/Online-shooter,2100,France,Positive
Firespite,0,500,11,58,Action/Adventure,2600,USA,Negative
Christian-(FES),160,30,3,7,Simulation,0,USA,Negative
MarioFanatic-XV,200,470,6,13,Card-Games,0,USA,Positive
Kerrsquy,80,50,6,6,?,0,USA,Positive
Valley,5,200,5,10,Online-shooter,0,Singapore,Positive
Rika,20,690,5,14,Open-World/Adventure,0,USA,Positive
Culga,500,300,10,46,Multiplayer,0,Ireland,Positive
Zeron,930,950,4,45,Online-shooter,0,Portugal,Positive
crua9,850,50,5,9,Early-Access-Games,0,USA,Positive
Dark-Oucharka,80,40,5,24,Strategy,300,?,Negative
Internisus,20,2600,10,115,Top-Down-shooter,3100,?,Positive
Kurtino,350,520,9,19,Multiplayer/Online-Shooter,0,?,Positive
Eethal,100,180,3,29,Multiplayer,0,USA,Positive
```

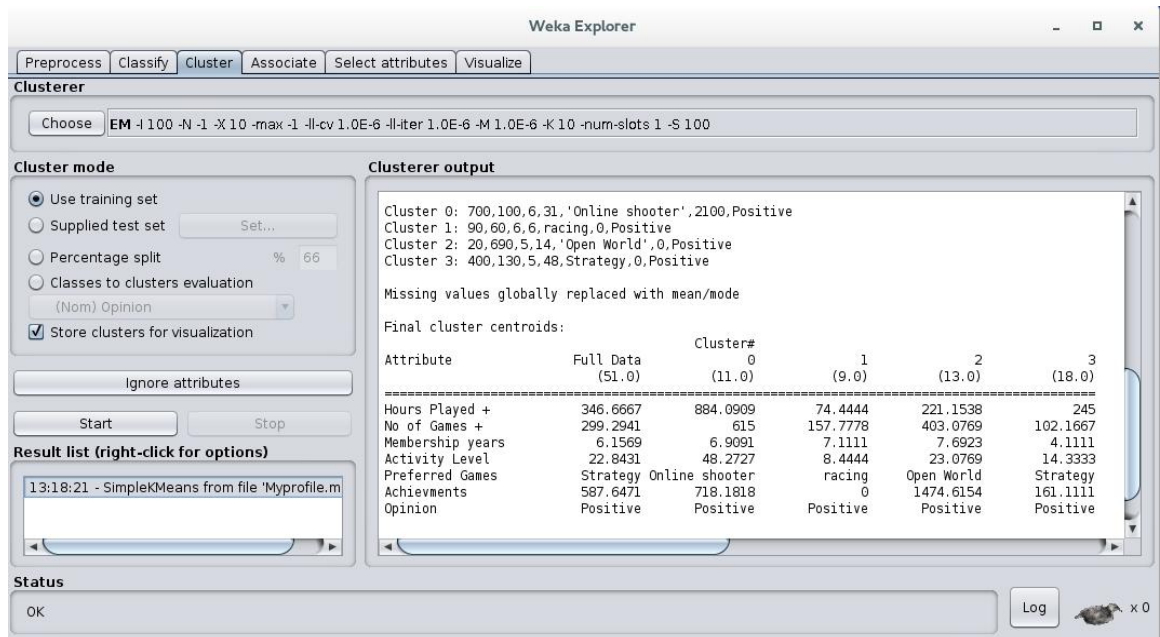
- Started WEKA and Loaded the data from this .arffl file (Figure 3).

Figure 3 WEKA Explorer



- Pressed Cluster button
- Selected Choose and selected SimpleKmeans. Because this is the preferred method of clustering.
- Number of clusters defined as four. Because this number of cluster give us a most meaningful result.
- Unselected Nickname attribute via the “Ignore Attribute” button.
- Pressed Start button (Figure 4).

Figure 4 Clustering



2.2.4 Analysis Of The Clustering Results

The bigger number of data involved around the cluster center must be selected for proper analysis (Figure 5).

This model consists of four user clusters.

Cluster #0: Only interested in game playing. They have a lot of games, high level of experience, and a lot of years of game playing. They are very interested in multiplayer games, especially “Online Shooter” genre, which can be played via co-op and over a server.

Cluster #1: These players are the ones who have a very little spare time to play games, based on their low value of “Hours Played” and “Number of Games” attributes. Presumably these players may have jobs or spend their spare time on other activities. Playing games may not be the priority hobby for them.

Cluster #2: These are the type of players that may be labeled as completionist. These players prefer open world games which give them a lot of activities to complete. They try to collect everything they can find in the game including achievements.

Cluster #3: These are the type of players that prefer only selected strategy games. These players spend a lot of spare time for only selected strategy games via subgenre of Turn Based or Real Time Strategy. Since this cluster have the biggest data, it is going to be chosen as our model.

Figure 5 Clustering Results

```

=== Model information ===
Filename:      Myprofile.model
Scheme:       weka.clusterers.SimpleKMeans -init 0 -max-candidates 100 -periodic-pruning 10000 -min-density 2.0 -t1 -1.25 -t2 -1.0 -N 4 -A
Relation:     Myprofiles-weka.filters.unsupervised.attribute.Remove-RL,8
Attributes:   7
              Hours Played +
              No of Games +
              Membership years
              Activity Level
              Preferred Games
              Achievments
              Opinion

=== Clustering model ===

kMeans
=====

Number of iterations: 4
Within cluster sum of squared errors: 35.221629186420884

Initial starting points (random):

Cluster 0: 700,100,6,31,'Online shooter',2100,Positive
Cluster 1: 90,60,6,6,racing,0,Positive
Cluster 2: 20,690,5,14,'Open World',0,Positive
Cluster 3: 400,130,5,48,Strategy,0,Positive

Missing values globally replaced with mean/mode

Final cluster centroids:
Attribute          Full Data          Cluster#
                   (51.0)            0                1                2                3
                   (11.0)            (9.0)            (13.0)            (18.0)
=====
Hours Played +     346.6667           884.0909         74.4444           221.1538           245
No of Games +     299.2941           615              157.7778          403.0769           102.1667
Membership years   6.1569             6.9091           7.1111            7.6923             4.1111
Activity Level     22.8431            48.2727          8.4444            23.0769            14.3333
Preferred Games    Strategy Online shooter racing Open World Strategy
Achievments        587.6471           718.1818         0                  1474.6154          161.1111
Opinion            Positive            Positive          Positive           Positive            Positive
  
```

It can be seen that from this output, cluster center of cluster number 3 has more data points than the others. For this reason, it is selected for analysis (Figure 6).

Figure 6 Selected Cluster

Attribute	3 (18.0)
=====	=====
Hours Played +	245
No of Games +	102.1667
Membership years	4.1111
Activity Level	14.3333
Preferred Games	Strategy
Achievements	161.1111
Opinion	Positive

2.2.5 Additional Data Usage

As mentioned before, later in 2016 the number of data has been increased up to 151 video game players, in order to see if there is any change in the attribute values of our model (Figure 7). In the Appendix, Figure 12 shows all of the 151 video game players' data. As same with above, all of those threads and discussions read. Like the first model, the same clustering process has been done (Figure 8). The nearest neighbor technique is used for the precision and accuracy of the selected clusters. Also with the nearest neighbor technique, comparison between the two data has been explored.

Figure 7 WEKA Explorer for 151 Players

Weka Explorer - □ ×

Preprocess | Classify | Cluster | Associate | Select attributes | Visualize

Open file... | Open URL... | Open DB... | Generate... | Undo | Edit... | Save...

Filter
Choose **None** Apply

Current relation

Relation: Myprofiles2-weka.f... Attributes: 7
Instances: 151 Sum of weights: 151

Attributes

All | None | Invert | Pattern

No.	Name
1	<input checked="" type="checkbox"/> Hours Played +
2	<input type="checkbox"/> No of Games +
3	<input type="checkbox"/> Membership years
4	<input type="checkbox"/> Activity Level
5	<input type="checkbox"/> Preferred Games
6	<input type="checkbox"/> Achievements
7	<input type="checkbox"/> Opinion

Remove

Selected attribute

Name: Hours Played + Type: Numeric
Missing: 0 (0%) Distinct: 54 Unique: 27 (18%)

Statistic	Value
Minimum	0
Maximum	2500
Mean	273.093
StdDev	392.035

Class: Opinion (Nom) Visualize All

Status
OK Log x 0

Figure 8 Cluster Results for 2nd Data

```

=== Model information ===

Filename:      Myprofile2.model
Scheme:       weka.clusterers.SimpleKMeans -init 0 -max-candidates 100 -periodic-pruning 10000 -min-density 2.0 -t1 -1.25 -t2 -1.0 -N
Relation:     Myprofiles2-weka.filters.unsupervised.attribute.Remove-R1,8
Attributes:   7
              Hours Played +
              No of Games +
              Membership years
              Activity Level
              Preferred Games
              Achievements
              Opinion

=== Clustering model ===

kMeans
=====

Number of iterations: 5
Within cluster sum of squared errors: 74.74338557257926

Initial starting points (random):

Cluster 0: 100,470,5,11,'Open World',0,Positive
Cluster 1: 90,60,6,6,racing,0,Positive
Cluster 2: 250,234,4,11,'Online shooter',200,Positive
Cluster 3: 200,329,9,27,RPG,2017,Positive

Missing values globally replaced with mean/mode

Final cluster centroids:

```

Attribute	Full Data (151.0)	Cluster# 0 (19.0)	1 (68.0)	2 (37.0)	3 (27.0)
Hours Played +	273.0927	250	180.5735	465.9459	258.0741
No of Games +	252.3245	239.2105	155.4559	326.7568	403.5185
Membership years	6.2252	5.9474	5.4118	6.5135	8.0741
Activity Level	19.2185	22.8947	12.7794	22.5135	28.3333
Preferred Games	Strategy	Open World	Strategy	Online shooter	RPG
Achievements	495.0331	932	213.3235	524.1081	857.1852
Opinion	Positive	Positive	Positive	Positive	Positive

Figure 9 Selected Cluster for 2nd Data

```

Attribute
              1
              (68.0)
=====
Hours Played +      180.5735
No of Games +      155.4559
Membership years    5.4118
Activity Level      12.7794
Preferred Games     Strategy (
Achievements        213.3235
Opinion             Positive

```

When we examine the new clusters we realized that Cluster #1 is the biggest clustered data (Figure 9). Interestingly Cluster #1 has the same type of gamers

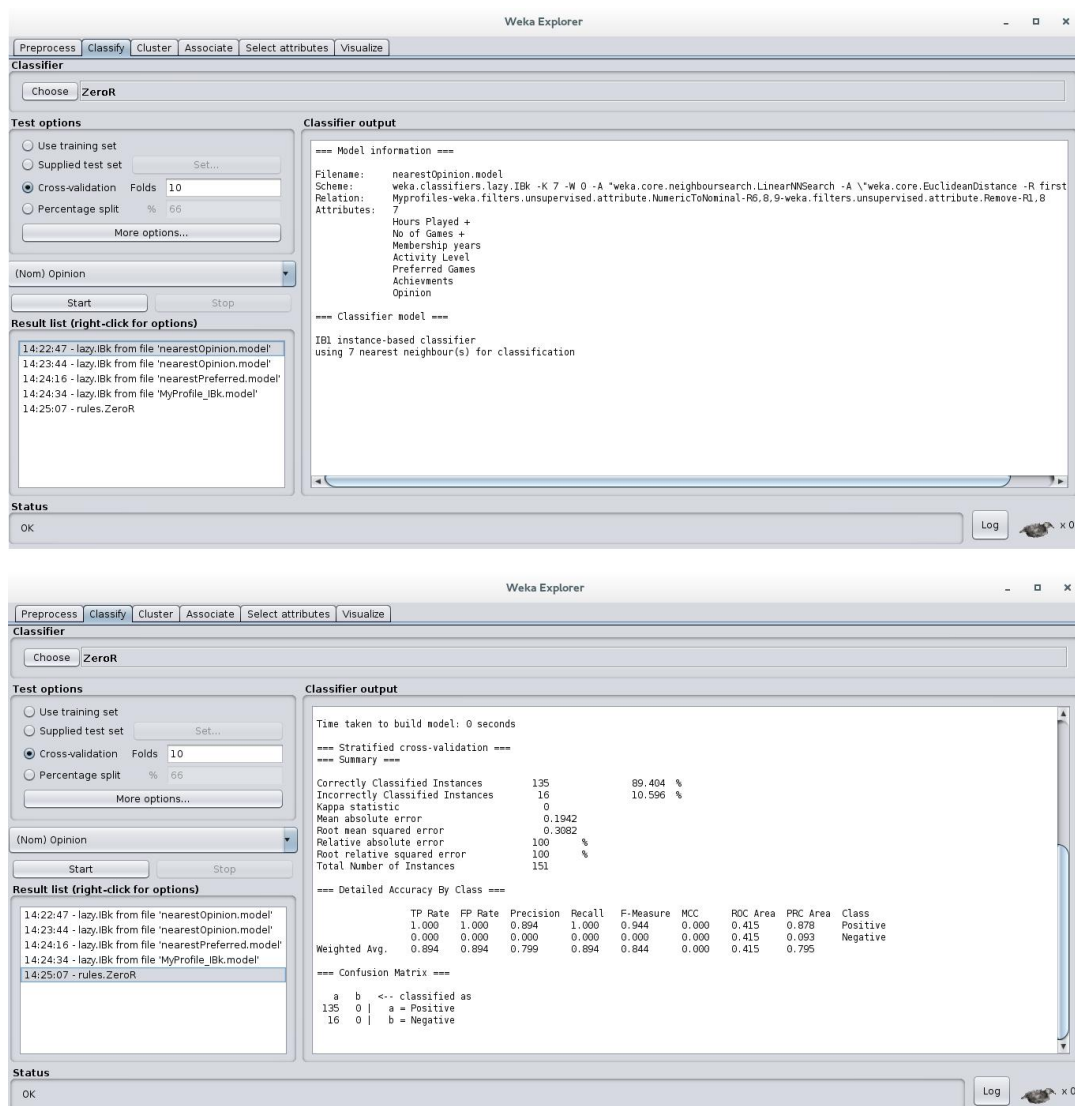
with the old cluster #3. It can be said that the selected model attribute values are similar and can be assumed as unchanged. As the old cluster #3 (Figure 6), these type of video game players have a considerable investment in video games. Furthermore, they spent a lot of their time on playing video games and they participated in online video game community more than five years. Also, they are involved in online video game community for a lot of their time. This tending towards investment to future video game crowdfunding campaigns.

Since the model is the same in both data, using nearest neighbor method can show the precision of opinions of game players.

2.2.6 Nearest Neighbor

Our model predicted that 16 (10.6%) game players may support crowdfunding but they did not trust it yet. 135 (89.4%) game players would support crowd-funding projects if they could trust (Figure 10).

Figure 10 The Nearest Neighbor Results



Data mining results shows that, the selected cluster data had more than 89% precision. Although we don't have data from other platforms, this cluster group can give us information for identifying the video game players that participated user-led innovation in video games industry via crowdfunding. Furthermore, data mining shows us tendencies of video game players that participated in crowdfunding. For instances, their preferred video game type and their participation level in Steam community. This result shows that this method can be used in order to improve the design of the game by understanding the demand of these players.

CONCLUSION

This study examined the impact of user-led innovation in video game industry by reviewing and analyzing the growth, trends of the industry through the history and user profiles and perceptions about user-led innovation approaches, and presented a user selection model based on a data mining practice. Furthermore with the understanding of the production process of the video game industry, it is seen that it is a demand pull industry, thus the success of a video game depends on the understanding the requirements of the users. Therefore, as the advancement of the user-led innovation with the involvement of the Internet, techniques like crowdfunding became much more important to identifying the market needs. Because, customers of the video game industry turned into backers who funded the video game project. As this study revealed, involvement of the video game players in the production process became a necessity for the developers so that looking to secure funds to their project and form a community around it. Thus in this era of the video game industry, developers and video game players relationship evolved to a platform which both negotiate and contest the features of the video game project.

When developers take into account the voices of video game players, they could tune their design more precisely to their needs. As mentioned before, when a video game designed, designers have to think how their design decision is enjoyable for their video game players. If a video game offer no fun, it won't be interesting to play. With the user-led innovation, a designer can predict more precisely their fans response regarding to the design of the game such as levels, user interface, non playable characters and art style of the game. Because of that, response of the video game players can effect the core of the video game design and produce better games for the video game players.

Based on the examination and intention of this thesis; to include video game players in the innovation process, the video game player communities are not effectively used in the video game industry. As mentioned before, they are mostly

used in the beta version of the game as beta testers. However, this study shows that video game players should be included in the production process. Developers have not use effective methods such as data mining to select pioneers or targeted video game players. In this data age, this kind of analytic techniques must be used in innovation process of new product development as mention before. As there are no methods to select which kind of video game players, this study experimented and selected video game players' cluster that may be participated in crowdfunding and production process. Furthermore, this method may be used as a cluster for understanding the video game players that may involve in user-led innovation.

Imagine a developer behind the screen with a vision and imagination that can develop a game. Could he/she be successful to reach his targeted video game players without their feedback? If he uses this method to select his targeted video game players, and then he understand their needs, and create his new design accordingly to the voices of his targeted video game players, should he be more successful? Yes, he should be successful as he can move beyond his own abilities and ideas. This is the major outcome that was explored and experimented in this study.

In that regard, this thesis uniquely provides a sample practice and a roadmap for using data mining methods to select pioneers and targeted video game players, under the open innovation principles prioritizing to involve video game players in the process of new game design.

Discussion and Further Research

Smith (2014) claims that while communication between developers and video game players during development is under the purview of publishers, often limited, interaction between these two social group is ongoing from the early stages of the development in the crowdfunding sphere. Furthermore, he argues that communications between developers and video game players during crowdfunding campaigns can instigate significant shifts concerning project details, as was the case with same games.

This study shows that as the user-led innovation grows and became more important in the video game industry, techniques like crowdfunding forced to evolve the relationship between developers and video game players. As a demand pull industry, developers always have to listen the voices of video game players to some degree. As revenue of the video game industry grows, the risks grows either. Thus, ignoring the voices of the video game players may became fatal to both developers and publishers.

Also Yuki Aoyama and Hiro Izushi (Aoyama and Izushi, 2008) suggest that industries and products that have following, a group of hobbyist previously organized or disorganized, are the most likely sources of active user-led innovation today. This in turn leads to a strong possibility that user-led innovation in its applications is constrained in those industries that do not have such a cultural base among users. Moreover, they claimed that blind faith of in the involvement of users and user communities in innovation process may became fatal. From the mature phase to the discontinuities phase, it becomes more important to question the status quo and keep an eye on opportunities outside the existing trajectory.

Even though this study shows that hobbyist as the extreme users are the most likely source of active user-led innovation today and blind faith to them may involve limit to the creativity of the development ideas, ignoring the voices of the video game players is not the solution. As the video game development is a demand pull industry, understanding of the demand is important. Yuki Aoyama and Hiro Izushi gave an example of the case study of Nintendo's Wii as the success of the console was due to the developer's ignorance of the voices of the hardcore players. However, this study examined that Nintendo's Wii success is an isolated case as ignoring the demand of the video game players carries a lot of risks as the consequences of this strategy may cause grave implications. The result of this study shows that video game players as a potential self developer who, were interested in the video game properties, involved in crowdfunding and became an important customer and backer. Within this type of video game players' environment, Nintendo's Wii's close design technique may not be

sustainable. As mentioned before prediction of the demand is become much more important in the video game industry, as new games often could not meet the expectation of their player base. As the result of that, developers could not meet their predicted sales numbers in the recent years (Calvin, 2016). For instance, Microsoft could not understand the demand of their consumer base in 2013 regarding Xbox One. At E3 press conference, they announced their licensing policy which limits their consumers first-sale rights by required to connect to internet once every 24 hours to play the game even in offline mode(single player). As a result of that decision, reaction to the Xbox One was extremely negative and Sony's Playstation 4 dominated the console market. Even though Microsoft change their policies, it was too late. In 2016, Call of Duty Infinite Warfare trailer is became number one most disliked video in YouTube because of their developer's design decision. Call of Duty franchise is one of the biggest franchise in the video game industry in all time. The franchise well known for their realistic and basic gameplay of World War 2 themed games. However, in the recent years franchise turn to more science fiction aspects. This was not well received by their fans and when developers announced their next game in YouTube, it was disliked by many. As a result the sales of the Call of Duty was not enough and recently developers decided to develop their next game in World War 2 theme. They were forced to listen the voices of the video game players.

This study intends to include more data via other platforms, surveys and in game player data in the future. These platforms such as, Steam community, reddit fan pages, official forums, social media platforms and YouTube channels from where enumerated data can be collected in to a database. This type of database will be able to serve for data mining to design, upgrade and create modular expansions. Furthermore, this type of data can be useful to identify and understand the targeted video game players. Moreover, gaining perspectives on additional aspects of crowdfunding process as an user-led innovation tool, including social groups other than developers and video game players may be useful. Further research into how developers balance the need of video game players with the professional investors that are contributing additional funding to

the video game projects may be needed. Also researching strategies of the developers may deploy to ensure that their content will be attractive to the wider audience, while simultaneously satisfying the needs of their hardcore video game players.

Background Of The Researcher

The researcher graduated from Istanbul Bilgi University Management of Performing Arts. After the researcher finished his graduate, he went to United States of America to study business aspect of the Video Game Industry. The researcher applied and finished Entertainment Business Master of Science program in Full Sail University. During his master program the researcher specialized in Video Game Industry and earning Course of Director Award and recommendations regarding my expertise of this subject. Since his graduate program in Istanbul Bilgi University, he was interested in Video Game Industry. The researcher read every news feed he can find and participated many video game forum and modding community as a reader. For over 8 years, the researcher read and follow not only Video Game Industry but also official forums and other social networks like Reddit, Steam and YouTube Channels. After his graduation in Full Sail University, The researcher created many video game projects and during that time he read books about Video Game Design. Recently, aside of his freelancer work in digital marketing, He is also developing a video game as the sole developer for two years.

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APPENDIX

Figure 11 History Of Worldwide Video Game Industry Revenues (As Line Chart)

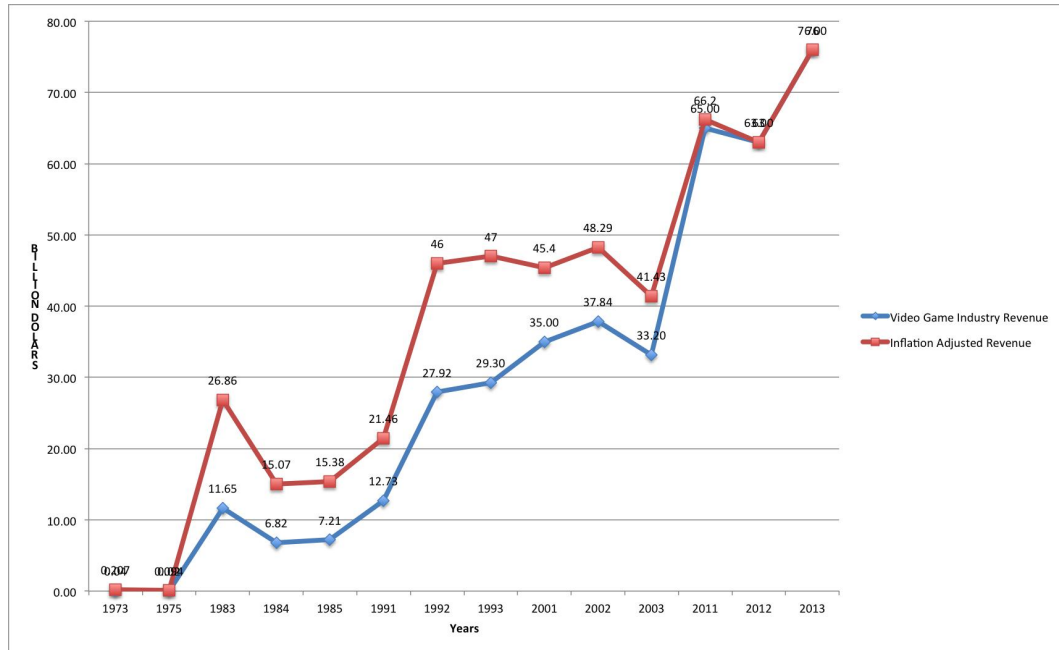


Figure 12 Video Game Players (151) Data

1	Nickname	Hours Played +	No of Games +	Membership years	Activity Level	Preferred Games	Achievements	Opinion
2	Gunver	600	100	9	8	Online shooter	0	Positive
3	Remi	2000	100	2	43	Online shooter	0	Positive
4	Mermer	20	100	9	9	RPG	0	Positive
5	Bathroom_Boy	700	100	6	31	Online shooter	2100	Positive
6	Firespite	0	500	11	58	Action	2600	Negative
7	Christian (FES)	160	30	3	7	Simulation	0	Negative
8	MarioFanatic XV	200	470	6	13	Card Games	0	Positive
9	Kerrsguy	80	50	6	6	?	0	Positive
10	Valley	5	200	5	10	Online shooter	0	Positive
11	Rika	20	690	5	14	Open World	0	Positive
12	Culga	500	300	10	46	Multiplayer	0	Positive
13	Zeron	930	950	4	45	Online shooter	0	Positive
14	crua9	850	50	5	9	Indie	0	Positive
15	Dark Oucharka	80	40	5	24	Strategy	300	Negative
16	Internisus	20	2600	10	115	Top-Down shooter	3100	Positive
17	Kurtino	350	520	9	19	Online Shooter	0	Positive
18	Eethal	100	180	3	29	Multiplayer	0	Positive
19	Samus	0	330	11	14	Strategy	0	Positive
20	GHKtruc	0	9	2	3	Simulation	0	Positive
21	Lolan	100	470	5	11	Open World	0	Positive
22	The King of Spades	500	60	1	20	RPG	0	Positive
23	cfiend	70	240	8	20	Puzzle	4700	Positive
24	Ezechiah Winterspoon	30	100	2	14	Indie	880	Positive
25	bobbyjack	1000	10	1	1	Strategy	0	Positive
26	diji	40	950	10	20	RPG	0	Positive
27	tomthebearded	40	95	4	22	Strategy	1130	Positive
28	Polar Bear	50	230	5	11	racing	0	Positive
29	schigara	150	10	5	4	racing	0	Positive
30	pauldalton	50	100	12	9	racing	0	Positive
31	Dave R	50	240	7	10	racing	0	Positive

	A	B	C	D	E	F	G	H
1	Nickname	Hours Played +	No of Games +	Membership years	Activity Level	Preferred Games	Achievements	Opinion
32	FM Lad	90	60	6	6	racng	0	Positive
33	Kickz	1970	1030	11	117	Horror	0	Positive
34	Hardy <3 Hup	60	130	4	8	Strategy	0	Positive
35	Desperate man	1330	100	7	9	Open World	0	Positive
36	Hatty	140	540	7	76	Online shooter	2700	Positive
37	adzl33t	25	160	4	8	Open World	0	Positive
38	scironex	1760	85	4	14	Indie	0	Positive
39	qaopjll	10	140	8	8	Platformer	0	Positive
40	Aletheia	1100	760	8	26	Online shooter	0	Positive
41	MegaMan Trigger	100	460	7	68	Open World	8400	Positive
42	Yoda	410	210	3	4	Strategy	0	Positive
43	Alancazain	290	95	4	23	Strategy	590	Positive
44	HeavyArms	400	130	5	48	Strategy	0	Positive
45	RIP Gidget	140	110	3	11	Strategy	0	Positive
46	le Duc	110	90	7	8	Strategy	0	Negative
47	zerotown	40	410	6	17	RPG	1110	Positive
48	Marshall	550	290	6	20	Open World	0	Positive
49	robinzx	50	70	6	6	Sports	0	Positive
50	Thunderbolt	110	360	13	25	RPG	2360	Negative
51	Fictional Hero	160	120	5	7	Strategy	0	Negative
52	Ensign	140	90	9	11	Open World	0	Negative
53	Trigger	400	19	4	4	Open World	0	Positive
54	Washell	150	400	7	42	Strategy	1820	Negative
55	Jej	150	209	7	24	Online shooter	0	Negative
56	EolSunder	150	169	6	22	Open World	1053	Negative
57	Sonntam	8	71	3	7	RPG	0	Positive
58	Jcm	40	189	6	21	RPG	0	Positive
59	FOU-01	20	2275	12	62	Online shooter	2691	Positive
60	IRI.lsi	300	43	10	19	Online shooter	78	Positive
61	chicken	300	119	13	11	Online shooter	0	Positive

1	Nickname	Hours Played +	No of Games +	Membership years	Activity Level	Preferred Games	Achievements	Opinion
62	Satanicxela	100	740	5	37	Online shooter	4196	Positive
63	2D Wario	70	354	6	18	Shooter	0	Positive
64	GuyOnAChair	250	234	4	11	Online shooter	200	Positive
65	Jrogers 2112	10	17	2	2	Shooter	0	Positive
66	Lunar Reactor	250	103	5	18	Open World	0	Positive
67	Frozen Devliz	500	272	5	31	Multiplayer	626	Positive
68	Vincent	500	17	3	12	Online shooter	0	Negative
69	laff	2500	118	10	14	Online shooter	0	Negative
70	Yandere hime	10	10	1	5	RPG	0	Negative
71	Labyrinth	300	543	11	15	Shooter	0	Negative
72	Pyromaniac	40	32	4	6	Online shooter	0	Positive
73	Rory Rayne	70	77	4	19	Simulation	0	Positive
74	Bolan720	60	402	11	16	Online shooter	0	Positive
75	TheArid	250	34	4	10	Online shooter	0	Positive
76	Stan the Sumo Man	256	34	7	5	Strategy	0	Positive
77	Gabo Codarniz	60	162	6	12	Online shooter	102	Positive
78	Mazutheamazing	300	94	4	15	Online shooter	0	Positive
79	Futon	10	17	7	15	Strategy	0	Positive
80	Ben	150	120	7	9	Strategy	0	Positive
81	EpicFlyingRaptor	110	356	7	21	Online shooter	0	Positive
82	Der Flo	80	304	5	16	Strategy	0	Positive
83	Hogga	500	107	4	8	RPG	0	Positive
84	super-yowie	60	39	6	6	Strategy	0	Positive
85	Rymn	40	238	11	12	Indie	0	Positive
86	Japitan	200	225	8	24	Online shooter	0	Positive
87	Altrue	100	420	7	11	Multiplayer	66	Positive
88	Porth	200	329	9	27	RPG	2017	Positive
89	Dude	180	530	12	51	Online shooter	30	Positive
90	epilogue 1212	100	315	3	13	Strategy	0	Positive
91	AStrongerFellow	30	109	6	9	Strategy	0	Positive
91	AStrongerFellow	30	109	6	9	Strategy	0	Positive
92	Legend-CZ	200	458	8	24	RPG	50	Positive
93	Ky	110	75	4	8	Strategy	26	Positive
94	13Dagger	90	224	3	13	Online shooter	1004	Positive
95	Milk	120	69	6	9	Online shooter	27	Positive
96	Neb Neblar	40	70	2	4	RPG	36	Positive
97	herbiter88	200	82	7	7	RPG	61	Positive
98	Rootriver	200	446	8	18	Online shooter	1823	Positive
99	Blutuogt	200	348	10	18	Strategy	44	Positive
100	caden	70	105	2	22	Open World	71	Positive
101	GuliMatias	700	98	9	20	Strategy	373	Positive
102	The Duck Knigth	300	288	6	38	Strategy	2101	Positive
103	[B04]Gruz	250	466	13	13	Indie	0	Positive
104	Space Hedless	450	214	9	12	Multiplayer	102	Positive
105	Iskander	150	80	4	8	Strategy	40	Positive
106	FuckISIS	130	40	1	15	Strategy	299	Positive
107	OhMecha	100	423	5	11	Online shooter	0	Positive
108	C.P.O	70	149	3	10	Strategy	31	Positive
109	SharpOV	150	77	4	19	Indie	23	Positive
110	Pally Wal	130	130	2	15	Strategy	21	Positive
111	Anatas	110	301	6	13	Open World	24	Negative
112	Whelsko	600	202	8	12	Online shooter	1439	Positive
113	foraldo	245	518	6	22	Online shooter	2168	Positive
114	aubzeymal	300	82	10	9	Open World	29	Positive
115	Mrfancymike	80	199	3	15	Strategy	1119	Positive
116	DoomMaster18895	140	72	5	5	Strategy	0	Positive
117	Chardicles	60	54	5	5	Strategy	51	Positive
118	Man13	380	421	8	31	Shooter	2448	Positive
119	FlagerBlasted	260	497	9	40	Open World	2974	Positive
120	GreK Jemmings	50	83	13	9	Strategy	55	Positive

1	Nickname	Hours Played +	No of Games +	Membership years	Activity Level	Preferred Games	Achievements	Opinion
120	GreK Jemmings	50	83	13	9	Strategy	55	Positive
121	Rawhide	100	64	7	8	Strategy	88	Positive
122	Yawen	600	415	9	93	Multiplayer	4503	Positive
123	Chaoslock	180	473	7	91	Open World	937	Positive
124	Chadman	175	251	12	12	Strategy	19	Positive
125	Warden-DC	90	128	2	7	Strategy	37	Positive
126	Padd	70	234	7	10	Strategy	4	Positive
127	Lfon AK47	350	153	9	14	Strategy	944	Positive
128	Kitsune Weeb	510	115	6	31	Open World	2967	Positive
129	Aurumlamina	200	1228	7	45	Strategy	2708	Positive
130	Crossfire	123	90	4	6	Strategy	10	Positive
131	subzul	80	112	7	11	RPG	57	Positive
132	The Blue Jelly	940	144	5	12	Multiplayer	115	Positive
133	yugijak	45	226	5	10	Open World	8	Positive
134	weizen 1988	1100	162	5	10	Strategy	9	Positive
135	Doc. Voltacon	130	173	7	31	Online shooter	8	Positive
136	Dr. ScharK	40	124	2	16	Online shooter	40	Positive
137	Proteus2	160	143	6	20	Open World	1215	Positive
138	Steve 1596	520	206	8	15	Online shooter	0	Positive
139	Idle SCV	50	48	8	6	Multiplayer	6	Positive
140	facciola007	200	231	5	13	Strategy	785	Positive
141	entropyjones	1200	149	8	20	Strategy	40	Positive
142	caleb.hull	50	26	5	4	Shooter	13	Positive
143	nobody	70	76	4	5	Strategy	68	Positive
144	Winter	180	408	4	18	Indie	362	Positive
145	Cweber.a47	50	52	4	14	Open World	30	Positive
146	Wuch	130	173	6	14	Indie	48	Positive
147	OPERATOR	200	63	10	15	Strategy	39	Positive
148	ADJames35	130	74	2	5	Multiplayer	63	Negative
149	OneNuttheQuitter	175	59	2	4	Strategy	256	Positive
150	Inquisitioner	350	814	8	36	Online shooter	45	Positive
151	Zuphold	530	52	4	6	Indie	36	Positive
152	Dr. Deetz	140	54	10	10	Strateev	2	Positive