Multi-homing in the Gaming Industry

Master's Thesis

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Content

1 Introduction

The video game industry has grown to a multi-billion dollar industry (Rishe, 2011), now one of the largest entertainment industries in the world. The increase in popularity and technological advances creates opportunities for new developers, publishers and consumers. Changes in the mobility and connectivity of platforms allow games to be entrenched in our daily lives (Terry & Babb, 2013). These technological changes and popularity of games allow for different adaptation of gaming aspects in our daily lives, entertainment, education, healthcare, et cetera. The video game industry contain multiple platforms that have a (major) focus on video games. A solution to cover multiple platforms is multi-homing.

Multi-homing is the practice of releasing your product to multiple platforms, also known as multiplatform (Techterms, 2014). This paper also mentions Single-homing, which is the practice of releasing your product to one platform, this is also known as an exclusive.

Multi-homing ensures that customers (that have less purchasing power) are not required to buy multiple platforms to play a video game interesting for them. The popularity and accessibility of multi-homing, does not indicate that all newly developed games are multi-homed. Single-homing is still widely used and is important for new platforms to offer value and resist competitor attacks (Landsman & Stremersch, 2011). The use of single-homed games can have greater differentiation than many multi-homed games (Mantena, Sankaranarayanan & Viswanathan, 2007). Both single- and multi-homing have strong arguments that support each strategy. Landsman and Stremersch (2011) state that single-homing is more effect with a new platform, which decreases as the platform matures. The major benefit from multiple platforms is the increase in potential customers, however the initial risk increases as developing for multiple platforms increases the development cost.

The purpose of this research is to analyze the video game industry with a focus on platform single- and multi-homing and the comparison of multiple factors between the two. The comparison is done using publicly available sales data to determine significant differences between multiple aspects of single- and multi-homing. With almost no similar scientific research available, we analyze a multiple aspects multi-homing in our theoretical background, to provide a foundation for this research. With the lack of previous scientific research between single- and multi-homing regarding significant differences, we have created a formal problem statement for this research: *Which factors can provide early on insight for developers and publishers, when creating a game development strategy?*

The remainder of this thesis is structured as follows. Firstly, the research approach is described in Chapter 2. This chapter describes the structure and methods used throughout the research. Secondly, the theoretical background is presented in Chapter 3. The theoretical background, describes the research topic using related literature. Thirdly, the findings are presented in Chapter 4. All findings are described and presented, to provide an answer to the sub-questions. Fourthly, a discussion is provided in Chapter 5, in which the researchers describe the research and results and compares these to initial assumptions. The discussion also includes a section for future research and limitations of this research project. Finally, a conclusion is provided in Chapter 6. The conclusion chapter sums the research and provides an answer to the main research question using the results presented in Chapter 4.

1.2 Research questions

The research questions are listed in this section. The list of research questions starts with the main research question, which is answered by multiple sub-questions. Multiple sub-questions are answered using a statistical analysis, for this reason we included multiple hypotheses, that answer the sub-questions. These hypothesis are listed with $H_{.0}$ or $H_{.a}$, under the corresponding research question. $H_{.0}$ describes the null hypothesis, this is the hypothesis we reject if our statistical analysis is significant. $H_{.a}$ describes our predicted outcome for the hypothesis test, this hypothesis is the opposite of the null hypothesis, where one describes a significant difference and the other does not.

Main research question:

1. How does platform multi-homing compare to platform single-homing in the gaming ecosystem?

With the main research question we explore different aspects of single-platform games and multi-platform games in the gaming ecosystem and test these aspects to test significant differences between the two concepts.

Sub research questions:

1.   How did platform multi-homing develop from 2006-2013 in the gaming industry?
    1.1   Is there a diversification or consolidation battle going on?

The first sub question is used to gather numerical values on single- and multi-homing and compares these against each other. This sub question has a focus on multiple aspects namely, games, sales, relationships between developer and publishers and the relationship between publisher and platforms. This sub question provides a broad analysis, that is used for the remaining sub questions.

2.   Are platform multi-homers more successful in the gaming industry?
    $H_{1.0}$ Platform multi-homers sell equal or fewer copies than platform single-homers
    $H_{1.a}$ Platform multi-homers sell more copies than platform single-homers.

The second sub question tests the if multi-homers are more successful than single-homers. A sample is used to tests significance between single- and multi-homing.

3.   What factors influence platform multi-homing in the gaming industry?
    3.1   Are platforms single- or multi-homed oriented?
    3.2   Are multi-homed genres more successful than single-homed genres?
    $H_{2.0}$ Platforms solely focus on platform multi-homed games.
    $H_{2.a}$ Platforms do not focus solely on platform multi-homed games.
    $H_{3.0}$ Multi-homed genres are not more successful than single-homed genres.
    $H_{3.a}$ Multi-homed genres are more successful than single-homed genres.

    The third sub question explores different factors of video games and tests these, this is then used to provide together with the previous sub-questions to answer the main research question.

2 Research approach

The research conducted in this thesis document is performed using a combination of two methods; a literature review and quantitative research. The literature review was performed to create a theoretical background. The theoretical background covers a multitude of topics related to multi-homing in the gaming industry, from the video game history up to the video game industry and the gaming ecosystem. The quantitative research, provides the data required to answer the research questions. The quantitative aspect provides facts and figures to demonstrate multi-homing changes, relationship changes in the gaming industry and the success of multi-homing compared to single-homing. These results provide the basis for the strategic findings for the game industry.

2.1 Literature Review

A literature review was performed to create a theoretical background for the thesis project. The literature review considers multiple studies to address contributions made by other scholars or researchers. These contributions provide the theory, around the research topic. These publications also demonstrate a research gap, on which no publications or research is (performed) available.

A scoped literature review has been used to determine key literature related to the research questions. The scoped literature can be used to create a theoretical background and determine research gaps (Arksey & O'Malley, 2005). The process of acquiring the related literature was based on a manual search, using multiple search queries. The searches were performed using the digital library on the Digital Games Research Association (DiGRA), Google Scholar and Google. Additionally, references of acquired literature was also regarded as an important source for related literature. The search phrases are listed in Appendix A.

An important aspect of literature reviews is the selection criteria. The selection criteria defines which paper is included and which are excluded.

The resulting list of literature is too large to process in full. A procedure including selection criteria is created to defined which papers are included and which are excluded. The selection criteria for the literature review are:

1. Literature is written in English
2. Literature is not excluded based on age
3. Literature is related to one of the research questions
4. Literature is related to single- or multi-homing

Relevant sources were determined based on title, keywords, abstract and content. The procedure to reduce the list of potential literature starts with the title, followed by keywords and abstract and finally content after a quick scan.

2.2 Quantitative research

The sub-research questions described in Chapter 1 are answered using statistics, combined with charts and an network graph. The approach for each sub question is explained in detail in this chapter.

SQ1: How did platform multi-homing develop from 2006-2013 in the gaming industry? Is there a diversification or consolidation battle going on?

The first sub question is answered by using statistics to provide easy to read figures (i.e. ratio single-home to multi-home, platform preference, et cetera). A tool used to display the results for this question is a chart. The research question can be explained using facts (numerical value) and figures (chart). Besides different numerical overviews and charts, we use network graphs to provide visual changes of the industry. Using network charts to represent a shift from single-homing to multi-homing. This sub question provides detail into the development of multi-homing. The outcome of this sub question covers multiple aspects of multi-homing development, for example:

- Ratio between multi-homing and exclusives between 2006 and 2013
- Change of multi-homing for genres
- Popular platform for games (general, exclusive, multi-homed)

SQ2: Are multi-homers more successful in the gaming industry?

To determine if multi-homers are more successful than exclusive games, sales figures will be used (copies of a game sold). Before the question can be answered, a definition of successful is given as this term is determined by company targets. The term successful has a simple, yet highly subjective definition. However, the term successful requires an indicator; a target usually indicates the intent for a game and can be different per game. This information is not available, therefor to determine if a game is successful the same target will be used for every game to create an equal measure. Below is the definition of successful used for this research, together with two examples, one described as a success and one described as a failure:

Successful; "Having obtained something desired or intended" (Merriam-Webster, 2014)

- An example of a successful game is "World of Warcraft", this game has sold over 15 million copies and has a subscription model that requires everyone to pay a fee per month. The estimated revenue generated to date is $10 billion (Digitalbattle, 2012).
- An example of a game failed to meet its target is "Sleeping Dogs", with an estimated 1.75 million copies sold the publisher (Square Enix) claimed this title as a failure. This indicates that the target was higher than the actual sales (VG24/7, 2013). However, the head of product development claimed that the title is profitable for the company (Gallagher, 2013).

A problem we face to determine the outcome of this research question is a lack of data. In order to accurately determine if multi-homers are more successful, we require data that is not available to the public; development costs and revenue of each video game within our scope. In order to counter this, video game copies sold is used as a measurement to determine if multi-homers are more successful than single-homers.

SQ3: What factors influence platform multi-homing in the gaming industry? Are platforms single- or multi-homed oriented? Are multi-homed genres more successful than single-homed genres?

The third sub question is answered using statistics and literature. Statistics are used to determine if there is a significant differences between single- and multi-homing when looking at platforms and genres. A significant result would indicate that one is favored over the other, this could be true for both platforms and genres.

2.2.1 Database selection

For this research, data will be collected from different sources (databases) regarding games. The data collection consists of data from 2006 to 2013 (October). This time frame was chosen to gather similar data for all platforms. The starting point (2006) was selected, because from 2006 all selected platforms were available. The end point marked the end of the data collection, which was ended at October 2013.

The research data is gathered from different internet databases. These are often informal databases which are maintained by companies or individuals that participating in maintaining internet databases. A selection of three databases will be used. Most internet databases offer user interaction and maybe incomplete, using multiple database should improve the reliability of the data, to provide more accurate results.

A selection procedure by Mosa, Yoo and Sheets (2012) is used to narrow the list of potential databases. The selection procedure (Figure 2.1), depicts the procedure to limit the number of databases. Google was used to identify multiple databases are potential data sources. A total of 106 databases were identified using the search phrases: video game databases, internet video game databases and games databases.

To narrow the number of databases, multiple criteria had to be met in order to qualify as a useful database. Four selection criteria were used to narrow the list of databases:

1. The language criteria has to be met in order to interpret the data. The results contained five databases that did not meet this criteria as they were written in Japanese and French.
2. The data have to cover the scope of this research. This research has a focus on games for the PC, Wii, PS3 and Xbox 360 between 2006 and October 2013. 71 databases did not meet this criteria, some only listed one genre, others only one platform.
3. Six databases were excluded based on incomplete content.
4. The last criteria was accessibility of the internet databases. There is no standard for website or database layout. Limited time and large amount of games, require an accessible database for manual data gathering. 21 databases were deemed not accessible enough. The three remaining database are used as data sources for this research:
   - RF Generation (www.rfgeneration.com)
   - MobyGames (www.mobygames.com)
   - VGChartz (www.vgchartz.com)

A detailed list, separating each database in the corresponding selection criteria can be found in Appendix – B.
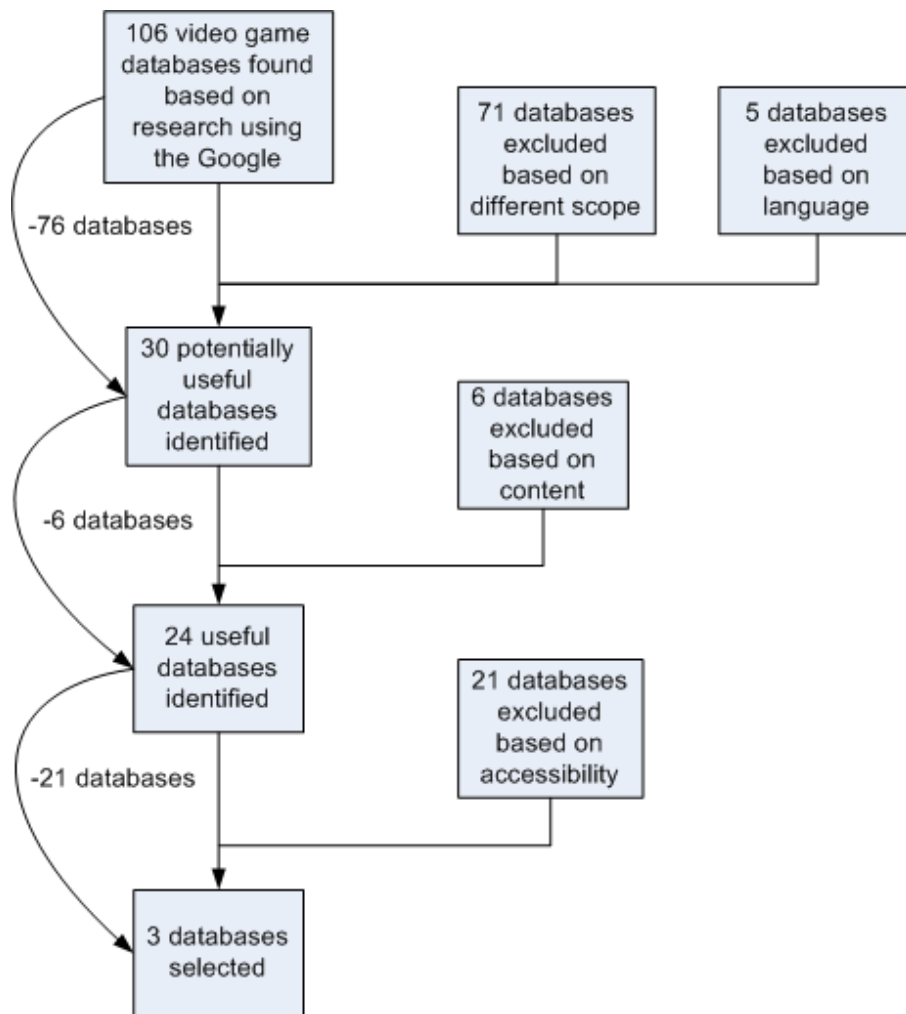
Figure 2.1 – Database selection procedure (Mosa, Yoo & Sheets, 2012)

2.2.2 Data gathering

The data gathering is done manually, from three previously specified sources. Data that is required to answer all of the research questions: game title, platform, genre, developer, publisher, release date and sales figures.

Data from one source will be used for this research, the other databases are used for data verification. As internet databases are mostly based on user entries, different mistakes occur for example; missing data, incorrect data or switched data (developer/publisher listed wrong). Data entries with missing data will deleted, an exception is data with sales figures as only a limited amount of sales figures is freely available. In order to further clean the data before the analysis can take place the following actions are executed:

- Remove out of scope games (entries before 2006 or after 2013, mobile/handheld games)
- Remove adult games
- Remove compilations (multiple game in one pack, as they don't always have the same developer/publisher)
- Remove non game entries (map packs, character packs)
- Remove data with unknown or less than 100.000 (shown as 0) games sold
- Clear inconsistencies in name entries (developer/publisher)

2.3　Data verification

Data verification is performed to match data between databases, in order to test the reliability of the data. Data can be matched via multiple methods, for this research we use an automatic and a manual method. The automatic method uses a database query to match similar data records between databases, the query does not account for manual errors that could be made during the data entry into the source database. Also, the data can contain small differences in styles (example: one database might register the development studio (EA Salt Lake), the other might only include the encompassing (mother) organization (Electronic Arts)). Another aspect of the automatic aspect is the lack of information, the data is only registered as a match or excluded when the data doesn't match, a minor inconsistency excludes the entire record. The manual method can ignore minor inconsistencies and verify the data by scoring each data record. However, the manual method is not viable for large quantities of data, as it requires more time to verify each record.

2.3.1　Automatic verification

During the data gathering phase, data from three databases were gathered, one as a sample database, the others to verify the data. The automatic method is performed on two databases with a combined total of almost 12.000 data entries. The data used to answer the research questions is gathered from vgchartz.com and contains 8.300 data entries. The control data is gathered from Rfgeneration.com and contains 3.583 data entries. This creates a gap of 4.717 data entries that are present in the sample database, but not in the control database. Different layers of manipulation are applied, the first was scribed in section 2.2.2 in this paper, which describes the removal of games from the list. The second layer, is used to remove minor differences between game titles, for example; one database uses a colon, the other a dash to separate the same subtitle. The automatic verification resulted in the following figures:

Matching records	Details
2.563	The 2.563 matching records are based on the combination of Game Title & Platform
2.352	The 2.352 matching records are based on a combination of Game Title, Platform & Year
931	The 931 matching records are based on a combination of Game Title, Platform, Year, Developer & Publisher

Table 2.1 - Automatic verification results

The results of the automatic method demonstrate a decrease in matching records when first adding year as a third factor. This can be explained by different database regions, because release dates can be different based on continent. The databases are located in different regions, as one database is located in Great Britain the other in the United States of America. The difference when adding developer and publisher as a matching parameter is quite large (1.421 records that do not match). However, this difference can be explained based on multiple factors. First, a game can have multiple developers which have to be written exactly the same for both databases (also in the same order). Second, differences between databases in publisher and developer names lower the matching records. As the data extends to almost 12.000 entries, the names have not been manipulated to lower this factor. Third and final, publisher and developer data was registered incorrectly, where developer was registered as the publisher and publisher registered as the developer.

The automatic method demonstrates multiple matching figures, however it lacks depth and flexibility to provide a reliable outcome. The manual method will provide the flexibility to counter the influencing factors that limit the automatic method. The combination of automatic and manual indicates the reliability of the sample data.

2.3.2   Manual verification

The gathered data from the sample database (VGChartz) is manually verified against data from two other databases (MobyGames and RF Generation). To manually verify the data from the sample database approximately ten percent of the data is verified against the control databases. The ten percent translates to 900 records. We used the first 100 records of each 1000 game titles, starting at zero. Each of the 900 records were matched against two other databases, using a five-point scoring system. The five-point scoring system requires five similar characteristics for each data record and matches each characteristic between databases, every match increases the matching score. The scoring ranges from zero to five, zero indicates that the game title is not present in the other database(s), a five indicates that all characteristics match, anything in between indicates a matching number of characteristics. We matched the following five characteristics:

- Game Title
- Genre
- Release date
- Developer
- Publisher

Each game title is combined with a platform, the scoring is based on the combination of game title and platform. The combination of game title and platform provides a possibility of multiple game titles in the verification sample. Each unique combination is matched in similar fashion.

The results indicate a large number of missing game titles in the first database (two-thirds of the sample), the second database has approximately 50 percent missing game titles. The large number of missing game titles in both control databases will drastically influence the verification of the data, for this reason the results are presented in two stages, the first stage includes the missing game titles (resulting in a lower score), the second excludes these titles and focuses solely on matching titles.

Score	Number of Game titles included	Database	Description
1.48	900	Database 1	An average score of 1.48 was calculated including the missing game titles in control database 1.
2.22	900	Database 2	An average score of 2.22 was calculated including the missing game titles in control database 2.
4.23	315	Database 1	The 315 matching game titles in control database 1 scored an average of 4.23.
4.00	490	Database 2	The 490 matching game titles in control database 2 scored an average of 4.00.

Table 2.2 - Manual verification results

Table 2.2 summarizes the verification results to a simple lay-out. The results of the manual verification including missing game titles are below average for both control databases. However,

this outcome is expected when looking at the missing values that result in a game title scoring 0. In order to verify the data that is present in one or more control databases the missing titles are excluded, this results in a score that is well above average for both control databases. Table 2.2 depicts the total number of games for both databases per verification points (0-5).

The main characteristic that lowered the score on both sides were the genres, this was especially true when matching data with control database 2. The error in genre data can be explained based on interpretation and adaptation of genres for each database. Genres are interpreted differently based on experience or insight, one could argue that genres have different levels of abstraction, e.g. a "shooter" can also be considered an "action" game. Another factor that could decrease the consistency of genre data when addressing games is that a game can have multiple genres, which are not always registered with all genres. If the genre characteristic would be removed from the verification method, both databases would score closer to the maximum amount of points (5), however the genre characteristic is part of this study and thus not excluded.

Scoring points	Database 1	Database 2
0	585	410
1	3	2
2	6	19
3	47	116
4	118	195
5	141	158

Table 2.3 - registered verification points per database

The manual verification method indicates that the data matches well above average, with 4 out of 5 points. However, the outcome clearly demonstrates that the data used in this research does contain some minor inconsistencies when comparing the data. The automatic verification demonstrates a decline in the number of matches when adding multiple game characteristics. The decline increases exponentially when adding publisher and developer as a characteristic in the automatic method. The manual verification method added a fifth characteristic (genre) that lowered the outcome of the verification method. Taking the automatic verification into account, we generalize the results of the manual verification to the entire data set and rate the reliability of the data well above average.

2.4   Scope

The increase in technology offers new and more platforms for games, with the relatively new gaming market on smartphones and tablet computers (date), providing easy access into this entertainment branch for everyone.

Because this increase of available platforms, a selection has to be made in order to steer the results and limit the research. Below, possible platforms are listed (selection of the most recent and more popular platforms) and follow by a list of the, for this research, selected platforms. Also a rationale is given on the selected platforms.

- Smartphone & Tablet computer (Android, iOS, Windows)
- Handheld computer (Nintendo DS, Nintendo 3DS, Sony PlayStation Portable, Sony PlayStation Vita)
- Consoles (Nintendo Wii, Nintendo Wii U, Sony PlayStation 3, Microsoft Xbox 360)
- Computer (Windows PC, Windows Laptop, Apple iMac, Apple MacBook, Linux)

For this research the following platforms are selected:

1. Windows PC (PC)
2. Nintendo Wii (Wii)
3. Sony PlayStation 3 (PS3)
4. Microsoft Xbox 360 (Xbox 360)

These platforms are selected for multiple reasons:

1. The platforms have been available for approximately seven to eight years, which offers a large collection of games.
2. This generation has gone through some major changes with the internet becoming mainstream for consoles.
3. The level of competitiveness between selected platforms is extremely high in regard to other platforms, which is good to stimulate the market and to "force" innovation.

3   Theoretical background

This research relies on multiple theoretical foundations. The theoretical background begins with an overview of gaming history to provide some background information on the video game industry, and development budgets. The background continues with single-homing and multi-homing decisions and the impact of those decisions on sales and platforms. Afterwards the video game market is described, which informs about market changes, network effects and different relationships between organizations. Finally the video game ecosystems is described, containing previous studies on ecosystems.

3.1   Video game (console) history

In the earliest days, the pre-cursers to today's games were primitive and limited based on hardware, yet innovative and entertaining enough to start a new market. These games were either full-text adventure games or early tennis derivatives, the most famous tennis derivative is Pong, which was released in 1972 for the Atari (Novak, 2008). Initially games were not created for mass production, as large mainframe computers were required to run these games. In 1972, the year Pong was released by Atari, another company released the first gaming device for home use. The system received the name Magnavox Odyssey after the company Magnavox and popularized the cartridge system for distributing games, a system that is still used today in handheld devices (Baer, 2005). The Magnavox sold well in Europa and North America, as it achieved two million units in sales (Baer, 2005). When technology improved and the market grew size, the Magnavox was classified as a first generation console, along with several competitors. Each generation improved upon the previous with new hardware to demonstrate the change of technology. The industry is currently counting eight generations, these generations are described below to provide background on the gaming industry.

> A generation is used to classify a group of gaming consoles based on specifications and the year they were released. The generations have their own era (life span of the entire generation), and different generations can overlap (e.g. new generation of console starts with a new release, but the consoles of the previous generation are still selling).

First Generation
The success of the Magnavox Odyssey attracted competitors to the upcoming market. These competitors utilized the cartridge system and used similar means of distributing their games (Terry & Babb, 2013). During the first generation the major players were Magnavox with the Magnavox Odyssey, Atari with an arcade system containing Pong (figure 3.1), Coleco with the Coleco Telstar and Nintendo with Color TV Game. These companies paved the way for others and can be considered the foundation of home gaming systems. These days, Nintendo is the only first generation hardware manufacturer still developing new gaming systems, Magnavox was acquired by Philips and used the Magnavox's brand name to introduce a new gaming system and the concept of

Figure 3.1 - Pong

compact disks, Coleco filed for bankruptcy in 1988 after introducing an unreliable home console and Atari recently filed for bankruptcy in July of 2013 (Feld, 2013).
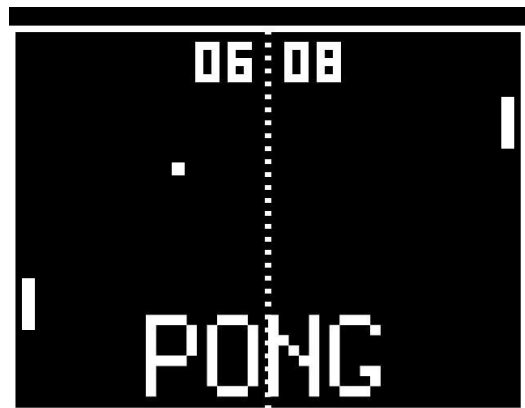
In the second generation the availability of home consoles grew with continued investment from previous players and new additions like the Fairchild Channel F and the Intellivision. This popularity defined the concept of a marketplace for games and created the market around this idea (Terry & Babb, 2013). A different platform which grew from the home gaming industry was the personal computer (PC).

> A platform is "a foundation technology or set of components used beyond a single firm and that brings multiple parties together for a common purpose or to solve a common problem" (Gawer & Cusumano, 2002).

Many well-known legacy systems are still used today for the sole purpose of playing games, like the commodore 64 (figure 3.2) and the Amiga. When the PC became popular, the availability of multiplayer games on these systems became available. The PC using dial-up modems were able to connect to the Internet (figure 3.3), something that was not introduced in the home console market until the sixth generation. However, in this stage the multiplayer aspect only took root as the internet was expensive and by today standards very slow. Next to multiplayer, games were also replicated for other

Figure 3.2 - Commodore 64

platforms, mostly from arcade systems to other platforms, setting the initial steps into multi-homing.

The second generation experienced a new event after its huge success, a market crash (Ernkvist, - 2008). This event caused the second generation to end abruptly. The crash starting in 1983 ended in 1985 after success of the Nintendo Entertainment System (NES), which managed to sell a total of 61.91 million units (Nintendo, 2012; Wolf, 2008).

Figure 3.3 – Dial-up internet connection

Third Generation

Nintendo, who did not introduce a new console in the second generation took advantage of the console crash and introduced a new console the NES (figure 3.4) which dominated the home console market (Terry & Babb, 2013).

Figure 3.4 - Nintendo Entertainment System

Atari, one of the biggest competitors of Nintendo was struck deeply by the crash losing more than 500 million US dollars in 1983 (Ernkvist, 2008). Well known franchises that still thrive to this day originated from the third generation, games like Final Fantasy, Legend of Zelda (figure 3.5) and Dragon

Figure 3.5 - Zelda 2

Quest. The 8-bit NES together with its innovative games shaped the gaming industry. The industry was further changed by the release of Windows 95 for the PC, which together with decreasing prices provided a boost for PC gaming (Terry & Babb, 2013).

Fourth Generation

The Japanese console manufacturers Nintendo and Sega continued to dominate the industry in the fourth generation. With the increasing technical specifications the consoles CPU processors doubled its bit size from 8- to 16-bit, increasing the graphics and sound quality. The major technological influence in this generation is the compact disk. Even though these systems using the compact disks were not as popular as the Super Nintendo Entertainment System (SNES) or the Sega Genesis, they did influence the following generation. Figure 3.2 depicts a SNES cartridge for the game Secrets of Mana, the cartridge, with likely the most popular game character; Mario from Mario world depicted in figure 3.7.

Figure 3.6 - SNES Cartridge

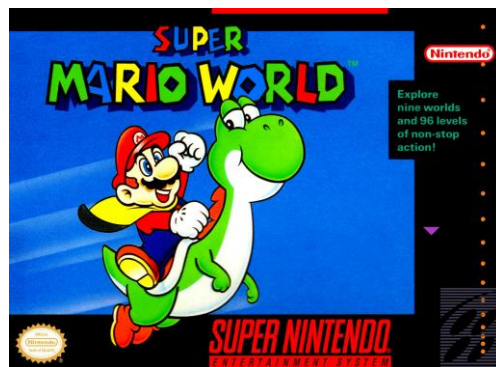**Figure 3.7 - Super Mario world (SNES)**

Fifth Generation

A new major player emerged during the fifth generation and is still one of the largest console manufacturers. Sony introduced the 32-bit PlayStation (figure 3.8) in 1995 using the CD-ROMs as a distribution media for games. Even though the main competitor released a 64-bit platform two years later,

Figure 3.8 - PlayStation

Sony managed to overtake its competitors in units sold. The CD-ROM, which were introduced in the fourth generation are made popular by the PlayStation and are the new standard for the sixth generation.

Sixth Generation
Like the previous generation, a new major player emerged this generation. Microsoft already a platform provider with its operating systems on the PC, released a home console called the Xbox (figure 3.9). Three other players launched a new console, which are the Sega Dreamcast, Sony PlayStation 2 (figure 3.10) and the Nintendo GameCube, but it was the PlayStation 2 from Sony that became the best-selling home console of all time, managing to accumulate 60% market share

Figure 3.9 - Xbox

(Frederick & Sekiguchi, 2003). Major changes occurred in the industry, big-budget titles were produced by well-known publishers like Electronic Arts and Blizzard (Terry & Babb, 2013), multi-homing started to get more attention from major companies and the Internet was associated with every console and big-budget game. With the switch to a console with online capabilities the platform owners build upon their own networks to what is currently a digital distribution network. The switch also ensured that multiplayer got a bigger role in gaming, even if multiplayer was already an important component the online capabilities offered easy access to other gamers via the internet, making you less dependent on friends.

Figure 3.10 - PlayStation 2

Seventh Generation
Currently a transition is happening from seventh to eight generation, the seventh generation is the scope of this research focusing on the PlayStation 3, Xbox 360, Nintendo Wii and the PC (figure 3.11). The increased interest into online gaming in the last generation is continued as a standard for the seventh generation. Each platform has its own online network and marketplace for digital distribution. This new concept for console gaming was already used for PC
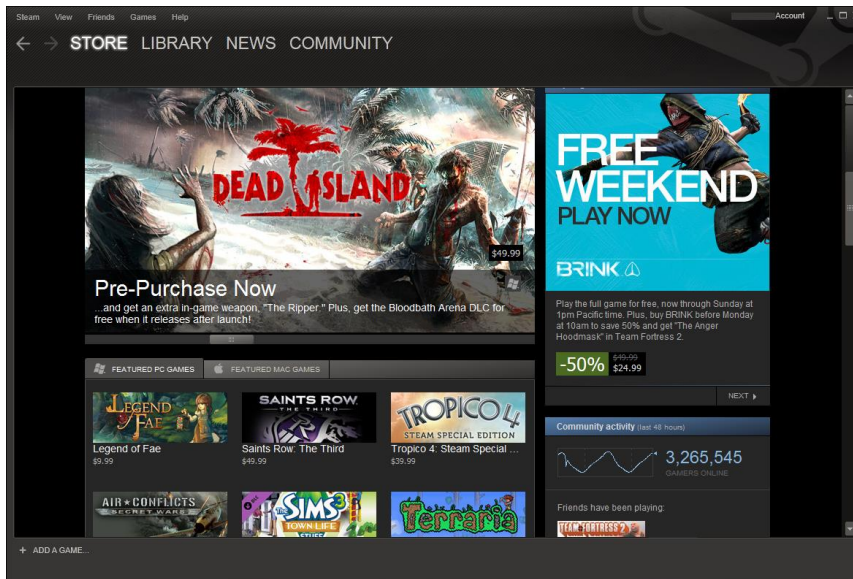
Figure 3.11 - Wii, PS3, Xbox 360

Figure 3.12 - Digital PC platform, Steam

Games (figure 3.12). Digital distribution uses the console marketplace as a distribution platform instead of retail games. Even though the content is offered via the Internet, retail distribution is still ongoing for certain gamers who prefer a physical copy instead of digital copies.

During this generation, multi-homing has grown to be a standard for big-budget games. As consoles are quite an expensive initial purchase, most gamers stick to one console and want big-budget games to be released on their platform. The idea of multi-homing provides a game on multiple (two or more) platforms, however this increases the development costs tremendously when platforms use different architectures. The decision of increased costs versus a higher target audience is extremely important for the success of a game and the company. For this reason, exclusive games (single platform) are still widely used, though losing ground to multi-homed games (Chapter 5, Findings).

Figure 3.13 - World of Warcraft logo

World of Warcraft (figure 3.13), a Massive Multiplayer Online Role Playing Game (MMORPG) was also released during the early stages of the seventh generation. This large scale game is only available on the PC and paved the way for new MMORPGs (most of them are known as clones). This long-lasting single-homed multiplayer game has a monthly subscription model, where a user has to "pay to play" , paying roughly $12 per month (~$ 12). At its peak World of Warcraft had 12 million subscribers around the world.

<u>Eight Generation</u>
The latest generation started with the launch of the Nintendo Wii in 2012 and has recently been expanded by the PlayStation 4 and the Xbox One. The latter two use a similar architecture to PC, which should provide an easier experience for developers of multi-homed games. This feature impacts the ease of development as only two architectures are used (Nintendo uses a different architecture), this leads to shorter development time which should result in lower development costs. The development efficiency and costs reduction has yet to be proved.

3.1.1   Development Budgets
The gaming industry offers a wide selection of games, ranging from large games created by large development studios, to small games developed by a handful of people. With the increasing demand

and expectations of higher quality games, the development costs are rising exponentially. The definition of a better game is highly subjective and will most likely differ for each person. For example one person thinks graphics are valuable and expects better graphics, while another favors the storyline and less about the graphical aspect of the game. A developer must find a suitable balance for their game that addresses multiple features.

Information regarding the development costs is often kept private. When published, the information is often integrated in one figure for both marketing and development cost. These costs are directly related to one another, however they are not proportional to each other. The combination of both figures hinder the potential market analysis on the development costs.

A graph visualizing the development costs is depicted in figure 3.14. Kotaku (2014) provides a list of publicly available figures and state that the data might not be accurate as figures are acquired from media platforms, interviews, books and many other public sources. All data in the graph are based on publicly available data (Kotaku, 2014; VGsales; Jonathan, 2006; Gameinvestments, 2010). The costs from Kotaku and VGSales are averages, because multiple entries were available, an average was used in this graph.
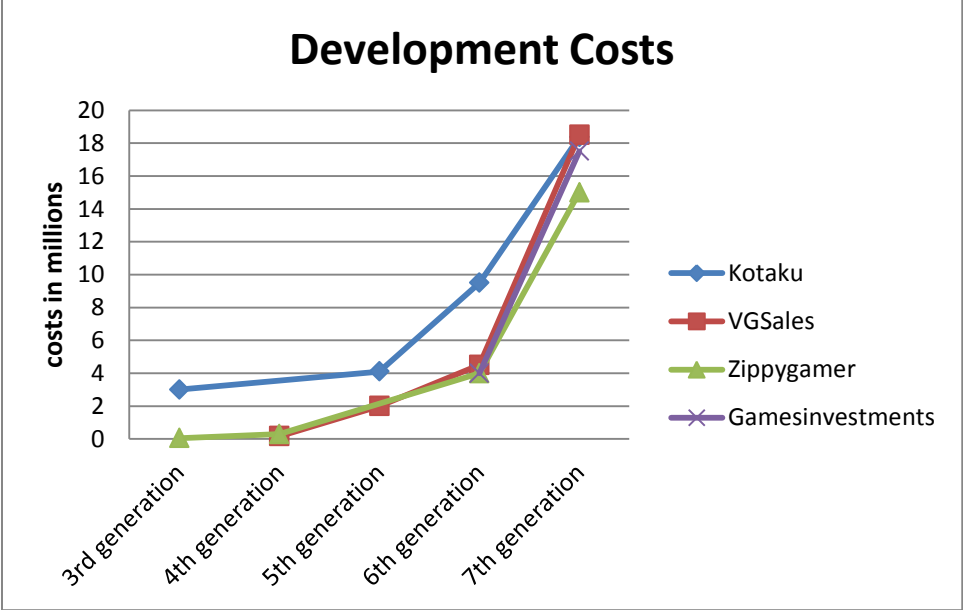
Figure 3.14 – Video game development costs over multiple generations

Figure 3.14 depicts an increase in development costs over multiple years. These years represent different generations, starting in the third generation. According to these development costs, the first entry by Kotaku's is considerably higher than VGSales and Zippygamer, as there is almost $3 million difference. An explanation for this difference could be related to different data, Kotaku provides a single game entry, while Zippygamer provides a single figure and no game reference. However in 2004 (the start of the seventh generation), most of the sources are located near the 18 million mark, which is more than four times the previous number of 4 million. However, the retail price of a game at release has been constant around $50, this requires higher sales to break even. The growing development costs negatively influence the chances companies are willing to take on new games (Jonathan, 2006). Crossley (2010) mentions a difference in development costs between single-homed games and multi-homed games. He states that the average development costs for a

single-homed games is 10 million. He also states that the development budget for a next-gen multi-homed game averages between 18 million and 28 million. The next-gen refers to the upcoming generation of consoles (the eight generation). Expectations regarding the increase in development costs for the next-generation vary, some state a 5-10% increase (Kowaliski, 2013), others expect the costs to double (Mattas, 2012).

3.2   Single- and multi-homed

The decision to single- or multi-home becomes more important for developers and publishers. With the increase of costs in development, the risk of investing in a new multi-homed game increases. For this reason, the decision to single- or multi-homed has a bigger impact, as the initial investment is almost double. The choice to single-home lowers the development costs and initial risk of investment, because no adaptation for multiple platforms is required. A potential bonus for single home are exclusivity fees. These exclusivity fees are paid by the platform owner to persuade sellers to single-home their game (Landsman & Stremersch, 2011). Barnes (2007), Edwards and Grover (2008) state that single-homing decisions, made by movie studios supports the adoption of a new technology. The adaptation of Sony's Blu-ray over Toshiba's HD DVD is partially credited to movie studios by single-homing on Blu-ray instead of multi-homing on Blu-ray and HD DVD. The exclusivity fees paid by Sony to different movie studios increased the value of the Blu-ray technology and decreased the value of the HD DVD, which eventually resulted in the adoption of the Blu-ray technology (Barnes, 2007; Edwards and Grover, 2008). On the other hand, if the seller choses to multi-home their game, they are able to reach a much larger audience, which increases (potential) revenue.

The choice to single- and multi-home is not only important for developers and publishers, but also for the potential platforms. This is because, both single- and multi-homing have a different effect on the value of a platform (Landsman & Stremersch, 2011). One reason for this effect is differentiation, a platform can differentiate itself from other platforms using different strategies for the platform. Nintendo (a gaming company that has been active in manufacturing game platforms since the first generation) offers a platform centered around single-homed games. Out of the three console manufacturers used throughout this research, Nintendo is considered to be more casual and child/family oriented. However, the innovative aspect of motion controlled gaming made Nintendo's console (Nintendo Wii) the highest selling platform of the seventh generation, to this day. Landsman and Stremersch (2011) state that differentiation from competitors provide a greater resistance to competitor attacks. This differentiation is used in the gaming industry to increase the platform brand. Nintendo provides buyers with strong single-homed games, franchises with a lot of history. The use of single-homed games (even in small numbers) can achieve greater differentiation than platforms with many multi-homed games (Mantena, Sankaranarayanan & Viswanathan, 2007). An example is Atari, a famous console manufacturer and game developer. The game Pong released by Atari in 1972, became Atari's first success (Herman, Horwitz, Kent & Miller, 2002). The success of Pong started and credited the Atari brand.
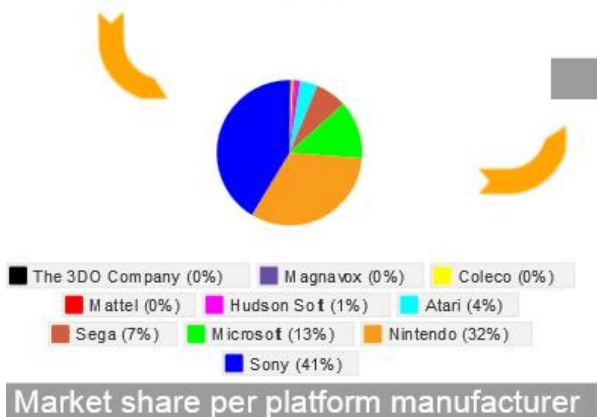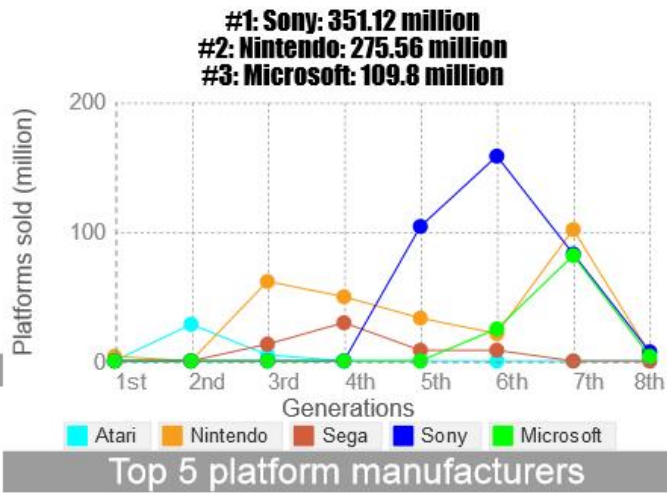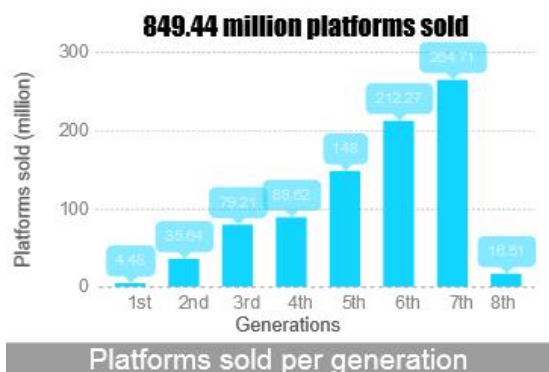
However, as part of a two-sided market differentiation is not only between games, but also between platforms. Each platform competes with the others in the same market, trying to improve its market share. Besides differentiation, multiple factors influence the acquisition of market share in a consoles life cycle.
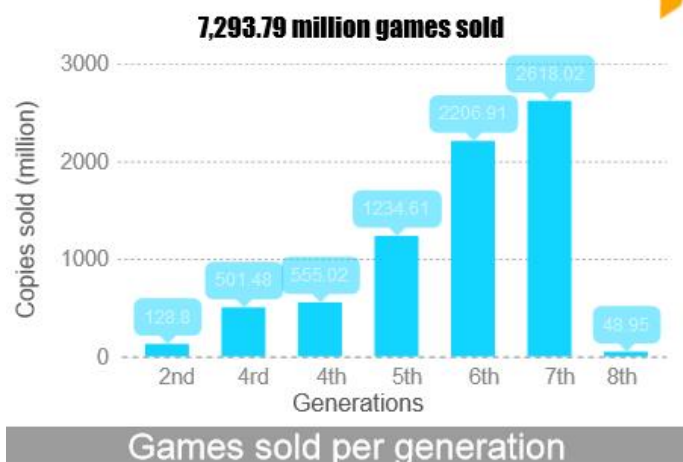
3.3   Two-sided Market

Landsman and Stremersch (2011) state that the maturity (age) and market share of a platform influences the effectiveness of differentiation. Landsman and Stremersch (2011) prove that a negative relationship between multi-homed games and platform sales of new platforms exists and fades over time, demonstrating the initial importance of platform differentiation. The same is true for platforms with a small market share (Landsman & Stremersch, 2011). Furthermore, the study shows that characteristics of a platform can influence multi-homing if characteristics do not match the seller's games (e.g. if a platforms biggest characteristic is "all ages" content, a "mature" game is more likely to be released as a multi-homed game). The outcome clearly demonstrates that new platforms benefit from single-homed games positively and negatively from multi-homed games, also that this effect decreases as a platform matures. However, research regarding the seventh generation of console shows that both a head start and innovation increases the chance for market share (Terry & Babb, 2013). Terry and Babb (2013) state that the Nintendo Wii was launched 12 months after the Xbox 360. The Wii managed to outsell its competitors and take the highest market share of the seventh generation (43.5%), based on its motion control technology. The head start landed the Xbox 360 29% market share and the PlayStation 3 with 27.5%. Landsman and Stremersch (2011) confirms that the PlayStation 3 had a slow launch with 60% of its games (out of 17) that were multi-homed, in April 2008 this figure has increased to 75%. This lack of differentiation could have hurt the PlayStation 3 in initial sales, as the research shows that new platforms suffer more from multi-homing than mature platforms. Arthur (1989) states that two-sided markets tend to favor the largest-share platform. A large market share is easier for buyers to measure as value (Schilling, 1999), than the number of single-homed games present on a given platform. Having a well-developed entry strategy, a head start and technological innovation or just a good launch line up of single-homed games will favor the initial launch of a platform. Figures 3.15 demonstrates the increase in sales for both platforms and games. The figure also depicts the market share per generation and overall. This visualization demonstrates a decline in market share for Nintendo after its initial success with the Nintendo Entertainment System in the third generation, but claimed the highest market share for the seventh generation. The opposite is true for Sony, which had initial success in generation five and six, but lost the top position to in generation seven.

Figure 3.15 - Infographic gaming industry sales (data sources: mainly VGChartz, Wikipedia)

3.3.1 Network Effect

In the previous paragraphs, the term network effect has not been mentioned, however the effect has been partially described and explained using multiple examples.

> A network effect is "the effect where one user of a product or service influences the value of that product or service for other people" (Shanker & bayus, 2003).

For example, if a gaming platform is released without any games and services, the value of this platform for buyers and sellers is low, because there is no incentive to buy this platform. The value for buyers is primarily based on the number of games the platform offers, for sellers the value is the number of buyers. The network effect ensures that the platform owner attracts sellers to develop games, which in turn attracts (potential) buyers. This effect increases as more buyers and sellers support the platform, which in turn increases the value of the platform. This network effect is described as a two-sided network effect (Katz & Shapiro, 1994; Rochet & Tirole, 2006; Parker & van Alstyne, 2005). This positive network effect can potentially reach critical mass and become a negative effect, which is called congestion (Rochet & Tirole, 2006; Lee, 2008). When a critical mass is reached, each new buyer decreases the value of the product for other buyers. For example, the value of a news website increases with each reader, however once critical mass is reached each additional reader will increase the websites load, which slows down (or crashes) for other readers.

The coordination of attracting buyers and sellers is known as the chicken-and-egg problem (Evans, 2003; Caillaud & Jullien, 2003; Hagiou, 2006). This coordination problem is applicable in many markets, where the platform has to attract buyers before the platform has multiple established sellers, also the platform has to attract sellers without the investment of buyers. The chicken-and-egg problem is sometimes solved by collecting a share of the revenues from one user group, while lowering the threshold for the other user group, perhaps even taking a loss (Evans, 2003). For example, the PlayStation 3 had an estimated development costs of $800 (20GB version) and $840 (60GB version) (Reisinger, 2010; Kanellos, 2006), however Microsoft's Xbox 360 was priced at $299 and $399 (Surette, 2005). Sony released the PlayStation 3 with a launch price of $499 and $ 599. This meant an initial loss of a hundreds of dollars per sold platform, but lowering the threshold for buyers. In order to cover the loss, the platform will charge a fixed fee on the seller side per sold game.

3.4 The Video game Market

The video game market has experienced a tremendous growth since the start of the video game industry. The video game industry, once small and collective, has evolved to rival the movie industry for household entertainment. During the seventh generation the annual US sales have grown from $7 Billion to over $10 billion in 2009 (Siwek, 2007), even when the economy as a whole was struggling the gaming industry managed to grow (Rishe, 2011). The growth of the video game market, also introduces new platforms that support the growth of the market, platforms such as mobile phones (smartphones) and tablet computers have become increasingly more popular. Initially smartphones and tablet computers were not developed as gaming platforms, but these days these platforms are increasing in popularity and have a low entry level as the prices for these games range from free to play (usually contains advertisements or in-game purchases to generate revenue) to a couple of dollars. As video games are becoming more entrenched in daily lives and the availability of games on different platforms increases, it is likely that people are buying a variety of games on a variety of different platforms (Terry & Babb, 2013). The gaming market is not just expanding in home

entertainment. Games are used in multiple industry for training purposes, as Aldrich (2009), Reeves and Read (2009) state that the US military spends roughly $6 billion annually for training purposes.

The changes in budget regarding development and marketing costs are rivaling the movie industry's budgets, with some budgets even exceeding $100 million. In 2008 a game called Grant Theft Auto IV was created with a $100 million budget (Terry & Babb, 2013). This game managed to gross $310 million within the first 24 hours, taking the title of the most successful entertainment release, managing to outsell books and movies. This feat, according to Stuart (2011) was bested by Modern Warfare 3, which managed to gross $775 million in its first week. Furtado (2014), Graser (2014) claim that the latest Grand Theft Auto game had a development budget of $260 million, and managed to gross $800 million within the first 24 hours and surpass the $1 billion in three days. As the industry continues to grow these figures will increase and demonstrate the possibilities in the video game industry.

Prato, Feijoo, Nepelski, Bogdanowicz and Simon (2010) visualize the growth of the global video game market, starting in 2006 with roughly $33.5 Billion estimating a total of roughly $82 billion in 2015. These figures originate from 2010 and demonstrate an increase of $12,5 billion from 2006 to 2010 and claim that the industry will grow to $70 billion in 2013, an increase of 27%. However, Gartner(2013) estimates the global video game market at $93 billion in 2013 and forecasts $111 billion in 2015. The forecasts are based on current changes in market segments new platforms, trends and emerging markets. Both Gartner (2013), Prato et al. (2010) state that the mobile market will demonstrate significant growth. The figures demonstrate that the mobile segment increased by $3.9 billion (42%) between 2012 and 2013 (Gartner, 2013). The forecast is likely to follow the smartphone trend and increase value to the mobile gaming segment. One platform that is continuing to decline is the PC. The steady growth the PC experienced up to 2000 (Williams, 2002) has shown decline ever since.

Prato et al. (2010) depict the decline in PC game market in three major regions (North America, Europe, Middle East, Africa (EMEA) and Asia), only Latin America demonstrates an annual increase in the PC market. Out of the three major regions, PC gaming is still relevant in EMEA and provides approximately two-thirds of the revenue. However, in 2004 the PC gaming segment only accounted for 17% of the gaming industry and decreased to 8% in 2009 (Prato et al., 2010). The opposite is true for the console and handheld gaming market and continues to grow in all regions. The relativity new segment online and mobile gaming is also growing in all regions. Online games provide a new approach to gaming as it has a strong focus on multi-homing. This type of multi-homing is also related to the availability of the product on all platforms, however the platform is not taken into consideration. The game is played on a website and requires an Internet connection, a browser and an account to play (Prato et al., 2010).

The Internet, not online provides connectivity options for gamers or platform independent games (online games), but also new distribution methods. These new distribution methods change the supply chain of the gaming industry. A traditional supply chain, which provides a hardcopy of the game via a retail or web store (reseller) is depicted in figure 3.16 (Prato et al., 2010):
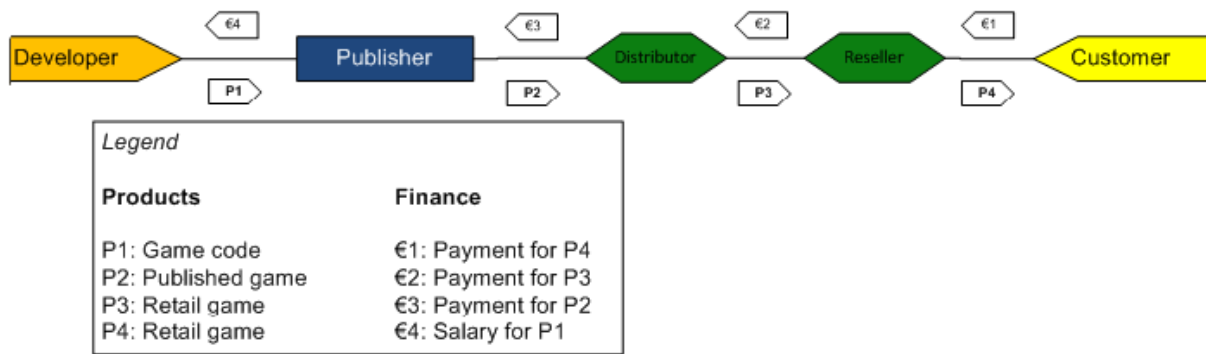
Figure 3.16 - Retail distribution process of a game

This simple representation only describes the supply chain from developed product to customer, excluding combined roles such (one company performing multiple steps). Phillips et al. (2009), and Tomaselli, di Serio and de Oliveira (2008) provide two different complex views on the supply chain. Both views add more players to the model, which enhances the relationships between the players.

One of the new supply chains requires an internet connection to transfer the game to the customer. This distribution method is known as mobile or digital distribution (Prato et al., 2010), depicted in figure 3.17:
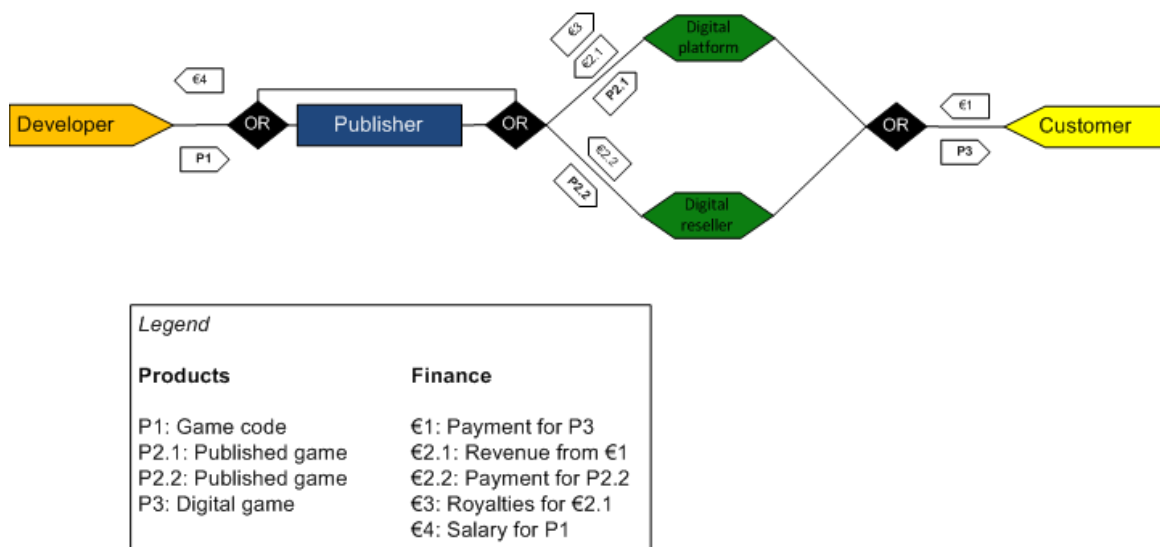
Figure 3.17 - Digital distribution process of a game

For the digital distribution the publisher is not always present in the supply chain. Digital distribution provides cheaper means to release and market a game as the platform or reseller will promote the release in order to sell copies. It is still possible for a publisher to fund a game and participate in the supply chain, if this is true than P1 will go to the publisher, else P1 is internal and a published game (P2.1 & P2.2) is sent to the digital platform and reseller. The salary €4 is only available when the game is developed with a publisher.

Another new supply chain, uses the internet to connect developers and customers via an online game (Prato et al., 2010), depicted in figure 3.18:
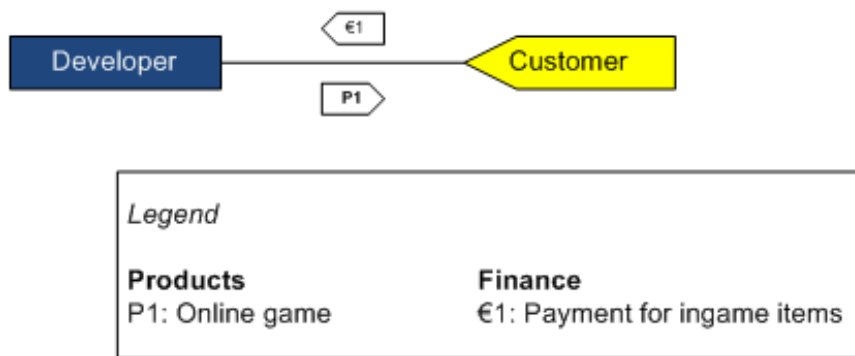
Figure 3.18 - Online game distribution process

The purchase price between retail- and digital distribution, is not necessarily different. However, the percentage of revenue acquired by the developer for each purchase is different. Prato et al. (2010) depict an 8% royalty fee per game sold using the retail driven supply chain, 40% revenue for digital distribution (without a publisher) and 100% revenue for the online supply chain.

The value of digital distribution is increasing and has already surpassed the retail distribution in sales. The distribution offers a fast and easy portal to a new game, by offering games digitally on the players selected platform. The retail distribution is also changing, with online retailers shipping the purchased game to the customer. Even though retail distribution is losing ground, the physical media is unlikely to disappear within a short amount of time. Publishers provide special editions that which vary in price from $70 to $150 and offer different extra's (e.g. art book, figurines, cards, soundtrack) per game.

3.4.1 Developer and publisher relationships

Throughout the thesis multiple referrals to two roles have been made namely, the developers and publishers. However, neither of them have been properly introduced, which is required in order to take the underlying relationship into account. To start off, the developer is responsible for designing and creating the game from concept to finish product. The development team (most often) consists of multiple people, that can range anywhere from a single person up to 70 (Wilson & Zackariasson, 2007), possibly even higher. The market growth provides opportunities for game developers. With the costs of development projects increasing a developer has multiple options, a; develop the product as an independent game developer, funding the development and marketing the game without using funding from a publisher or b; develop the game together with a publisher that markets the game. A publisher provides three main aspects to video game development, 1; a publisher provides the funding to develop a game, 2; markets the game using their established network and 3; make sure that games are distributed via several channels (digital platforms and physical copies (Wilson & Zackariasson, 2007).

When developing a game in combination with a publisher, new game ideas are pitched to the publisher using a playable product or "mock-up" screenshots (Wilson & Zackariasson, 2007). This pitch is the initial stage of a new game idea, to progress to the next goal, a prototype). This prototype is an initial test version of the game that is created within half a year. Based on the prototype the continuation of a project is decided. In this stage the return on investment (ROI) is assessed by the publisher. During this stage both the developer and publisher discuss conditions under which the game is developed (Wilson & Zackariasson, 2007). The same steps are true when a publisher

approaches different development teams with game ideas or general concepts and require individual pitches to partner with a development team.

Perez (2012) describes important distinctions between the two parties. A developer is solely focused on the game, providing a high quality game with a lot of content that is valuable for the customer. The publisher tends to focus on numbers, size of the demographic or the success of previous (franchise) titles, which is supported by Johns (2006). These different approaches conflict with each other, and are resolved in favor of one party, which could influence the game. Lien (2013) states that these conflict don't always end in a one-way-street, where the developers have to succumb to the publishers demand. Johns (2006) explains that publishers make money of the developers ideas and retain the Intellectual Property (IP) rights.

A third party that is introduced is the console manufacturer. The console manufacturer has direct control over the platform and because of this, direct power over publishers (Johns, 2006). The manufacturers measure quality of games, before they are released, and reject a game if desired. The relationship tends to focus on the technical aspect, however Microsoft performs a concept approval on top of that (Johns, 2006).

3.4.2 Three major platform companies

The console market currently has three major players, providing platforms, games and services for buyers and sellers. The three major players adopt a different strategy in regards to the gaming industry. To start off with Nintendo, the one with the longest gaming history. The Nintendo platform (Wii) provides a human interactive motion controlled gaming experience. This experience was not only innovate for its time, it also combined gaming with motion. During the previous generation (sixth), Nintendo's platform the GameCube was unable to compete with Sony's (PlayStation 2) in terms of market share and was slightly behind Microsoft's first console (Xbox) (Frederick & Sekiguchi, 2003). The Nintendo Wii was released in 2006 and has a focus on single-homed games (Terry & Babb, 2013), to increase value and a stronger brand name. The innovative platform managed to outsell both its competitors gaining the highest market share of this generation. With the release of the Wii U, Nintendo started a new generation ahead of its competitors, using a Gamepad as its main controller which is received with mixed reviews.

The second platform to compete with Nintendo for the largest market share is Sony with its platform the PlayStation 3. Sony, like Nintendo released its console roughly 12 months after the Xbox 360 from Microsoft. In the previous generation the PlayStation 2 reached a staggering 60% market share (Frederick & Sekiguchi, 2003). The new technologically advanced PlayStation 3 was priced higher than its competitors and provided initial challenges for developers. The new Cell-based architecture from the PlayStation 3 was difficult and unfamiliar for developers, resulting in mostly multi-homed games during the consoles launch.

Microsoft's Xbox 360 was the second console to be manufactured by Microsoft. With the Xbox 360, Microsoft changed it initial strategy with the Xbox as a pure gaming machine to an all-round machine. The functionality of the Xbox 360 was not only applicable to gamers, but all forms of multimedia. In the first year of the Xbox 360, the console was technologically more advanced than its competitors, providing better specifications, but also focusing on the Internet. Microsoft was the first manufacturer to include its own network with the Xbox 360, which is called Xbox Live. This functionality, provides an online service with two subscriptions (free and paid). The Xbox live

network only offers limited functionality for unpaid subscription, the paid subscription offers full access and granted players the ability to play multiplayer games. Microsoft also introduced to concept of achievements to the console market. Achievements are rewards for completing objectives in games or any other Xbox live service (e.g. fully completing a game). These achievements are implemented to increase the longevity of a games, by providing extra objectives to complete. These changes on the view of gaming were also included by the Xbox competitors, providing Internet functionality and media functionality. However, only Nintendo made the strategic decision not to compete as an all-round media platform and focuses on games.

3.5   Impact of reviews

A relatively new aspect for many products and services are reviews. Before the Internet, reviews were based on organizations providing a service to check for instance the quality of a restaurant or on word-of-mouth when someone shared their experiences. With the availability of the Internet, almost everything receives a review from customers expressing their satisfaction or dissatisfaction. These reviews are mostly related to a personal experience with a product or service. This means that everyone is able to review, which might not necessarily be a positive effect, as a reviewer can be driven by an emotion, which influences the objectiveness of the review. The goal of a review (positive or negative) is to inform others about the positive and negative aspects of a product or service, who based on this review can make a more informed decision. The effect of reviews are different for each market. For example, people are less likely to be turned off by a "bad" game than poor employee hygiene in a restaurant.

A market that has a lot of (professional) reviewers is the games industry. This industry has a lot of reviewers that are paid to review games. One of the reasons for the large number of (professional) game reviewers is the size & quantity of games. There are thousands of games available on a multitude of platforms all varying in size. Another reason is quality, because of the large number of games that vary in size and quality it requires extensive testing, to provide an adequate review. One obvious reason is supply and demand. The increasing market attract more gamers, which in turn use reviews to gather information before purchasing a game. The industry also supports users critics, similar to the movie industry, where a company reviews a movie and provide their reviews.

However, Visser (2012) states that user review scores are influenced by company review scores. This effect (based on a 0 to 100 scale) exists when the company review score changes by one, it would result in an user increase of 0,6. He continues that this effect increases sales by 3.5%. Further result shows that games developed in Asia do not sell as well as European counterparts, however these games are rated more positively by users. The study also shows that single-homed games receive a higher user score and the involvement of the console manufacturer as a publisher increases sales with 50%.

Visser (2012) demonstrates the effect of review scores on game sales, however the research does not include user and developer interaction before the release of a game. In the gaming industry, the a game is tested throughout its development, but developer interaction with potential customers is increasing during this process. Developers provide potential customers and reviewers early access to play and test their product. These test phases are publicly known as Alpha and Beta tests. The alpha tests are (always) internal and occurs early in the games lifecycle. This version is incomplete and does not represent the final product. Beta testing closely represent the final product and often occurs in

two stages, closed beta and open beta. The first stage requires an invite by the developer to be able to participate in the beta test. The second stage is accessible for everyone. The public test provides user interaction to eliminate bug or performance issue before its release (Dolan, 1993). Dolan (1993) states that the beta test provides a optimization aspect as well as an advertising aspect. They also notice the possible negative effect and relate this to too many bugs or poor design. The interaction with potential customers could provide a negative or positive effect, that can influence the user review score, before the official release. Future research combing reviews and beta testing, could result in new development strategies, where one aspect (beta testing) is used to positively influence another aspect (review scores).

3.6   The video game ecosystem

As described in a previous section, in the video game industry different organizations and users complement each other. The interaction creates a network of different organizations in the industry, which can be described as an ecosystem. Ecosystems are used to describe and study the relationships between actors (organizations or individuals) within market(s), industries or specific networks (e.g. game developer network) (Jansen & Finkelstein, 2009). An ecosystem is not specific to the relations between actors in industries, the concept originated from biology, in which an ecosystem is a natural unit that contains all living organisms and non-living factors in an area (Smith, Smith, Hickman & Hickman, 2006). Moore (1993) described natural ecosystems as self-reinforcing systems, in which multiple species were dependent on each other. Based on the natural ecosystem, Moore 1993 states that organizations have a similar dependency, and defined the business ecosystem as follows:

> "An economic community supported by a foundation of interacting organizations and individuals. The economic community produces goods and services of value to customers, who are themselves members of the ecosystem. The member organisms also include suppliers, lead producers, competitors, and other stakeholders. Over time, they coevolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies. Those companies holding leadership roles may change over time, but the function of ecosystem leader is valued by the community because it enables members to move toward shared visions to align their investments, and to find mutually supportive roles."

However, Jansen and Cusumano (2012) argue that a difference exists between a business ecosystem and a software ecosystem. They differentiate both ecosystems based on specific characteristics related to the software industry. They relate software ecosystems as a subset of business ecosystems, focusing only on software related organizations and individuals (Jansen and Cusumano, 2012). Jansen, Brinkkemper and Finkelstein (2009) define a software ecosystem as follows:

> "A software ecosystem is a set of actors functioning as a unit and interacting with a shared market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform or market and operate through the exchange of information, resources and artifacts."

The difference between the two ecosystems is important when describing the video game ecosystem, because a video game can also be classified as software. Johns (2006) states that the video game ecosystem consists of multiple adjacent industries, such as software, audio and video.

MacInnes, Moneta, Caraballo, and Sarni (2002) describe the addition of the smartphone- and telecom industry when considering mobile games. However, the same can be said about the software industry. The definition of a software ecosystem corresponds with previous sections in this literature study. Currently, no definition for video game ecosystems exists. The definition of software ecosystem closely resembles the video game ecosystem and will be adopted throughout this paper.

Vaz, Nogueira, Rodrigues and Chimenti (2013) describe the existence of a superstar in the video game industry and describe the superstar as:

> "a software title of exceptional quality, which yield a disproportionate payoff and even positive effects on platform sales".

They demonstrate the effect of the superstar sales in a network graph comparing platforms, publisher and relates the location of the publisher to the amount of sales on a particular platform. A publisher that single-homes is located close to that particular platform, a multi-homing publisher is located based on the sales (higher sales on Xbox, located the publisher closer to that platform and further from others). V17n demonstrates superstar strength and advises new entries to partner up with established parties (e.g. Nintendo, Microsoft and Sony).

3.6.1 Actors and relationships

In the (video game) ecosystem, actors play an important role as they create, exchange and innovate with other actors in that ecosystem. Actors can influence other actors, the value of other actors and the value of (other) products. Van Angeren (2013) defines an actor as follows:

> "An entity that shapes, orchestrates, participates in, or contributes to an ecosystem depending on its role, type and purpose. "

Van Angeren (2013) describes multiple classifications for actor within a software network, and presents three roles based Iansiti and Levien (2004), Iyer, Lee and Venkatraman (2006), Jansen, Brinkkemper, and Finkelstein (2009). These roles are Keystone, Dominator and Niche Player. In the gaming ecosystem a keystone is a platform (e.g. Nintendo, Microsoft and Sony), a Dominator is a big publisher (e.g. Electronic Arts) who acquires or eliminates the competition and the Niche player is the developer. However, classifications can be made based on requirements or relationships.

Another aspect of an ecosystem is the relationships between the actors. In network analysis the relationship provides the information regarding the ecosystem and the connectivity of the ecosystem. Van Angeren (2013) defined a relationship as follows:

> "A connection between two or more actors, characterized by the flow of products, services, money and intellectual property."

Vaz, Nogueira, Rodrigues and Chimenti (2013) describe the relationship between a superstar title, a platform and the customers. The relationship can also demonstrate platform loyalty and market change. The change of an ecosystem over time can provide interesting results, that can be used by actors to react to.

3.6.2 Network graph

Network graphs are a visualized representation of a network. The network graph consists of nodes, which represent the actors and edges that represent the relationship between the actors (Vaz,

Nogueira, Rodrigues & Chimenti, 2013; van Angeren, 2013). This graph demonstrates the relationships between different actors, but can also demonstrate their connection to one or more platforms. When a network graph depicts a centralized ecosystem, one central actor is surrounded by different actors. Research of a single company/platform would result in a centralized network graph, as the connections are related to the central actor. The centralized ecosystems can provide insight into other central actors (Baldwin & Woodard, 2009). Baldwin and Woodard (2009) describe a negative effect of a network graph, when the complexity is increased it adds to the clutter in the graph.

A network graph can result in a highly complex representation of the ecosystem, which is hard to analyze based on observation. Network analysis, provides a solution by using qualitative measures that describe the structure of a network (van Angeren, 2013). (Venkatraman & Lee, 2004) visualize the video game ecosystem and used network analysis to study these ecosystems. Van Angeren (2013) visualized the Google apps ecosystem and used network metrics to analyze the ecosystem. A network metric is a measurement for a particular aspect of the network graph (e.g. size or density).

Figure 3.19 depicts an example of a gaming ecosystem. The example contains multiple platforms and developers, both are connected based on the games created. Figure 3.19 demonstrates different aspects of the network as both single- and multi-homing are demonstrated in this figure. The figure created by venkatraman and Lee (2004) excludes developer names to remove cluttering, but added size differences based on the number of titles released (size of the squares and circles is proportional to the number of games released by a developer on one or more platforms).
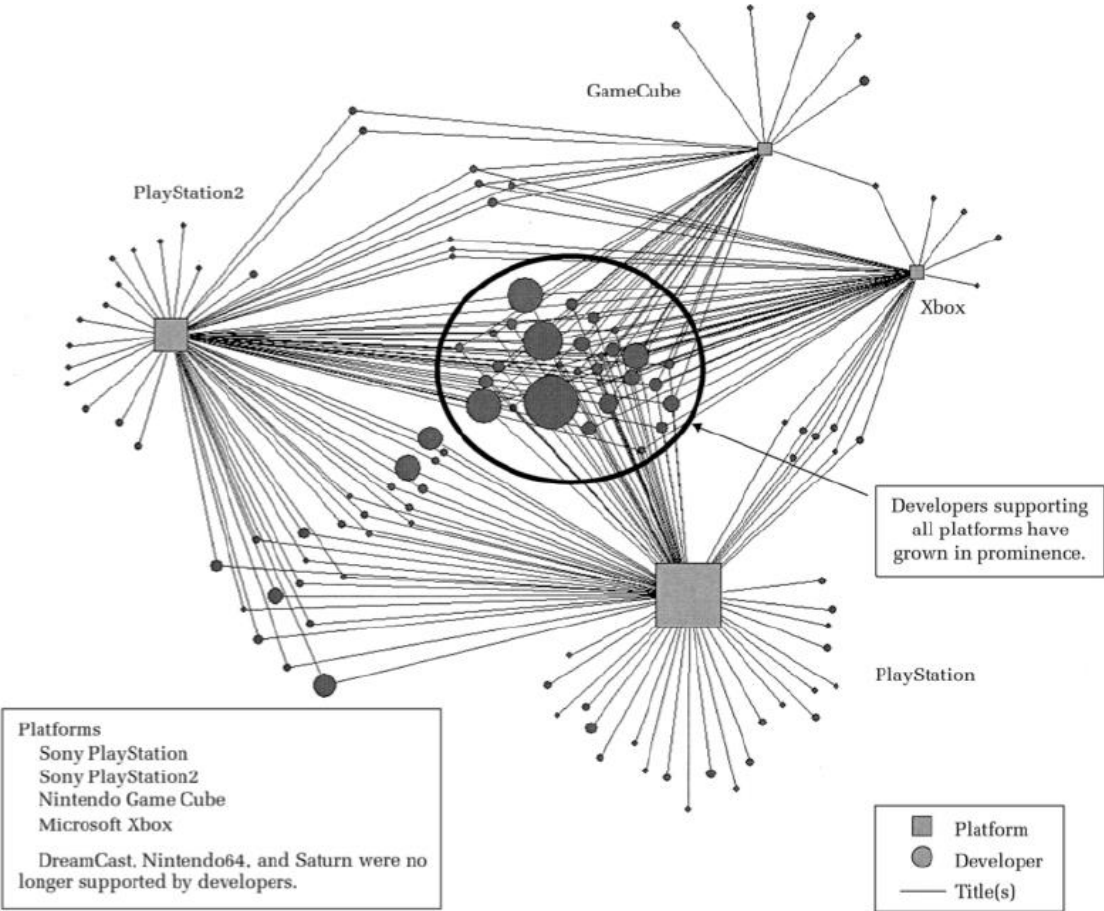
Figure 3.19 - Gaming ecosystem example (Venkatraman & Lee, 2004)

3.7   Reflection

The theoretical background covers various topics that are related to the gaming industry. These topics are described using published papers and news articles to create a background for the thesis. The topics are also related to the research questions described in Chapter 1. With an emphasis on single- and multi-homing in the gaming industry, this research covers a broad spectrum of influences on strategic decision making.

The research conducted in this thesis document describes single- and multi-homing in the gaming industry, advancement of multi-homing compared to single-homing, the success of multi-homing and relationships among developers and publishers in relation to multi-homing. These aspects are all multi-homing related and are used for creating a strategy model concept and important factors when developing a development strategy for a game. The model and factors were created for developers and publishers, to support them with the decision between single- and multi-homing. The decision to single- or multi-home is important for multiple parties, not just developers and publishers. The theoretical background provides the theory behind the effects of a single- or multi-homing decision. Using different aspects of multi-homing research, provides a broad background for our research project. The decision to widen the background, was made based on the lack of research regarding multi-homing in the gaming industry. The majority of the multi-homing research papers found relate to the development of multi-homing, which is not part of this research project. The large selection of related multi-homing aspects, are used to determine multiple factors that influence multi-homing in the gaming industry.

4   Results

The preceding chapters provided the theoretical foundation for this thesis, this chapter described the findings of the quantitative research and provides answers for the research questions. To provide an answer for the research questions a scope was created to limit the research in size, the scoped platforms are; Xbox 360, Nintendo Wii, PlayStation 3 and the Personal Computer (no Mac or Linux). These platforms were selected based on the availability of data and the impact these consoles have had on multi-homing. The required data to test the corresponding research questions' hypotheses, is gathered from multiple sources to verify the accuracy of the data. The platform and database selection process are explained in detail in Chapter 2. Below is a recap of the collected data, excluded data and the sample data used for hypotheses testing:

Collected data	8.577 game records
Excluded data	4.964 game records
Sample data	3.613 game records

Table 4.1 - Data population and sample size

To answer the research questions, we used quantitative research and added a visual representation (network graphs) to analyze the data. The network graphs are created using the full data set, excluding the data regarding the four exclude factors. The quantitative figures added another factor, which removed 4.673 games from the data set, leaving a sample of 3.613 to answer the research questions. The extra factor required for the quantitative research was; copies sold. This data was listed in millions, but games that had less than 100.000 copies sold were excluded, because the gathered data has two decimals which automatically lists copies sold as 0,00 when the amount is below 100.000.

For this research, a combination of Microsoft Excel, NodeXL and SPSS were used to answer the research question. Chapter 4.1 regarding the development of multi-homing, is based on tables, and charts created in Excel and network graphs created with the Excel add-on NodeXL. The remaining sub-questions are answered using SPSS. SPSS is a software application created for statistical analysis. This application provides a statistical analysis of the data, based on different statistical methods. This research contains Independent Sample T-tests and a Two-way Anova to answer to research questions.

The remainder of this chapter describes the findings from the quantitative research. The findings in this chapter include the sub-questions and the findings for the industry which provides multiple factors for creating a development strategy. The conclusion section, concludes all findings of the sub-questions and describes the main-research question.

4.1 Development of multi-homing

The development of multi-homing encompasses multiple focus areas; development of multi-homing, techniques used for multi-homing and change from single- to multi-homing. The focus for this document is on the change from single- to multi-homing in the gaming industry, describing the development of multi-homing using multiple figures. This is represented in tables and charts and network graphs. Data presented in this section does not include statistical analysis. The statistical analyses are described in section 4.2 and 4.3.

Table 4.2 lists the total single- and multi-homed games per year and presents the corresponding ratios. This list is created using the sample data described in the previous section and represents the total games per year with at least 100.000 copies sold. The exclusion of games with sales lower than 100.000 copies has a large impact on table 4.2. The current table demonstrates a favorable outcome for multi-homing, where the same table including all data, would result in a favorable outcome for single-homing. This statement is depicted in figures 4.1 and 4.2 (other years are presented in Appendix E, figures E.1 to E.8). These figures are created using all 8.577 records and depict a large amount of single-homed games.

Year/Games	Single-homed	Multi-homed	Percentage (SH|MH)
2006	108	86	56%|44%
2007	220	226	49%|51%
2008	282	342	45%|55%
2009	323	400	45%|55%
2010	288	394	42%|58%
2011	217	447	33%|67%
2012	75	205	27%|73%

Table 4.2 - Single- and multi-homing per year

The figures 4.1 and 4.2 depict two snapshots of a platform network graph in 2007 and 2011. The network graph show platforms, single-homed games and multi-homed games. The network graph has different levels of multi-homing:

- Yellow; two platform multi-homing, a game has been released on two platforms.
- Green; three platform multi-homing, a game has been released on three out of four platforms.
- Purple; four platform multi-homing, a game has been released on all platforms within our scope.

Both figures show an extreme favor of single-homed games over multi-homed games. A small increase towards multi-homing can be detected when combining all figures, a six to one ratio is depicted in 2007 and a 3 to 1 ratio is depicted in 2011. A clear shift between 2007 and 2011 is the demographic of games. The network graph of 2007 depicts a large number of Wii games, a total of 402 games are listed. The second largest platform is the PC with 203, followed by the Xbox 360 and the PS3. The 2011 network graph depicts a reverse order, with PS3 taking the top spot, followed by the Xbox 360, the PC and finally the Wii. The shift in popular platforms can be explained with the shift from single-homed majority to multi-homed majority, as the Xbox360, the PS3 and the PC are more multi-homed oriented than the Wii. A second influencing factor is the new Nintendo console which would be released in 2012.

The large differences in data without sales (0.00) and sales with (0.01 or greater), is something we have not been able to analyze in this study. The difference in results could be based on sales as the remaining games could have sold less copies than 10.000, however this is an unknown factor as we could not verify this data. However, a possible theory regarding the large difference in games is explained in the discussion section.
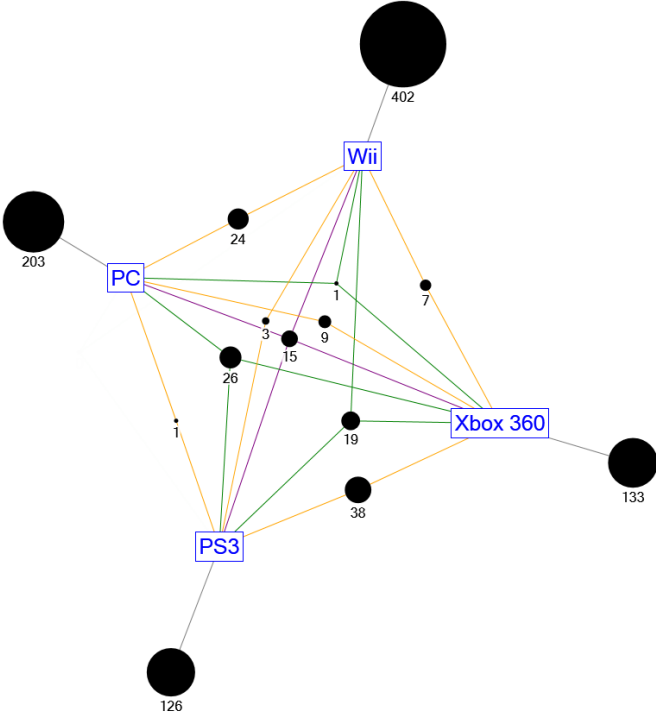
Figure 4.1 - Platform network graph 2007
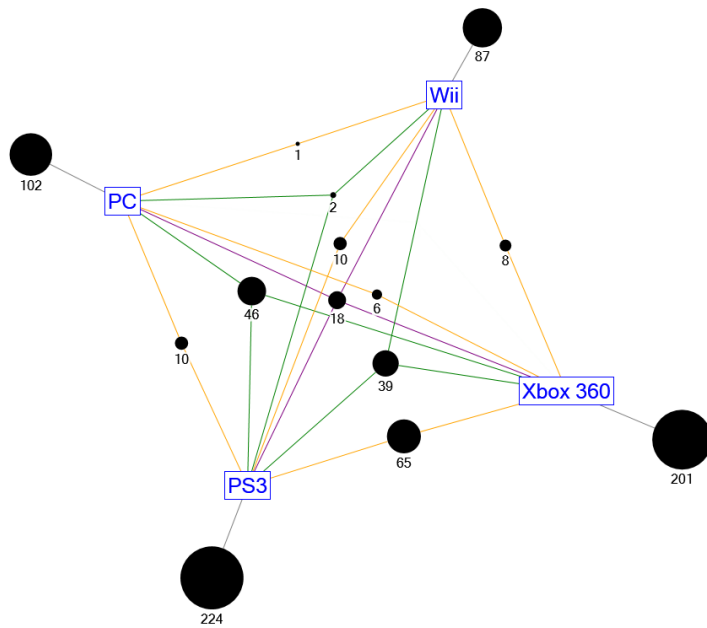
Figure 4.2 - Platform network graph 2011

Multiple aspects of a game can influence the decision to single- or multi-home. One of those aspects is represented in table 4.3. Table 4.3 is similar to table 4.2 in setup and describes the differences between single- and multi-homing for each platform using the sum of all years (2006-2012).

Platform/Games	Single-homed	Multi-homed	Percentages (SH|MH)
Xbox 360	218	754	22%|78%
Wii	797	410	66%|34%
PS3	242	658	27%|73%
PC	256	278	48%|52%

Table 4.3 - Single- and multi-homing per platform

Table 4.3 clearly lists the games for each platforms, which provides an overview of the platform's focus. The data clearly shows that both the Xbox 360 and the PlayStation 3 represent the multi-homing platforms, while the Wii represents single-homing and the PC is a neutral platform. The data in table 4.3 only lists the total games per platform categorized into single- and multi-homing, and excludes copies sold per platform. This data is depicted in table 4.4, which provides the average copies sold per game per platform for both single- and multi-homed games. Table 4.4 lists 3 relatively similar platforms which are equally represented in single- and multi-homing and one platform which is mostly represented in single-homing.

Platforms:	Single-homed	Multi-homed average
Xbox 360	0,709083	0,768156
Wii	0,786336	0,490707
PS3	0,615207	0,75766
PC	0,185117	0,184928

Table 4.4 - Single- and multi-homing average sales per platform (* million)

Figure 4.3 combines table 4.3 and 4.4 in a bar-chart, which calculates the total sum of copies sold and divides that by the sum of games, separated into single- and multi-homed.
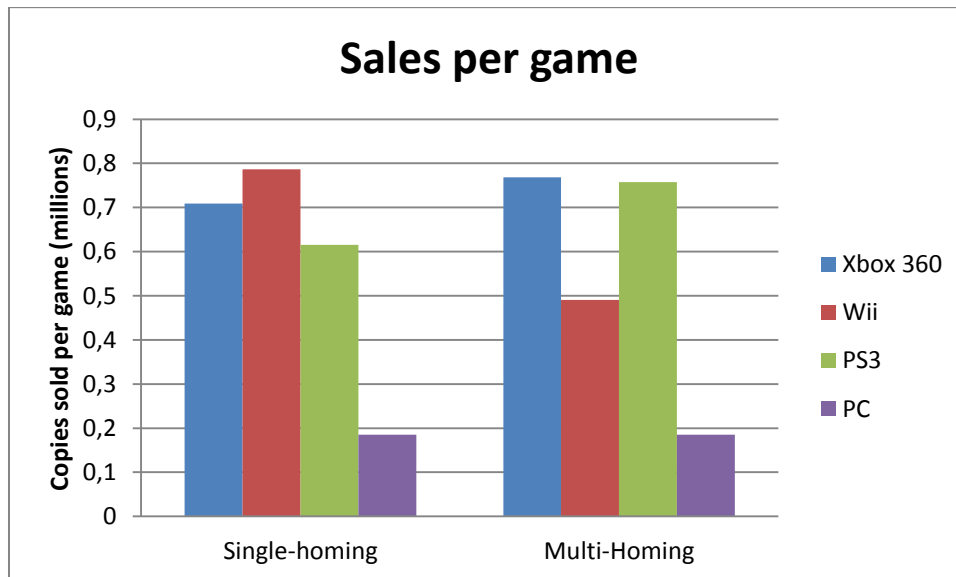
Figure 4.3 - Sales per game per platform

The combination of table 4.3, table 4.4 and figure 4.3 changes the view on multi-homing, but even more on single-homing. Figure 4.3 shows an average of 0,79 million copies sold per game for the Wii, however it also lists 0,71 million for the Xbox 360 and 0,62 for the PS3. A conclusion can be made that the Wii has the highest single-homed sales in total, but the average in sales is close to the Xbox 360.

Another level of detail for the development of multi-homing is the genre of a video game. Genres are used to categorize a video game to indicate what type of game you are buying or playing. In the development stage of a game a genre can influence the decision to single- or multi-home. When comparing single- and multi-homing per genre, preferences or use of certain genres that favor multi-homing over single-homing can be seen. Tables 4.5 and 4.6 list three different genres for both single- and multi-homing and separate these figures into a release year. These three genres all favor multi-homing, however one stands out with almost three times as many games.

The listed numbers in tables 4.5 and 4.6 only indicate the amount of games for each genre and exclude the sales figures. The sales figures are presented in table D.2 to D.11 located in Appendix C. Using those sales figures for the genre "Action", we can estimate that single-homed copies sold (88,73) versus multi-homed copies sold (303,56) is more than three times single-homed copies sold. The date presented in tables 4.5 and 4.6 demonstrates a switch from more single-homed fighting games to more multi-homed fighting games. These factors indicate that genres are important when deciding to single- or multi-home.

The theoretical background described multiple factors that influence both single-homing and multi-homing. The factors described in the theoretical background are:

- Risk, multi-homing is more expensive, however the game is able to reach a larger audience
- Exclusivity fee, a platform owner pays for exclusive rights
- Two-sided market, age and market share influence platform sales which influence game development.

These factors are an aspect of the development strategy and directly influence the decision to single- or multi-home. These factors are fully explained in the theoretical background and are therefore briefly mentioned as important factors.

Total SH	Action	Adventure	Fighting
2006	15		6
2007	26	13	14
2008	27	27	11
2009	32	43	6
2010	26	22	9
2011	20	17	7
2012	21	10	1
Sum	167	132	54

Table 4.5 - Game genres single-homing

Total MH	Action	Adventure	Fighting
2006	13	4	2
2007	47	11	3
2008	58	32	16
2009	98	33	20
2010	94	22	18
2011	107	21	27
2012	63	19	15
Sum	480	142	101

Table 4.6 - Game genres multi-homing

The research question "How did platform multi-homing develop from 2006-2013 in the gaming industry?" with the sub-question "Is there a diversification or consolidation battle going on?" is answered using the previous paragraphs. The focus from single-homed games to multi-homed games is increasing, as shown in tables 4.2, 4.5 and 4.6. The data shows that in total multi-homing is selling more copies than single-homing, this is true for three out of four platforms when comparing the sum of all sales. The change from multi-homed outselling single-homed occurred in 2008, after which the difference is increasing in favor of multi-homing.

Diversification or consolidation
Part of the sub-research question, regarding the development of multi-homing in the gaming industry, we researched if major players in the ecosystem are diversifying or consolidate their connections and platforms. The changes over multiple years (2007, 2009, 2011) are depicted in network graphs of these major players. We select these three years to demonstrate the changes, without cluttering the thesis with representations of ecosystems, using these years with a one year interval removing the first and last year of the collected data. These graphs depict major players, but also connections between these players and the importance of a single player in the graph. A player that is only connected to one other player, might be connected to numerous other players via that single connection. The first part of this section, describes the relationship between publishers and developers, where a publisher can also be a developer (displayed as a loop in the graph). The second part of this section, describes the relationship between publishers and platforms.
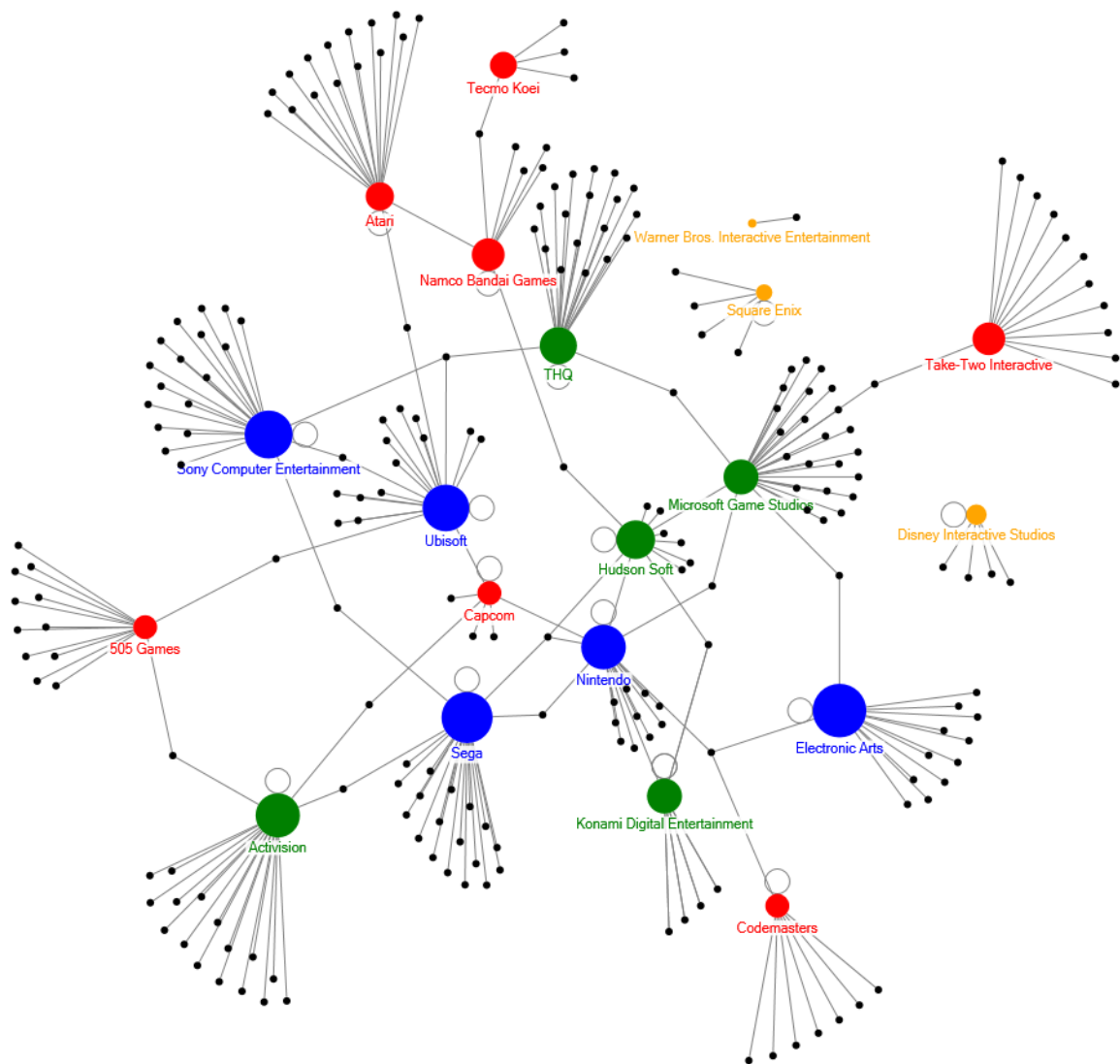
Figure 4.4 – Publisher & Developer graph 2007
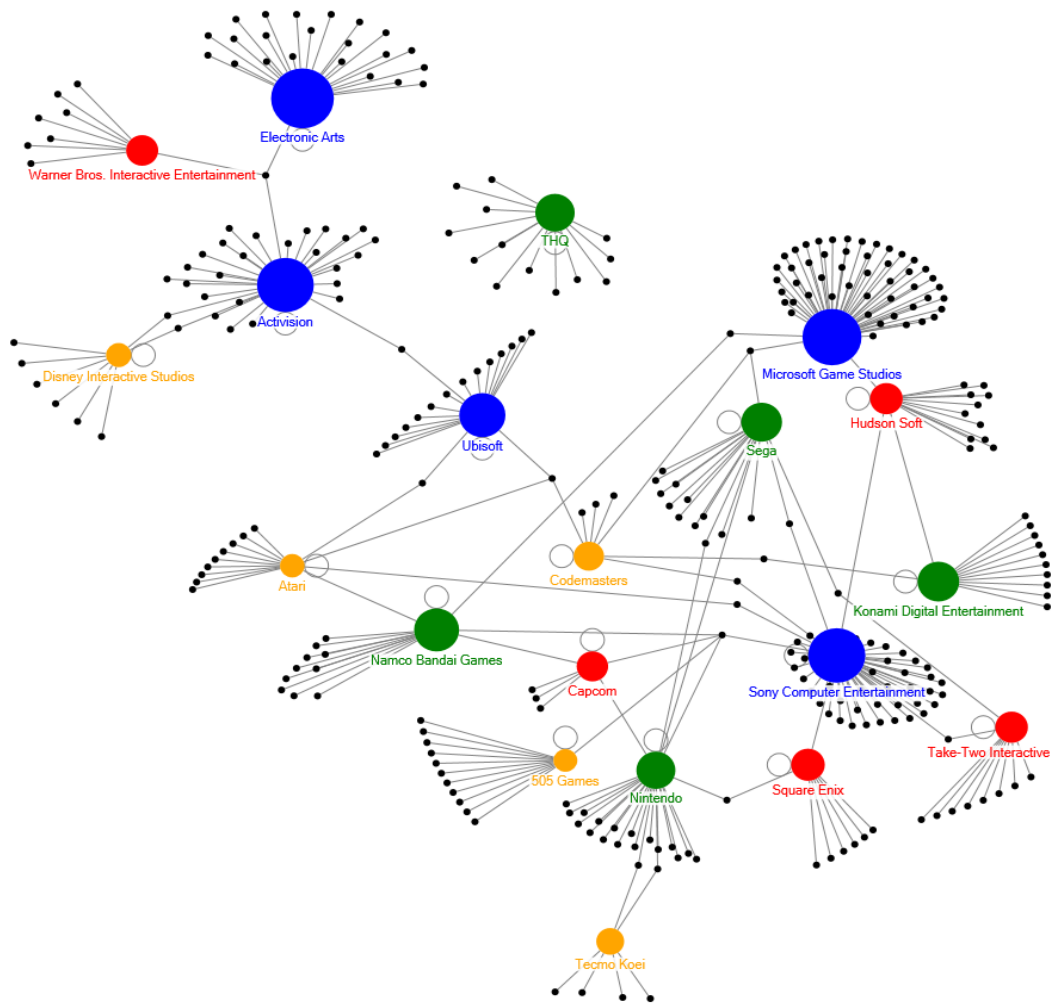
Figure 4.5 - Publishers & Developers graph 2009

The publisher and developer graphs, are depicted in figure 4.4, 4.5 and 4.6 (remaining years, including the three years depicted in this section, are included in appendix E). These pictures are organized by colour and size, based on games released that year; top five are blue, top 10 are green, top 15 are red, top 20 are orange. The black dots depicted in the graph are developers, names have been excluded for visual purposes. The figures depicted in this section demonstrate the connectivity of multiple publishers. When analysing these figures, we can determine that no central hub exists in this ecosystem, as the majority of players are connected to multiple publishers via a direct connection or a developer. The figures also depict that publishers can be disconnected from the ecosystem when excluding platforms as an hub, this is most often the case for the last group (orange) that released the least amount of games that year. Besides the lack of a central player (hub), another interesting aspect is depicted. The connections between players varies, indicating that the collaboration between players changes quite drastically. Although no reasoning can be concluded from the figures, multiple factors (e.g. poor sales, low review scores, etc.) could change the dynamic between players.
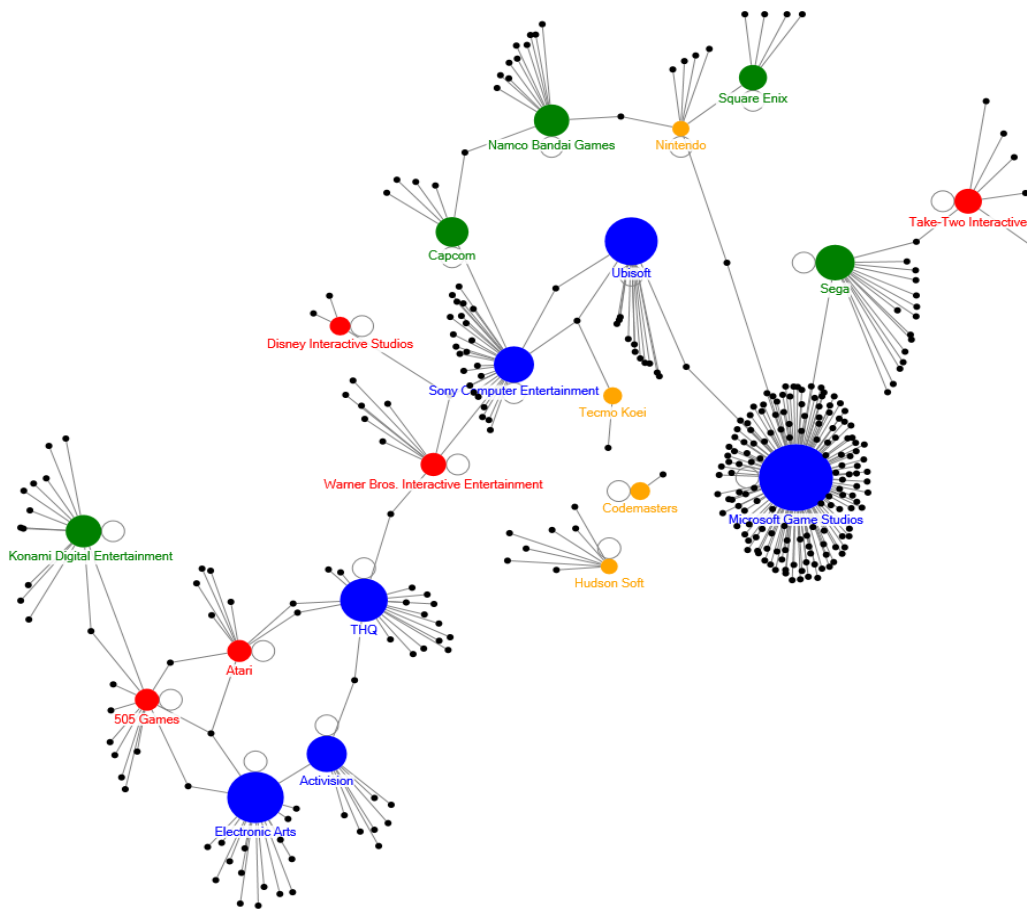
Figure 4.6 - Publishers & Developers graph 2011

In this section we explore the connectivity between the top 20 publishers and the four selected platforms. The colors used in this section corresponds with the colors in the previous section, however this section only includes publisher, which results in differences when applying the same color categorization (e.g. Sega is green in the 2011 graph of the previous section, and blue in the 2011 graph of this section). The ecosystem figures depicted in this section are structures as follows:

- The platforms are represented as black squares and are placed to form a square
- The single-homed publisher is placed near the platform, outside of the square
- The multi-homed publishers are structured based on their connectivity:
  - Two platforms: slightly outside the square, between the two connected platforms
  - Three platforms: within the square, away from the center
  - Four platforms: in the center of the square
- The lines represent connectivity between a publisher and a platform
- The size of the publisher varies depending on the games published that year
- The size of the platforms are fixed
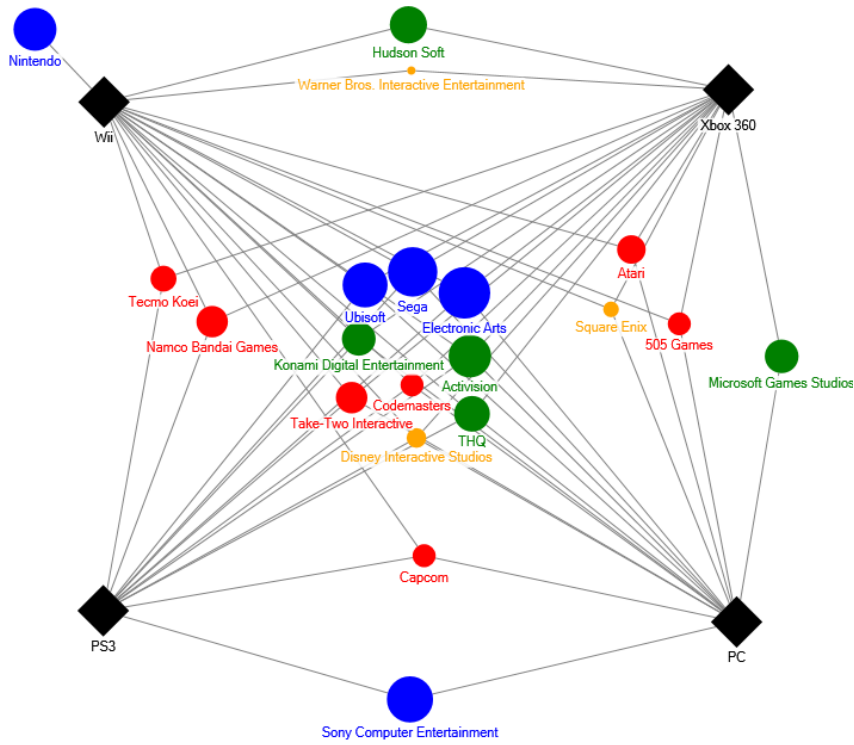
Figure 4.7 – Publisher & Platform graph 2007
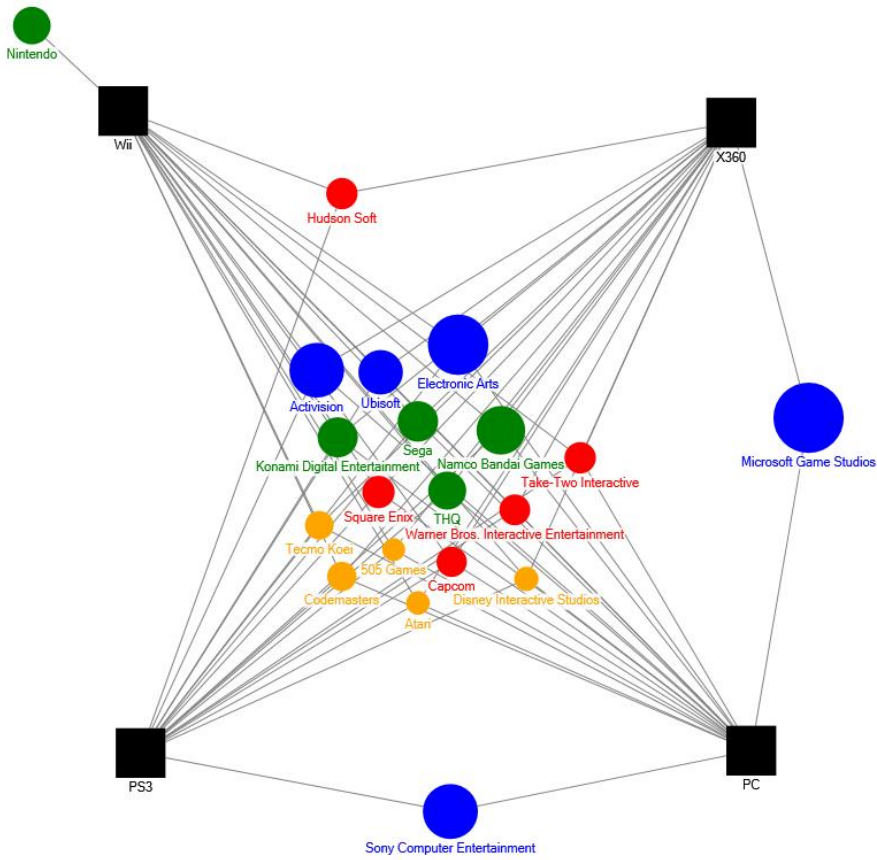
Figure 4.8 - Publisher & Platform graph 2009

The ecosystem graphs representing the connectivity between publishers and platforms are depicted in Figures 4.7, 4.8 and 4.9. The three figures demonstrate a similar situation, with some minor changes over five years of game publishing. There are two major similarities between all three figures, the top 20 publisher are heavily focused on multi-homed and the platform manufacturers (Microsoft, Nintendo and Sony) are only supporting their own platform, with the exception of Sony supporting the PC. The biggest change between these Figures are the three platform multi-homers. In 2007 six publishers focused on three platforms, however in 2009 and 2011 only one publisher has a focus on three platforms.
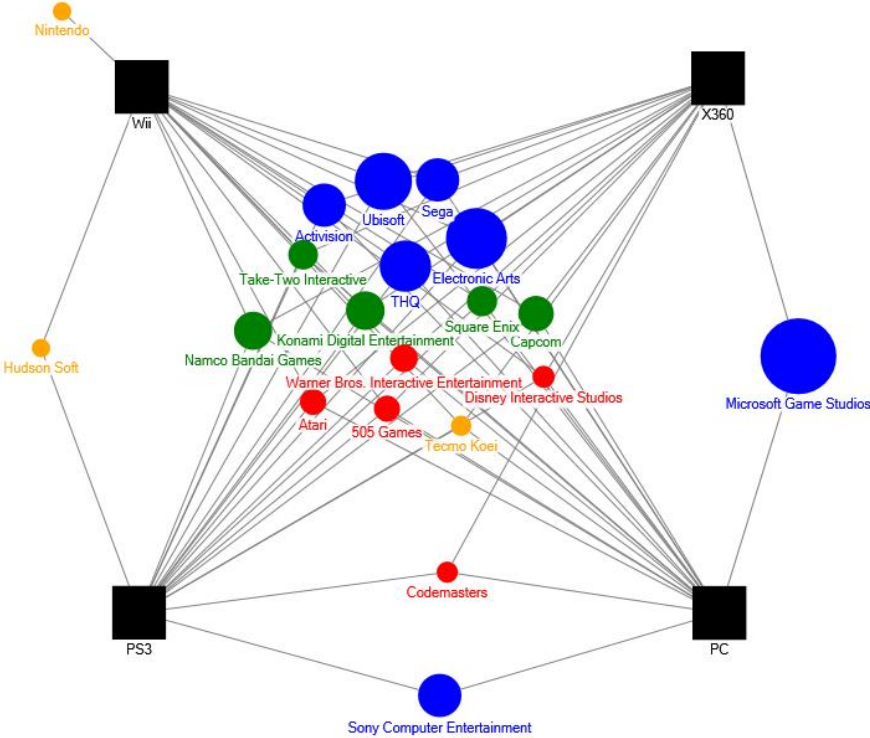
Figure 4.9 - Publisher & Platform graph 2011

This section illustrates that the gaming industry is a highly connected industry, with changing collaborations between the top 20 publishers and developers. Another aspect regarding the top 20 publishers is the lack of differentiation between single and different amount of platform multi-homing. The majority has a strong focus on multi-homing to all four platforms. The act of multi-homing increases potential revenue as potential customer base increases, however with the different specifications and strategies for each platforms, we express a concern for four platform multi-homing. We address this topic in our discussion.

4.2 Single-homing versus Multi-homing

In order to answer the research question, an independent sample t-test was performed. The independent sample t-test measures if one value (single- or multi-homing sales data), is significantly better than the other value. In this section we answer the sub-research question "Are platform multi-homers more successful in the gaming industry?". A hypothesis has been created, which is a tentative assumption for the purpose of testing and providing an answer to the research question. The hypothesis created for this research question is:

- H0 Platform multi-homers sell equal or fewer copies than platform single-homers

  H1 Platform multi-homers sell more copies than platform single-homers.

When creating a hypothesis a counter hypothesis or null hypothesis has to be included and is assumed true until proven otherwise. The hypothesis that is created to test the assumption is called an alternative hypothesis. The t-test will determine if we accept the alternative hypothesis (H1) and reject the null hypothesis or vice versa.

The independent sample t-test performed by SPSS, results in two tables with meaningful figures. Tables 4.7 and 4.8 are used to test the hypothesis, the entire outcome of the t-test is included in the Appendix (Appendix D, tables D.1 – D.4). The results are divided into two tables, the group statistics table (table 4.7) and the independent sample test (table 4.8). The group statistics provides basic information about the test and the data used for this test. Table 4.7 lists the sales of single-homed versus multi-homed. The data used has an equal sample size N = 500, an average (statistically denoted as a Mean) of ,5103 for single-homed data and ,6119 for multi-homed data, which clearly indicates a difference of approximately -1 but doesn't indicate if the difference is significant. The standard deviation indicates the spread of figures around the mean, if all figures were the same the standard deviation would be 0. The standard error of the mean predicts how accurate the estimated mean is. This figure is influenced by N as a larger sample is able to predict a more accurate mean, resulting in a lower result for the standard error of the mean.

Group Statistics

	Total	N	Mean	Std. Deviation	Std. Error Mean
Sales	Single-Homed	500	,5103	1,23212	,05510
	Multi-Homed	500	,6119	1,22868	,05495

Table 4.7 - Group Statistics SH vs MH

The independent samples test provides us with two sections of results; the Levene's Test for Equality of Variances and the t-test for Equality of Means, which contains the main results of the t-test. When analyzing the results, the first thing we look at is the Levene's Test. The Levene's Tests is actually testing two hypothesis:

- $H_{1.0}$ The variances between groups are equal
- $H_{1.a}$ The variances between groups are not equal

The result of this tests indicates which row we use for the t-test for Equality of Means based on the outcome with a significance level α =0.05. A significant outcome of p>=0.05 would result in a rejection of the null-hypothesis (H0). The Levene's Test depicted in table 4.8 lists p=.883, this means we accept the null-hypothesis that equal variences are assumed and used the top row of the t-test for Equality of Means.

The t-test provides us with the answer for our hypothesis. To analyze the significance level of the t-test we set α =0.05. The t-test that we ran using a population of N=500 resulted in: t(988)=-1.305, p=.192. This result indicated that our p value(p=.192) is larger than α =0.05. The SPSS test for an

independent samples t-test also outputs 95% confidence interval. The confidence interval provides a minimum (-.25426) and a maximum (.05114) and indicates that the value of the sample data is located between this minimum and maximum with a 95% confidence. A large difference between these two figures could indicate that the sample size was too small, which resulted in a large range of values.

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | 95% Confidence Interval of the Difference | |
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Sales	Equal variances assumed	,022	,883	-1,305	998	,192	-,10156	,07782	-,25426	,05114
	Equal variances not assumed			-1,305	997,992	,192	-,10156	,07782	-,25426	,05114

Independent Samples Test

Table 4.8 - Independent samples test SH vs MH

The results of the t-test where p (p=.192) is larger than our significance level (α=0.05) indicates that there is no significant difference, indicating that we cannot reject the null-hypothesis. This means that multi-homed games do not sell significantly more games than single-homed games. The difference between the single- and multi-homed Means does indicate out of the 500 sampled data entries multi-homed games sell more copies, however this difference is not significant enough to provide a statistical significance.

4.3   Influences on Multi-homing

The previous section demonstrated that there was no significant difference between single- and multi-homing. In this section we address the two-way ANOVA, which we performed to test our hypothesis and answer our corresponding research questions. This section is a continuation of our previous section, in which we go one step further to see if there is a significant difference on the platform level. Another part of this section is testing if genres are more successful as a multi-homed genre versus the single-homed equivalent. This section depicts the necessary figures to test our hypothesis and answer the research questions, the full list of statistical results are included in the appendix (Appendix D).

The two-way ANOVA measures the influence of two independent variables (platforms and single- or multi-homed) against the dependent variable (sales). The ANOVA is used to answer the following hypothesis:

- $H_{2.0}$ Platforms solely focus on platform multi-homed games.
- $H_{2.a}$ Platforms do not focus solely on platform multi-homed games.

In the previous section we used a t-test with an equal sample size, however we used an unequal sample size for the ANOVA test, to provide a realistic representation of the data set. We used 50% of all data for this test, which provides us with a sample size of N = 757 for Single-Homed and N = 1050 for multi-homed, which is listed in table 4.9. This table provides us with a Mean, standard deviation and sample size for each combination in the ANOVA.

Descriptive Statistics

Homed	Platform	Mean	Std. Deviation	N
Single-Homed	Xbox 360	,6395	1,70050	109
	Wii	,4238	1,02033	399
	PS3	,6095	1,10051	121
	PC	,1916	,57695	128
	Total	,4453	1,10916	757
Multi-Homed	Xbox 360	,8102	1,55710	377
	Wii	,4678	,88476	205
	PS3	,7421	1,33626	329
	PC	,1981	,46777	139
	Total	,6410	1,28597	1050
Total	Xbox 360	,7719	1,59017	486
	Wii	,4387	,97591	604
	PS3	,7064	1,27732	450
	PC	,1950	,52197	267
	Total	,5590	1,21855	1807

Table 4.9 - Descriptive statistics two-way ANOVA

The descriptive statistics are used in the Test of Between-Subjects Effects which provides us with the main results of the ANOVA. However, a similar step needs to be added, before addressing the main results, which is the Levene's Test of Equality of Error Variances listed as table 4.10. The Levene's test provides us with the test of variances where a significant result (p>= 0.05) results in different variances for the selected groups.

Levene's Test of Equality of Error Variances[a]

Dependent Variable: Sales

F	df1	df2	Sig.
9,617	7	1799	,000

Table 4.10 - Levene's Test two-way ANOVA

Table 4.10 lists a significant result, indicating different variances. To counter this result we analyze the results listed in Table 4.11 with a significance level of $\alpha=0.01$. A significance level of $\alpha=0.01$ is stronger level of significance than $\alpha=0.05$. We use the $\alpha=0.01$ to counter our difference sample sizes and the different group variances.

A visual representation of the descriptive statistics is depicted in Figure 4.10, which depicts a plot of the Estimated Marginal Means of our dependent variable (Sales) using the two independent variables to indicate the differences. This figure provides a clear overview of all the estimated Means and it can indicate a possible significant difference. However, the actual significance of the ANOVA is

not depicted in Figure 4.10, but listed in table 4.11.
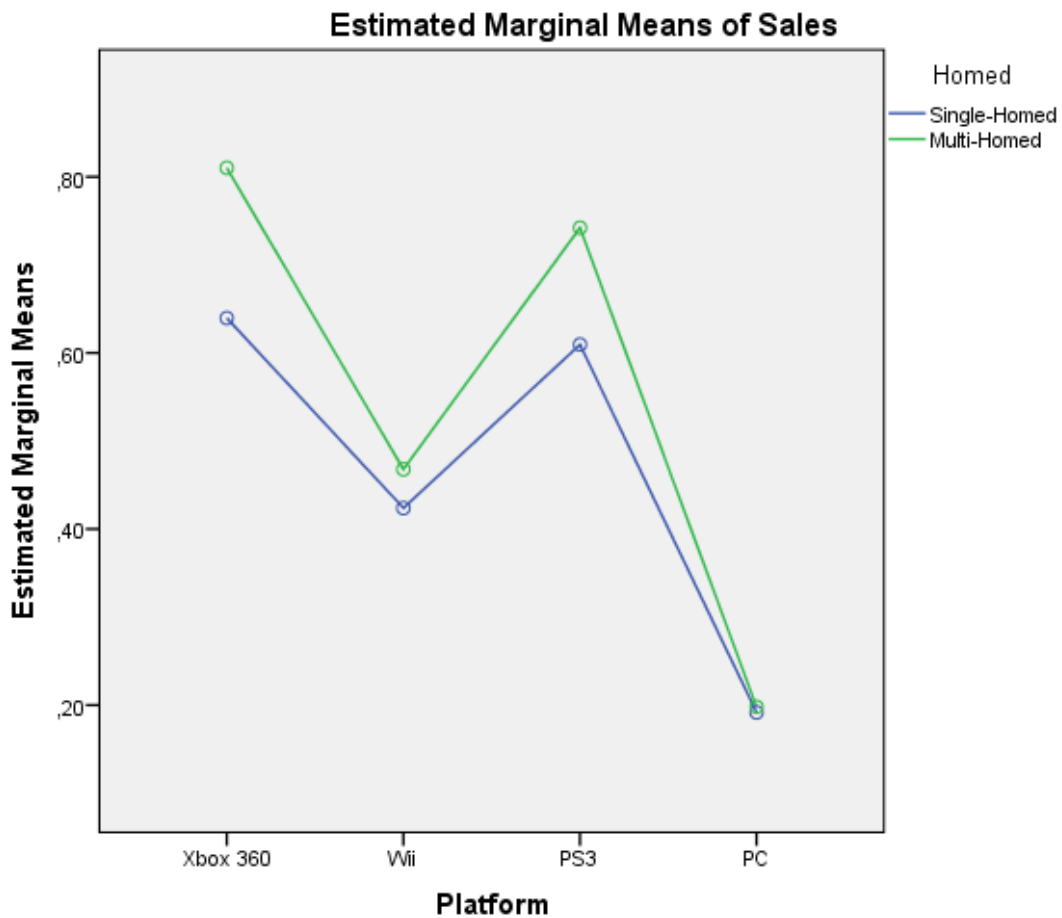
Figure 4.10 - Single- and Multi-homed plot for the estimated mean of sales

The two-way ANOVA provides multiple tables for analysis, however the table listed as table 12 contains the main results of the ANOVA. When performing the ANOVA we selected three variables for analysis, which are Homed, Platform and Homed * Platform. The tests of Between-Subjects Effects is testing the significant effect of the independent variables (Homed and Platform) and the interaction of independent variables (Homed * Platform) on our dependent variable (Sales). The results for this tests indicate a significant interaction between Platform and Sales with $F(3)= 12.433$, $p=.000$. This p-value is lower than our significance level of $\alpha=0.01$. The tests result also indicate that the interaction between Homed and Sales, and the interaction between Homed * Platform and Sales is not significant with $F(1)= 2.747$, $p=.168$ and $F(3)= .486$, $p=.799$.

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	80,203[a]	7	11,458	7,923	,000
Intercept	366,143	1	366,143	253,201	,000
Homed	2,747	1	2,747	1,899	,168
Platform	53,938	3	17,979	12,433	,000
Homed * Platform	1,458	3	,486	,336	,799
Error	2601,450	1799	1,446		
Total	3246,281	1807			
Corrected Total	2681,654	1806			

Table 4.11 - Tests of Between-Subjects Effects two-way ANOVA

The results for Homed versus sales with a p-value of .168 are not unexpected. This result is similar to our non-significant independent t-test in section 4.2, with a different p-value due to different sample sizes. The same can be said for platform and sales, this expectation is based on the mean difference presented at the start of this section in table 4.9. As part of the ANOVA we added some extra tests to increase the detail of results from the ANOVA, one of which is the Pairwise Comparisons for the Estimated Marginal Means. These Pairwise Comparisons provide the insight into the p-values of our Tests of Between-Subjects Effects.

Pairwise Comparisons

(I) Platform	(J) Platform	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Xbox 360	Wii	,279[*]	,083	,001	,116	,442
	PS3	,049	,091	,592	-,130	,228
	PC	,530[*]	,098	,000	,337	,723
Wii	Xbox 360	-,279[*]	,083	,001	-,442	-,116
	PS3	-,230[*]	,082	,005	-,391	-,069
	PC	,251[*]	,090	,005	,075	,427
PS3	Xbox 360	-,049	,091	,592	-,228	,130
	Wii	,230[*]	,082	,005	,069	,391
	PC	,481[*]	,098	,000	,290	,672
PC	Xbox 360	-,530[*]	,098	,000	-,723	-,337
	Wii	-,251[*]	,090	,005	-,427	-,075
	PS3	-,481[*]	,098	,000	-,672	-,290

Table 4.12 – Pairwise comparisons Platform two-way ANOVA

Table 4.12 is the result of executing a pairwise comparison for platforms and sales. The table lists the comparisons made between platforms, while taking Sales into account. The first thing that stands out when analyzing table 4.12 is one pairwise comparison, the Xbox 360 versus PS3 and vice versa, that is not significant with p=.592. All other comparisons are significant with a significant level of α=0.05 and α=0.01.

When adding an independent variable the pairwise comparisons between platforms changed to a pairwise comparisons between Homed, per platform using Sales as the dependent variable. Table 4.13 lists the results of the second pairwise comparisons and depicts no significant results. The table

does indicate a difference between platform single- and multi-homed, which was visually represented in figure 4.10, but does not indicate a significant result.

Pairwise Comparisons

Platform	(I) Homed	(J) Homed	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound
Xbox 360	Single-Homed	Multi-Homed	-,171	,131	,192	-,427
	Multi-Homed	Single-Homed	,171	,131	,192	-,086
Wii	Single-Homed	Multi-Homed	-,044	,103	,670	-,247
	Multi-Homed	Single-Homed	,044	,103	,670	-,159
PS3	Single-Homed	Multi-Homed	-,133	,128	,300	-,383
	Multi-Homed	Single-Homed	,133	,128	,300	-,118
PC	Single-Homed	Multi-Homed	-,006	,147	,965	-,295
	Multi-Homed	Single-Homed	,006	,147	,965	-,283

Table 4.13 - Pairwise comparisons Homed * Platform two-way ANOVA

The results listed in the previous paragraphs indicate that our we reject the null-hypothesis. The descriptive statistics in table 4.9 and the plot depicted in figure 4.10 indicate a difference between single- and multi-homing, however although our tests indicate a difference, no actual significance was measured when comparing platform single-homing with platform multi-homing. This answers the first sub-question, that platforms are not single- or multi-homed oriented. Although a preference might exists, there is no statistical significant preference based on the data used for our statistical analysis.

The research question; "what factors influence platform multi-homing in the gaming industry" a second sub-question, that questions the successfulness of multi-homed genres over single-homed genres. This test was performed using a series of independent sample t-tests on our data set. The corresponding hypothesis we used are:

- $H_{3.0}$ Multi-homed genres are not more successful than single-homed genres.
- $H_{3.a}$ Multi-homed genres are more successful than single-homed genres.

The series of independent samples t-tests include are performed on the total data, not on individual platforms. The reasoning behind this is the lack of data for certain genres on certain platforms, this results in no returning statistical values when performing the t-tests for those genres. The series of t-

tests use two independent variables Genre and Homed with an unequal sample size. When analyzing the group statistics (included in Appendix D) , we can see multiple large Mean differences between genres, this is true for Adventure, Platform, Racing, Role-Playing and Sports. Three out of the five mentioned genres, have a higher Mean value for single-homing over multi-homing. The independent Samples Test partially presented in table 4.14 provides the main results of the independent samples t-tests.

The results list the twelve genres, with only two significant results using the significance level of $\alpha=0.01$. A third genre is significant at $\alpha=0.05$. Among the significant genres are Adventure with $t(218.225)= -3.032$, $p=0.003$, Platform with $t(51.997)=2.344$, $p=0.23$ and Role-Playing with $t(178.736)=-3.525$, $p=0.001$. Out of the five previously mentioned Genres, three are significant and only one favors single-homing over multi-homing. However, the results indicate that the majority of Genres are not significant, indication that we cannot reject the null-hypothesis that multi-homed Genres are not more successful than single-homed Genres and we reject our alternative hypothesis.

Genre	t	df	Sig.
Action	-1,092	686	,275
Adventure	-3,032	218,225	,003
Fighting	-1,300	158	,195
Misc	,670	447	,503
Platform	2,344	51,997	,023
Puzzle	,411	80	,682
Racing	1,031	106,690	,305
Role-Playing	-3,525	178,736	,001
Shooter	-,953	443	,341
Simulation	-,398	201	,691
Sports	1,597	225,957	,112
Strategy	-,400	159	,690

Table 4.14 – Significant results of the genre comparison two-way ANOVA

The results listed in this section indicate a small favor towards multi-homing, however this favor is not significant enough to indicate that platforms or genres are focusing solely on multi-homed. With these hypotheses tested our research question is answered using the results of our tests and the literature described in our theoretical background to indicate factors that influence platform multi-homing in the gaming industry.

1. Platform maturity: studies show that a relatively new platform has a greater benefit from single-homed games over multi-homed games.
2. Network effect: a platform has to attract sellers, before it can attract buyers, the more sellers the higher the value of the platform for a potential buyer.
3. Exclusivity fees: a fee is paid from a platform owner to the game developer/publisher. The platform owner pays for exclusive rights, making the game in development a single-homed product.
4. Genre: The results show that some genres are significantly selling more copies either single- or multi-homed.
5. Time/Sales: the data shows that games are released on new or competing platforms after their initial launch. This might be part of a timed exclusive, or successful sales figures that drive success to another platform.

6. Platform strategy: Although the data does not demonstrate a clear favor towards single- or multi-homing, a platform strategy towards single-homing can influence multi-homed games for that platform.
7. Review scores: studies show that review scores increase the user base and the sales figures of a game. This factor might not directly influence multi-homing, but it is affecting development and sales of both single- and multi-homed games.

4.4 Findings for the industry

One of the biggest aspect of the research conducted is the findings for the industry. In the section, we address multiple findings from our study. All of the findings described in this section are derived from either the theoretical background, the results of this research, the concept strategy model (Appendix F) or multiple sources which were gathered during the research regarding multi-homing. The findings are already adopted in the gaming industry, however the adoption of these tactics is low compared to a fixed single- or multi-homed strategy. These two strategies are quite clear in their concepts; one focusing single platform with a select customer base and one focusing on multiple platforms with a large customer base. The findings described in this section, cover various options regarding single- and multi-homing strategies.

Timed exclusive

A timed exclusive is a game that is initially developed or released on a single platform. A platform owner might buy exclusivity rights from a developer or publisher, when the initial idea was to release the game on multiple platforms. The exclusivity rights are either full exclusive or timed, in case of the timed exclusive a game might be developed for (or ported to) another platform after a certain amount of time. There is no set time for a timed exclusive, however the idea of a timed exclusive offers multiple advantages and disadvantages. Advantages and disadvantages:

- Single platform development: initial development costs are lower, as development is only developing the game for a single platform.
- Low review scores: low review scores influence the sales of your game as described in Chapter 3 section 5.
- Potential exclusivity fees: depending on the amount the exclusivity fees could cover (a part of) the development costs .
- Lower initial customer base: the initial customer base is lower as only the customers with the selected platform are potential customers, excluding all others are potential customers.
- Marketing costs: the marketing costs might be higher, because the game is released in different months or years.

A different aspect of timed exclusive can be initial funding. A low development budget might suffice the development for a single platform. Revenue generated from releasing the product can be used to fund development on other platforms. A timed exclusive is used to generate revenue and feedback regarding, which can be used to develop the game on multiple platforms or stay as a single platform game.

Reviews

In Chapter 3 section 5 the importance of reviews are described, as a difference in review scores influences the sales. The study referred to described a score increase by one, resulting in a user increase in 0,6 and sales increase by 3.5%. As reviews are based on the reviewers opinion, it is hard

to predict the result of a review score, however striving to obtain the highest possible score is important as it directly influences your sales. Besides review scores a new method of reviewing is YouTube, in which reviewers interact with their audiences and build their own follower base. YouTube offers video capabilities incorporating gameplay and a spoken review. Cooperating with these YouTube reviewers either free or paid during the development project, can result in free marketing and feedback regarding different aspects of your game. These options are not described in Chapter 3 section 5, however these option provide coverage and marketing, this usually does not correspond with review scores, however the YouTube followers can create their own impression of the game. Advantages and disadvantages:

- Early feedback to improve upon and create a group of followers
- Coverage (free or paid) of your product to follower base.
- Problems or bad experiences will create bad publicity, before the release.

Competition
Having an unique and interesting mechanic in a game can be really important when differentiation between competitors. A game has to be unique or have a (couple of) new mechanics (features) in order for a game to sell, when a competitor product already exists on the market. However, it is important to take advantage of released games to develop new ideas or reuse existing ideas. Using existing and new game mechanics is importing in renewing an existing franchise.

Historical data
The gaming industry is currently in the seventh/eight generation, indicating that multiple platforms and games already exist on the market. Many of these games are no longer available, the same can be said for platforms, however information regarding popular franchises from early generation games is still available for use. Next to popular franchises in general, information regarding genres, sales and developers/publishers exists. Using data analysis on (old) data is proven to be an important aspect of across the world (not restricted to gaming companies). This research, analyzed historical data (from the seventh generation) and provides different grounds for the importance of using historical data.

Historical data can be used to determine possible success combinations using different levels of granularity. The lowest tier only compares single- and multi-homed, the highest tier compares individual platforms, sales, number of games sold and genres of each game to determine successful combinations. Using historical data on different levels of granularity provides insight in niche combinations and sales for those combinations. This information should be used to avoid unpopular or unsuccessful combinations and steer towards niche or successful combinations. Advantages and disadvantages:

- Multiple figures to provide insight into potential successful combinations for a video game (e.g. sports game on the Nintendo Wii).
- Results create a clear image of previous released titles and announced titles from direct competitors.
- Time consuming to create a proper analysis.
- No guarantees regarding successful combinations

Regional differences

During the research project, a minor factor discovered was regional differences. Regional differences are different game styles or mechanics that are extremely popular in one area (continent), and unpopular in another. Terminology used to classify differences are western style games and eastern style games (sometimes Asian or Japanese games). Regional differences are not applicable for each game developed in a specific region, this usually coincides with certain mechanics or an art style. The popularity shift from extremely popular to unpopular can be quite drastic. The major difference in area sales can be avoided by only releasing a product in a specific area and researching the interest in your product in other areas. Researching interest in a specific product can easily include extra information regarding platforms and distribution channel.

Realistic expectations

During the final stages of the development process, the marketing campaign is already generating followers. The expectations regarding sales and review scores are created based on feedback gathered during the marketing campaign.

> Marketing is the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large (AMA, 2013).

However, during the development process and the marketing campaign expectations are created based on costs and feedback regarding game sales. It is important that these expectations are realistic as unrealistic expectations create bad publicity, which in turn influences sales. Realistic expectations regarding review scores, copies sold and revenue are important for creating a potential franchise. An example was described in Chapter 2, where the game Sleeping Dogs, publishes by Square Enix, was profitable but deemed a failure claiming that the expectations were higher than actual sales (VG24/7, 2013). The game received multiple updates and downloadable content after the publications of this article, a "definitive edition" was released where the game was rebuilt for next generation consoles including all the downloadable content. One of the developers indicates an interest for creating a sequel, a statement that clashes with the failure state of the publisher (Makuch, 2014).

4.5   Research questions: summarized results.

The results presented in the previous sections of Chapter 4 are extensive. To provide a clear answer to the research questions we describe the findings for each question in a single paragraph.

Main research question: How does platform multi-homing compare to platform single-homing in the gaming ecosystem?
In the theoretical background we describe the platform or generation cycle. The cycle indicates a life span, where single-homed games are more important than multi-homed games during the initial years of a generation with a shift towards multi-homed at the end of the cycle. The research conducted, conclude with similar results when analyzing the figures presented in Chapter 4 Section 1. Multi-homing is increasing in popularity, where single-homing is decreasing in popularity. However, results in Section 2 and Section 3 of Chapter 4 describe the difference in sales between single- and multi-homing indicate minor significant differences between single- and multi-homing. To conclude these results, both strategies are strongly integrated in the gaming industry and are quite equally matched.

How did platform multi-homing develop from 2006-2013 in the gaming industry?
Multi-homing in the gaming industry is increasing as can be seen in Table 4.2. The ratio difference between single- and multi-homing is increasing in favor of multi-homing, this increase can also be noticed in the network graphs depicted publishers and their connections to different platforms. Results listed steer towards an initial favor of multi-homing that is present in the industry. However, the theoretical research conducted indicates that during a new generation of platforms a shift can occur, which favors single-homing over multi-homing. To conclude these results, we indicate that multi-homing is increasing in favor and has a higher potential to grow based on the size of potential customers. However, a differentiation in platform strategy as depicted in Table 4.3, offers an insight where both strategies are viable for a platforms success.

Is there a diversification or consolidation battle going on?
The video game industry is highly connected when depicting the ecosystem including developers and publishers. The figures (network graphs) depicted in Chapter 4 Section 1, demonstrate multiple connections for most organizations, besides similar connections over time, the network graphs depict changes in relationships between organizations. These results indicate that the industry is diversified, as no central hub or islands exists in the network graph, that would indicate consolidation.

Are platform multi-homers more successful in the gaming industry?
Research results described in Chapter 4 Section 2, clearly indicate that no significant difference is found between the sales of single-homed games and sales of multi-homed games. Results show a favor towards multi-homed games, however this does not indicate that multi-homed are more successful as these results are not significant.

What factors influence platform multi-homing in the gaming industry?
Multiple factors were determined during this research project. The research question is described on page 48 to page 50, here we list the resulting factors:
1. Platform maturity: studies show that a relatively new platform has a greater benefit from single-homed games over multi-homed games.
2. Network effect: a platform has to attract sellers, before it can attract buyers, the more sellers the higher the value of the platform for a potential buyer.
3. Exclusivity fees: a fee is paid from a platform owner to the game developer/publisher. The platform owner pays for exclusive rights, making the game in development a single-homed product.
4. Genre: The results show that some genres are significantly selling more copies either single- or multi-homed.
5. Time/Sales: the data shows that games are released on new or competing platforms after their initial launch. This might be part of a timed exclusive, or successful sales figures that drive success to another platform.
6. Platform strategy: Although the data does not demonstrate a clear favor towards single- or multi-homing, a platform strategy towards single-homing can influence multi-homed games for that platform.

Review scores: studies show that review scores increase the user base and the sales figures of a game. This factor might not directly influence multi-homing, but it is affecting development and sales of both single- and multi-homed games.

Are platforms single- or multi-homed oriented?

A clear difference in strategy is depicted in Table 4.12 and 4.13, where significant differences between platforms demonstrates a strong single- or multi-homed favor. These results indicate that the Xbox 360 and the PS3 have a strong multi-homing focus, where the Wii has a strong single-homing focus, the PC has a neutral focus. A simple conclusion can be drawn, where there are major difference regarding single- and multi-homing for platform strategies.

Are multi-homed genres more successful than single-homed genres?

A table (Table 4.14) depicts a list of genres and the results, indicating that three genres significantly sell more copies as single-homed game. These three genres provide the only significant results, when single- and multi-homed is compared. Similar to other results regarding a difference between single- and multi-homing, we indicate minor differences, however the majority of comparisons are not significant, thus resulting in a conclusion that multi-homed genres are not more successful.

5   Discussion

The key aspect of this research project is multi-homing in the gaming industry. Multi-homing is not a new practice, but has become more popular in the last decade, which is empowered by the internet, new distribution models and revenue models. Our thesis describes the development, success and influencing factors of multi-homing. This research is new in comparison, because little scientific work regarding multi-homing exists, that does not refer to development of multi-homed games.

The findings we discovered regarding the development of multi-homing is similar to our initial assumption. Looking at media, most heavily advertised games are multi-homed games. This resulted in the assumption that multi-homing is more popular these days. Results listed in our findings chapter (Chapter 4), indicate that multi-homing is in fact more popular than single-homing. However, the results also show that the sales per game are not that different between single- and multi-homing. Besides the assumption that multi-homing is more popular, we also discussed the possibility that multi-homing is a more successful strategy for video games. The reasoning behind this statement is, the increase in potential customers when expanding to multiple platforms. Each platform has its own user base that only own a single platform. Expanding to multiple platforms would increase the potential of selling your game. However, during our research we concluded that there was no significant different between single-homed games and multi-homed games, based on raw data (copies sold per game). The results indicate a difference between single- and multi-homing in favor of multi-homing, but no statistical significance was found. This indicates that our initial assumption was not accurate, which could indicate an incorrect assumption, error in the data or error in the test. After multiple tests, using random samples, we were unable to find any statistical significance. A limitation in the data could explain our findings, this limitation is described in section 3 of this chapter (5.2.1 VGChartz).

In Chapter 4 section 1, we addressed our concern regarding four platform multi-homing. The reasoning for this concern is the difference in hardware specification and the strategy of different platforms. Although this issue is not researched in this project, the difference in hardware, peripherals and platform strategy could result in different experiences and potentially sales. This concern is also addressed in Chapter 4 section 4, where we discuss findings for the gaming industry.

The abstract level of comparing single- and multi-homing did not meet our assumption, however we also included a detailed level. The detailed level differentiates between single- and multi-homed per platform, platforms, and single- and multi-homed genres and compares these figures to determine what factors influence multi-homing. This detailed aspect of the data, resulted in some significant result, however the majority was still non-significant. The major significance was found, when comparing platform sales to other platforms (e.g. sales for Wii vs. Xbox 360). Other significant results were found in three out of twelve genres. These results indicate a significant difference between platforms and certain genres. However, the non-significant results indicate, that platform are not solely focusing on multi-homing and that multi-homed genres are (in most cases) not more successful than single-homed genres.

Most of our initial assumption were inaccurate, although some assumption were (partially) accurate. With the difference in results and assumption we must address the limitations of this research, which is followed by future research as a continuation of this research.

5.1 Limitations

Limitations are part of scoping your research, else a research grows out of control, some of those limitations are listed in this sub-section.

5.1.1 VGChartz

The research project is based on data from VGChartz, which is verified for accuracy against two other databases. However, VGChartz is the only database with game sales available, which indicates that sales cannot be verified against other sources. Besides this aspect, there are other limitations, when using this VGChartz as a source.

Copies sold vs. Revenue

The sales data used in this research is depicted as game copies sold (estimated using small retail samples) and not total revenues per game. Results using revenues are more diverse, as revenue provides more options, one of which is success of a game using average development costs as cost factor.

Another aspects of providing the copies sold data and not revenues is the limitations in revenue models that are supported. To provide an example: League of Legends is a video game with a large player base (27 million daily players and 67 million on a monthly basis (Tassi, 2014)) is excluded from the data set, as the main game is free to play, with micro transactions to purchase new characters and character skins. This data might be hard to obtain, as these revenue figures are often kept private.

No digital downloads included

Data used does not include digital downloads of any kind. The exclusion of digital downloads has a big impact on the results, especially the PC results, because digital downloads are popular and often heavily discounted.

5.1.2 Data scope

Another aspect of the data limitations is the scope of the seventh generation. This research only includes three main consoles of the seventh generation of video games consoles and adds the PC to this list. With the scope on the three main consoles we automatically forfeit all other consoles as data for our research. The addition of mobile devices can complicate multi-homing, but also provides new opportunities to explore.

Additionally only using data of the seventh generation we exclude any preceding data that could highlight the change of multi-homing even further.

5.1.3 Validity of the strategy model

One of the major results of this thesis project is the strategy model. Usually this model would be validated in the field using game developers and game publishers. However, during this research we determined that receiving a reply via e-mail or phone to book an appointment for this is impossible. Having no connections of our own in the gaming industry and unable to contact multiple developers or publisher we determined that validation the model was not possible within the scope of this project.

5.2 Future research

The research results presented in this thesis provide a better understanding of the video games industry in general and also multi-homing in the gaming industry. This topic lacks scientific research and our research project will provide a basic platform for other researchers. The scope set for this research project provides future opportunities for others, which are laid out in the remainder of this section.

5.2.1 Expanding the data set

The research conducted in this thesis document has a scope for four platforms and the seventh generation. We selected this generation based on the growth of the internet to (every) household, which offers multiple opportunities for multi-homing. Future research, using our research as a basis could make the entire growth of multi-homing and predict trends based on more data. This study should expand towards multiple platforms and multiple generations, and focus on trend analysis.

5.2.2 Business models

An important aspect of the video game industry (all industries) are business models. There are numerous amounts of business models available (and used) within the industry. Business models determine the means to generate revenue after releasing a new video game. When researching the video game industry, we noticed changing business models throughout the seventh generation of video game consoles. In both the literature and the data we noticed different strategies, ranging from a single purchase, monthly subscriptions and a free game with in game transactions.

A study with the main focus on business models can build upon our research to categorize business models, map the success (copies sold) of a video game to a business model and determine successful business models or business model trends. This research could expand the strategy model with their findings and improve the entire model, providing more information.

6   Conclusion

The research presented in this thesis has studied the growth of multi-homing within the seventh generation, and has compared the sales figures from platform multi-homing to platform single-homing. The main research question: "Do game developers prefer multi-homing over single-homing in the gaming ecosystem?" is answered using the results from the sub-questions. In this section we conclude the research with a discussion of our findings.

When researching multi-homing we came across multiple papers regarding multi-homing, most were situated in the software industry or were focused on development of multi-homed games. The changing video industry with addition of new platforms, are using multi-homing more frequently than the at the start of the seventh generation. We include a theoretical background with multiple aspects of the video game industry in regards to platforms, video games and multi-homing. The theoretical background provides detail regarding video games and multi-homing.

The analysis of our research led to multiple interesting findings, which were not predicted at the start of this research. We discuss the pros and cons of multi-homing in the theoretical background, however one of the cons is not included in the results section of this paper, which is higher development costs. The results presented in this research use copies sold and not revenues as a sales figure. The expectation that multi-homing would be more successful, especially without the development costs as a factor if this research was not met. Results show that multi-homing is in fact increasing throughout the seventh generation when looking at new releases per year. However, there is no significant result regarding successfulness of multi-homing over single-homing. The only significant difference found was on genre level, where two genres were significantly more successful as a multi-homed genre. This indicates there some genres might be more accessible for multiple platforms, however the majority of the results were not significant at all indicating that single-homing is still important and successful. When addressing the success of a video game, multiple factors should be taken into account that make a video game successful. These factors can be hard to obtain or measure. The use of sales figures only shows a single view based on raw data. We did research multiple factors that influence multi-homing in the gaming industry, which in turn can influence the success of a multi-homed games. The list of factors does not include every factor, only those we found during our research.

The main research question of "How does platform multi-homing compare to platform single-homing in the gaming ecosystem?" is answered using the results from the sub-research questions. Research shows that that popularity of multi-homing is increasing and the popularity of single-homing is decreasing. In our theoretical background we stated that; as platforms mature the importance of single-homed games for a platform to be unique is less important than at the release of the platform. The games released indicate a shift towards multi-homing, however the introduction of the new generation could reset the cycle where single-homed is more popular initially. Further comparison of single- and multi-homed indicates that there is no significant difference between single- and multi-homed games. This indicates that, although the popularity of multi-homed games might be increasing, that does not mean that single-homed is not selling adequate or large amount of games. The research shows a difference favoring multi-homed, however we expect this to even out when with the new generation, which resets the cycle.

This research provides new insight into multi-homing in the gaming industry. The scientific community regarding multi-homing, revolves around the development of video games. This research has a focus on the sales figures of multi-homing in comparison to the sales figures of single-homing. Within our scope we provide detail regarding significant differences between single- and multi-homing that can be used by future researchers, video game developers and video game publishers to build upon or to extrapolate knowledge from.

Building upon this research while removing the limitations discussed in the previous chapter, could result in a different outcome of the main research question. These limitations directly impact the results, indicating that a more detailed research, excluding these limitations is required to adequately answer the main research question.

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Appendix A – Literature review search phrases

The list below shows the different search phrases used to find literature for the literature review.

- Business ecosystem
- Centralized Platform Ecosystem
- Comparing video game sales
- Competing platforms
- Competing technology games
- Console wars
- Defining Software Ecosystems
- Developer and publisher relationship
- Developer and publisher relationship Games
- Development costs games
- Development costs video games
- Economics of the video game industry
- Market research video game sales
- Multi-homing Gaming
- Multi-homing in a two-sided market
- Multiplatform Strategy Model
- Network Effect
- Network Graph
- Platform generations
- Platform Leadership
- Relationships in Video Game Development
- Software Supply Networks
- Strategy Model
- Supply Chain Digital Distribution gaming
- Supply Chain Gaming
- Two-sided game market
- Two-sided markets
- Value Chain Gaming
- Video Game Generations
- Video Game Sale data

Appendix B – Full database list from which three were selected

Multiple tables, containing databases initially found and categorized based on the selection criteria used to narrow the list of databases to three databases.

Excluded based on scope:	
http://www.abandonia.com/	http://www.internationalgamesdatabase.org/
http://www.adventuregamers.com/	http://www.jayisgames.com/
http://www.adventuretimegamejam.com/	http://www.lemonamiga.com/
http://www.arcadeflyerarchive.com/	http://www.lgdb.org/
http://www.arcade-history.com/	http://www.lparchive.org/
http://www.arcade-museum.com/	http://www.marketplace.xbox.com/en-US/
http://www.atari.org/	http://www.marvel.wikia.com/
http://www.atarimania.com/	http://www.mmogames.com/
http://www.bestoldgames.net/eng/	http://www.mmogamesite.com/
http://www.bogleech.com/games.html/	http://www.mmohuts.com/
http://www.browsergamez.com/	http://www.mmosite.com/
http://www.c64db.com/	http://www.myabandonware.com/
http://www.cdosabandonware.com/	http://www.onrpg.com/
http://www.chessgames.com/	http://www.pixelprospector.com/
http://www.coinop.org/	http://www.playbbg.com/
http://www.consoledatabase.com/	http://www.racketboy.com/
http://www.co-optimus.com/	http://www.reloaded.org/
http://www.db.tigsource.com/	http://www.retrobase.net/
http://www.dotmmo.com/	http://www.retrocollect.com/
http://www.fightersgeneration.com/	http://www.rpgmaker.net/
http://www.arcade-museum.com/	http://www.steamdb.info/linux/
http://www.freeoldies.com/index.php/	http://www.system16.com/
http://www.freeware.remakes.org/	http://www.ultimateconsoledatabase.com/
http://www.game-art-hq.com/	http://www.unseen64.net/
http://www.gamebase64.com/	http://www.uvlist.net/
http://www.gamejolt.com/	http://www.vgrebirth.org/
http://www.games.en.softonic.com/	http://www.xboxindies.com/
http://www.games-db.com/	http://www.xtcabandonware.com/
http://www.gamesdbase.com/	
http://www.gametdb.com/	
http://www.gbdb.org/	
http://www.ggdb.com/	
http://www.hardcoregaming101.net/	
http://www.healthgamesresearch.org/db/	
http://www.abime.net/	
http://www.homeoftheunderdogs.net/	
http://www.igcd.net/	
http://www.igdb.com/	
http://www.imfdb.org/wiki/Category:Video_Game/	
http://www.indiedb.com/	
http://www.indiegames.com/index.html/	
http://www.indiestatik.com/	

Table B.1 - Database list (excluded – different scope)

Excluded based on Language:	Excluded based on Content:
http://www.4gamer.net/	http://www.gamesradar.com/uk/
http://www.game.ocn.ne.jp/	http://www.hypejar.com/most-hyped/video-games/
http://www.inside-games.jp/	http://www.moddb.com/games/
http://www.jp.wazap.com/	http://www.rpgfanatic.net/
http://www.sosgamers.com/	http://www.spong.com/games-db/
	http://www.spritedatabase.net/

Table B.2 - Database list (excluded – different language and incomplete content)

Excluded based on accessibility:	Selected databases:
http://www.1up.com/	http://www.mobygames.com/
http://www.8bithorse.blogspot.gr/	http://www.rfgeneration.com/
http://www.collectorz.com	http://www.vgchartz.com/
http://www.didyouknowgaming.com/	
http://www.en.wikipedia.org/wiki/Portal:Video_games/	
http://www.eurogamer.nl/games	
http://www.gamefaqs.com/	
http://www.gamer.nl/	
http://www.gamerankings.com/	
http://www.gamespot.com/	
http://www.giantbomb.com/games/	
http://www.igamed.com/	
http://www.joystiq.com/	
http://www.mediastinger.com/	
http://www.metacritic.com/	
http://www.ign.com/	
http://www.opengamedatabase.com/	
http://www.thegamesdb.net/	
http://www.vgcollect.com/	
http://www.ultimategamedb.com/	
http://www.videogamegeek.com/	

Table B.3 - Database list (excluded based on accessibility and the selected databases)

Appendix C – Sales figures

Multiple sales figures are presented in appendix D. The first table (C.1) is a lists of sales figures for each video game console generation. The other tables included are from the sample data and list the sales figures per platform. These figures are split into single- and multi-homing and also into genres.

Generation	Console	Console sales (millions of copies)	Game sales (Millions of copies)
1st generation	Magnavox Odyssey	0.33	No data found
	Atari/Sears Tele-games	0.15	
	Coleco Telstar	1	
	Nintendo Color TV	3	
2nd generation	Atari 2600	27.64	128.8
	Atari 5200	1	
	Magnavox Odyssey2	2	
	Intellivision	3	
	ColecoVision	2	
3rd generation	Nintendo Entertainment System	61.91	501.48
	Sega Master System	13	
	Atari 7800	4.3	
4th generation	TurboGrafx-16	10	555.02
	Sega Genesis	29.52	
	Super Nintendo Entertainment System	49.1	
5th generation	3DO Interactive Multiplayer	2	1234.61
	Sega Saturn	8.82	
	PlayStation	104.25	
	Nintendo 64	32.93	
6th generation	Dreamcast	8.2	2206.91
	PlayStation 2	157.68	
	GameCube	21.74	
	Xbox	24.65	
7th generation	Xbox 360	81.12	2618.02
	Nintendo Wii	100.96	
	PlayStation 3	82.63	
8th generation	Nintendo Wii U	5.92	48.95
	PlayStation 4	6.56	
	Xbox One	4.03	

Table C.1 – Console and game sales per generation (data sources: VGChartz, Wikipedia)

Single-homing sales:

Xbox 360	Action	Adventure	Fighting	Misc	Platform	Puzzle	Racing	Role-Playing	Shooter	Simulation	Sports	Strategy	Avg Year	Sum Year
2006	3,52		0,7			0,04	0,67	1,29	1,07	0,47	1,3	0,29	1,038889	9,35
2007	0,53		0,27	2,91		0,36	6,1	1,25	13,87	1,81	0,27	0,08	2,745	27,45
2008	1,71		0,06	2,44	0,73		0,03	5,72	6,83	0,72	0,24	0,09	1,857	18,57
2009	0,09	0,09	0,61	0,53		0,07	5,55	0,28	6,72		0,33	2,35	1,662	16,62
2010	1,37	0,12	0,35	24,43			3,06	0,17	10,68	1,73	7,8	0,2	4,991	49,91
2011	0,71	0,03		6,49				0,1	8,59	0,3	3,33		2,792857	19,55
2012	1,4	0,24		0,62			1,48	0,18	8,4	0,11	0,7		1,64125	13,13
Avg Genre	1,332857	0,12	0,398	6,236667	0,73	0,156667	2,815	1,284286	8,022857	0,856667	1,995714	0,602		
Sum Genre	9,33	0,48	1,99	37,42	0,73	0,47	16,89	8,99	56,16	5,14	13,97	3,01		

Table C.2 - Xbox 360 single-homing sales

Wii	Action	Adventure	Fighting	Misc	Platform	Puzzle	Racing	Role-Playing	Shooter	Simulation	Sports	Strategy	Avg Year	Sum Year
2006	7,53		0,72	31,22	0,16	2,96	1,89	1,53	0,72	0,37	81,79	0,05	11,72182	128,94
2007	4,64	4,1	2,83	25,2	18,34	0,29	1,8	1,07	8,19	7,99	44,88	0,92	10,02083	120,25
2008	6,34	2,06	12,9	11,33	2,56	2,7	37,73	1,48	3,17	12,69	27,01	0,7	10,05583	120,67
2009	5,36	6,48	1,01	19,44	29,36	3,37	4,28	4,35	3,13	3,88	73,82	0,84	12,94333	155,32
2010	6,88	1,51	0,8	28,77	22,77	1,65	0,77	0,94	1,27	1,05	8,08	0,63	6,26	75,12
2011	4,76	0,64	0,12	7,43	1,62		0,04	1,55	0,25	0,15	6,93	0,05	2,14	23,54
2012	0,01		0,08	2,67			0,01				0,1		0,574	2,87
Avg Genre	5,074286	2,958	2,637143	18,00857	12,46833	2,194	6,645714	1,82	2,788333	4,355	34,65857	0,531667		
Sum Genre	35,52	14,79	18,46	126,06	74,81	10,97	46,52	10,92	16,73	26,13	242,61	3,19		

Table C.3 - Wii single-homing sales

PS3	Action	Adventure	Fighting	Misc	Platform	Puzzle	Racing	Role-Playing	Shooter	Simulation	Sports	Strategy	Avg Year	Sum Year
2006	0,73			0,04			5,87	0,17	4,17	0,2	0,27		**1,635714**	**11,45**
2007	8,41	0,12	1,04	1,35	2,44		4,16	0,26	0,82	1,02	1,61		**2,123**	**21,23**
2008	5,85	0,76	1	2,48	5,87		1,36	2,61	4,74		0,97	0,08	**2,572**	**25,72**
2009	9,94	1,06		2,08	1,72	0,32	0,05	2,69	3,48	1,02	0,84	0,04	**2,112727**	**23,24**
2010	4,81	2,64	0,5	1,7	0,6		11,58	3,25	2,03	0,26	5,05	0,13	**2,959091**	**32,55**
2011	8,95	1,17	1,26	0,96	4,08		0,38	3,08	5,44	0,16	1,07	0,03	**2,416364**	**26,58**
2012	3,99	0,25		0,09	0,59			0,82	0,1		1,9	0,37	**1,01375**	**8,11**
Avg Genre	**6,097143**	**1**	**0,95**	**1,242857**	**2,55**	**0,32**	**3,9**	**1,84**	**2,968571**	**0,532**	**1,672857**	**0,13**		
Sum Genre	**42,68**	**6**	**3,8**	**8,7**	**15,3**	**0,32**	**23,4**	**12,88**	**20,78**	**2,66**	**11,71**	**0,65**		

Table C.4 - PS3 single-homing sales

PC	Action	Adventure	Fighting	Misc	Platform	Puzzle	Racing	Role-Playing	Shooter	Simulation	Sports	Strategy	Avg Year	Sum Year
2006						0,02	0,01	0,09	0,01	0,96	0,01	0,26	**0,194286**	**1,36**
2007						0,04		4,02	0,09	0,15	1,11	0,16	**0,928333**	**5,57**
2008		0,07		0,02		0,04	0,02	3,85	0,5	1,55	0,01	1,11	**0,796667**	**7,17**
2009		0,63		0,01		0,05	0,03	0,01	0,16	0,73	0,05	1,58	**0,361111**	**3,25**
2010		0,13				0,05		3,44	0,04	3,47	1,17	6,61	**2,13**	**14,91**
2011	0,16	0,17		0,01		0,19	0,1	3,03	0,38	2,27	1,49	2,44	**1,024**	**10,24**
2012	1,04	0,11				0,03		3,43		0,11		0,17	**0,815**	**4,89**
Avg Genre	**0,6**	**0,222**	**0**	**0,013333**	**0**	**0,06**	**0,04**	**2,552857**	**0,196667**	**1,32**	**0,64**	**1,761429**		
Sum Genre	**1,2**	**1,11**	**0**	**0,04**	**0**	**0,42**	**0,16**	**17,87**	**1,18**	**9,24**	**3,84**	**12,33**		

Table C.5 - PC single-homing sales

Total	Action	Adventure	Fighting	Misc	Platform	Puzzle	Racing	Role-Playing	Shooter	Simulation	Sports	Strategy	Avg Year	Sum Year
2006	11,78		1,42	31,26	0,16	3,02	8,44	3,08	5,97	2	83,37	0,6	13,73636	151,1
2007	13,58	4,22	4,14	29,46	20,78	0,69	12,06	6,6	22,97	10,97	47,87	1,16	14,54167	174,5
2008	13,9	2,89	13,96	16,27	9,16	2,74	39,14	13,66	15,24	14,96	28,23	1,98	14,34417	172,13
2009	15,39	8,26	1,62	22,06	31,08	3,81	9,91	7,33	13,49	5,63	75,04	4,81	16,53583	198,43
2010	13,06	4,4	1,65	54,9	23,37	1,7	15,41	7,8	14,02	6,51	22,1	7,57	14,37417	172,49
2011	14,58	2,01	1,38	14,89	5,7	0,19	0,52	7,76	14,66	2,88	12,82	2,52	6,659167	79,91
2012	6,44	0,6	0,08	3,38	0,59	0,03	1,49	4,43	8,5	0,22	2,7	0,54	2,416667	29
Avg Genre	12,67571	3,73	3,464286	24,60286	12,97714	1,74	12,42429	7,237143	13,55	6,167143	38,87571	2,74		
Sum Genre	88,73	22,38	24,25	172,22	90,84	12,18	86,97	50,66	94,85	43,17	272,13	19,18		

Table C.6 - Total single-homing sales

Multi-homing sales:

Xbox 360	Action	Adventure	Fighting	Misc	Platform	Puzzle	Racing	Role-Playing	Shooter	Simulation	Sports	Strategy	Avg Year	Sum Year
2006	3,97		1,43	0,2	1,08		2,21	6,77	14,11	1,96	7,48	0,02	3,923	39,23
2007	5,95	5,66	1,4	4,66	0,78		6,16	4,42	18,9	0,35	10,96	1,15	5,49	60,39
2008	25,27	9,4	5,16	7,19	5,28		9,22	5,76	23,73	0,14	15,11	2,42	9,88	108,68
2009	23,92	4,21	8,49	6,56	0,59	0,11	4,37	4,9	25,22	0,67	13,96	0,62	7,801667	93,62
2010	27,29	2,16	4,75	3,62	0,24		4,53	14,97	27,14	1,37	18,89	0,66	9,601818	105,62
2011	20,12	3,41	5,83	5,71	1,99		9,3	10,78	34,73	0,76	14,8		10,743	107,43
2012	23,3	1,36	2,3	1			1,78	4,43	23,91	0,23	5,5	0,41	6,422	64,22
Avg Genre	18,54571	4,366667	4,194286	4,134286	1,66	0,11	5,367143	7,432857	23,96286	0,782857	12,38571	0,88		
Sum Genre	129,82	26,2	29,36	28,94	9,96	0,11	37,57	52,03	167,74	5,48	86,7	5,28		

Table C.7 - Xbox 360 multi-homing sales

Wii	Action	Adventure	Fighting	Misc	Platform	Puzzle	Racing	Role-Playing	Shooter	Simulation	Sports	Strategy	Avg Year	Sum Year
2006	0,16	0,39		1,44	0,54	0,02	2,15	0,39			1,03		0,765	6,12
2007	7,09	1,04	0,97	4,59	0,92	0,29	1,36		0,18	3,8	6,04	0,42	2,427273	26,7
2008	5,81	5,95	0,96	16,1	5,83	1,9	1,58		1,99	1,17	5,37		4,666	46,66
2009	6,76	3,64	0,7	11,79	1,03	0,41	1,99	0,31	0,58	0,89	9,74	0,07	3,159167	37,91
2010	4,89	3,1	0,44	14,48	0,54	0,02	2,09		1,46	1,73	13,79	0,33	3,897273	42,87
2011	9,37	0,22	0,55	12,6	1,25	0,01	0,94	0,17	0,74	0,01	3,41		2,660909	29,27
2012	3,68	0,01		7,36							0,61		2,915	11,66
Avg Genre	5,394286	2,05	0,724	9,765714	1,685	0,441667	1,685	0,29	0,99	1,52	5,712857	0,273333		
Sum Genre	37,76	14,35	3,62	68,36	10,11	2,65	10,11	0,87	4,95	7,6	39,99	0,82		

Table C.8 - Wii multi-homing sales

PS3	Action	Adventure	Fighting	Misc	Platform	Puzzle	Racing	Role-Playing	Shooter	Simulation	Sports	Strategy	Avg Year	Sum Year
2006			1,63		1,09		1,08	0,35	1,41	0,81	2,03		1,2	8,4
2007	4,34	4,76	1,29	2,26	1,14		5,32	3,14	13,91	0,11	9,47		4,574	45,74
2008	22,73	4,42	5,3	6,88	2,14		8,82	3,76	16,21	0,17	13,01	1,27	7,700909	84,71
2009	26,2	1,35	10,73	5,58	0,81		5,33	8,17	17,07	0,77	14,78	0,18	8,27	90,97
2010	26,8	4,1	6,17	3,51	0,35		6,57	4,42	22,77	1,35	20,46	0,42	8,810909	96,92
2011	21,62	4,03	6,96	2,66	2,3		6,88	12,33	31,15	1,02	17,06	0,16	9,651818	106,17
2012	26,14	2,47	3,61	0,29			3,09	2,11	21,04	0,49	6,06	0,33	6,563	65,63
Avg Genre	21,305	3,521667	5,098571	3,53	1,305	0	5,298571	4,897143	17,65143	0,674286	11,83857	0,472		
Sum Genre	127,83	21,13	35,69	21,18	7,83	0	37,09	34,28	123,56	4,72	82,87	2,36		

Table C.9 - PS3 multi-homing sales

PC	Action	Adventure	Fighting	Misc	Platform	Puzzle	Racing	Role-Playing	Shooter	Simulation	Sports	Strategy	Avg Year	Sum Year
2006	0,04	0,02		0,01			0,03	0,17	0,03				0,05	0,3
2007	0,04	0,03			0,01		0,06	0,01	2,3	0,01	0,02	0,09	0,285556	2,57
2008	1,35	0,9			0,02	0,04	0,03	1,53	0,63	0,02	0,01	0,61	0,514	5,14
2009	0,54	0,06	0,02	0,03	0,04		0,07	0,67	1,4	3,5	0,07	0,08	0,589091	6,48
2010	1,33	0,08	0,01	0,15	0,12	0,02	0,39	2,44	3,17	0,02	0,41	0,38	0,71	8,52
2011	2,43	0,16		0,01	0,04	0,23	1,06	5,18	7,77	0,04	0,8		1,772	17,72
2012	2,42	0,06	0,01				0,2	4,43	3,09		0,07	0,4	1,335	10,68
Avg Genre	1,164286	0,187143	0,013333	0,05	0,046	0,096667	0,262857	2,061429	2,627143	0,718	0,23	0,312		
Sum Genre	8,15	1,31	0,04	0,2	0,23	0,29	1,84	14,43	18,39	3,59	1,38	1,56		

Table C.10 - PC multi-homing sales

Total	Action	Adventure	Fighting	Misc	Platform	Puzzle	Racing	Role-Playing	Shooter	Simulation	Sports	Strategy	Avg Year	Sum Year
2006	4,17	0,41	3,06	1,65	2,71	0,02	5,47	7,68	15,55	2,77	10,54	0,02	4,504167	54,05
2007	17,42	11,49	3,66	11,51	2,85	0,29	12,9	7,57	35,29	4,27	26,49	1,66	11,28333	135,4
2008	55,16	20,67	11,42	30,17	13,27	1,94	19,65	11,05	42,56	1,5	33,5	4,3	20,4325	245,19
2009	57,42	9,26	19,94	23,96	2,47	0,52	11,76	14,05	44,27	5,83	38,55	0,95	19,08167	228,98
2010	60,31	9,44	11,37	21,76	1,25	0,04	13,58	21,83	54,54	4,47	53,55	1,79	21,16083	253,93
2011	53,54	7,82	13,34	20,98	5,58	0,24	18,18	28,46	74,39	1,83	36,07	0,16	21,71583	260,59
2012	55,54	3,9	5,92	8,65			5,07	10,97	48,04	0,72	12,24	1,14	15,219	152,19
Avg Genre	43,36571	8,998571	9,815714	16,95429	4,688333	0,508333	12,37286	14,51571	44,94857	3,055714	30,13429	1,431429		
Sum Genre	303,56	62,99	68,71	118,68	28,13	3,05	86,61	101,61	314,64	21,39	210,94	10,02		

Table C.11 - Total multi-homing sales

Appendix D – Statistical analysis of the data

The statistical analysis of the data contains a large quantity of tests that are all listed here. Multiple tables are also shown in the findings chapter.

Independent Sample T-test:

Group Statistics

	Total	N	Mean	Std. Deviation	Std. Error Mean
Sales	Single-Homed	500	,5103	1,23212	,05510
	Multi-Homed	500	,6119	1,22868	,05495

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
Sales	Equal variances assumed	,022	,883	-1,305	998
	Equal variances not assumed			-1,305	997,992

Independent Samples Test

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
					Lower
Sales	Equal variances assumed	,192	-,10156	,07782	-,25426
	Equal variances not assumed	,192	-,10156	,07782	-,25426

Independent Samples Test

		t-test for Equality of Means
		95% Confidence Interval of the Difference
		Upper
Sales	Equal variances assumed	,05114
	Equal variances not assumed	,05114

Two way Anova:

Between-Subjects Factors

		Value Label	N
Homed	1,00	Single-Homed	757
	2,00	Multi-Homed	1050
Platform	1,00	Xbox 360	486
	2,00	Wii	604
	3,00	PS3	450
	4,00	PC	267

Descriptive Statistics

Dependent Variable: Sales

Homed	Platform	Mean	Std. Deviation	N
Single-Homed	Xbox 360	,6395	1,70050	109
	Wii	,4238	1,02033	399
	PS3	,6095	1,10051	121
	PC	,1916	,57695	128
	Total	,4453	1,10916	757
Multi-Homed	Xbox 360	,8102	1,55710	377
	Wii	,4678	,88476	205
	PS3	,7421	1,33626	329
	PC	,1981	,46777	139
	Total	,6410	1,28597	1050
Total	Xbox 360	,7719	1,59017	486
	Wii	,4387	,97591	604
	PS3	,7064	1,27732	450
	PC	,1950	,52197	267
	Total	,5590	1,21855	1807

Levene's Test of Equality of Error Variances[a]

Dependent Variable: Sales

F	df1	df2	Sig.
9,617	7	1799	,000

Tests the null hypothesis that the error variance of
the dependent variable is equal across groups.[a]

a. Design: Intercept + Homed + Platform + Homed
* Platform

Tests of Between-Subjects Effects

Dependent Variable: Sales

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	80,203[a]	7	11,458	7,923	,000
Intercept	366,143	1	366,143	253,201	,000
Homed	2,747	1	2,747	1,899	,168
Platform	53,938	3	17,979	12,433	,000
Homed * Platform	1,458	3	,486	,336	,799
Error	2601,450	1799	1,446		
Total	3246,281	1807			
Corrected Total	2681,654	1806			

Tests of Between-Subjects Effects

Dependent Variable: Sales

Source	Partial Eta Squared
Corrected Model	,030
Intercept	,123
Homed	,001
Platform	,020
Homed * Platform	,001
Error	
Total	
Corrected Total	

a. R Squared = ,030 (Adjusted R Squared = ,026)

Estimated Marginal Means

1. Homed

Estimates

Dependent Variable: Sales

Homed	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Single-Homed	,466	,050	,368	,564
Multi-Homed	,555	,040	,476	,633

Pairwise Comparisons

Dependent Variable: Sales

(I) Homed	(J) Homed	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]
					Lower Bound
Single-Homed	Multi-Homed	-,088	,064	,168	-,214
Multi-Homed	Single-Homed	,088	,064	,168	-,037

Pairwise Comparisons

Dependent Variable: Sales

(I) Homed	(J) Homed	95% Confidence Interval for Difference
		Upper Bound
Single-Homed	Multi-Homed	,037
Multi-Homed	Single-Homed	,214

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Univariate Tests

Dependent Variable: Sales

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	2,747	1	2,747	1,899	,168	,001
Error	2601,450	1799	1,446			

The F tests the effect of Homed. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

2. Platform

Estimates

Dependent Variable: Sales

			95% Confidence Interval	
Platform	Mean	Std. Error	Lower Bound	Upper Bound
Xbox 360	,725	,065	,597	,853
Wii	,446	,052	,344	,547
PS3	,676	,064	,550	,801
PC	,195	,074	,050	,339

Pairwise Comparisons

Dependent Variable: Sales

(I) Platform	(J) Platform	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Xbox 360	Wii	,279[*]	,083	,001	,116	,442
	PS3	,049	,091	,592	-,130	,228
	PC	,530[*]	,098	,000	,337	,723
Wii	Xbox 360	-,279[*]	,083	,001	-,442	-,116
	PS3	-,230[*]	,082	,005	-,391	-,069
	PC	,251[*]	,090	,005	,075	,427
PS3	Xbox 360	-,049	,091	,592	-,228	,130
	Wii	,230[*]	,082	,005	,069	,391
	PC	,481[*]	,098	,000	,290	,672
PC	Xbox 360	-,530[*]	,098	,000	-,723	-,337
	Wii	-,251[*]	,090	,005	-,427	-,075
	PS3	-,481[*]	,098	,000	-,672	-,290

Based on estimated marginal means

*. The mean difference is significant at the ,05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Univariate Tests

Dependent Variable: Sales

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	53,938	3	17,979	12,433	,000	,020
Error	2601,450	1799	1,446			

The F tests the effect of Platform. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

3. Homed * Platform

Estimates

Dependent Variable: Sales

Homed	Platform	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Single-Homed	Xbox 360	,640	,115	,414	,865
	Wii	,424	,060	,306	,542
	PS3	,610	,109	,395	,824
	PC	,192	,106	-,017	,400
Multi-Homed	Xbox 360	,810	,062	,689	,932
	Wii	,468	,084	,303	,633
	PS3	,742	,066	,612	,872
	PC	,198	,102	-,002	,398

Pairwise Comparisons

Dependent Variable: Sales

Platform	(I) Homed	(J) Homed	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]
						Lower Bound
Xbox 360	Single-Homed	Multi-Homed	-,171	,131	,192	-,427
	Multi-Homed	Single-Homed	,171	,131	,192	-,086
Wii	Single-Homed	Multi-Homed	-,044	,103	,670	-,247
	Multi-Homed	Single-Homed	,044	,103	,670	-,159
PS3	Single-Homed	Multi-Homed	-,133	,128	,300	-,383
	Multi-Homed	Single-Homed	,133	,128	,300	-,118
PC	Single-Homed	Multi-Homed	-,006	,147	,965	-,295
	Multi-Homed	Single-Homed	,006	,147	,965	-,283

Pairwise Comparisons

Dependent Variable: Sales

Platform	(I) Homed	(J) Homed	95% Confidence Interval for Difference
			Upper Bound
Xbox 360	Single-Homed	Multi-Homed	,086
	Multi-Homed	Single-Homed	,427
Wii	Single-Homed	Multi-Homed	,159
	Multi-Homed	Single-Homed	,247
PS3	Single-Homed	Multi-Homed	,118
	Multi-Homed	Single-Homed	,383
PC	Single-Homed	Multi-Homed	,283
	Multi-Homed	Single-Homed	,295

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Univariate Tests

Dependent Variable: Sales

Platform		Sum of Squares	df	Mean Square	F	Sig.
Xbox 360	Contrast	2,461	1	2,461	1,702	,192
	Error	2601,450	1799	1,446		
Wii	Contrast	,262	1	,262	,181	,670
	Error	2601,450	1799	1,446		
PS3	Contrast	1,555	1	1,555	1,075	,300
	Error	2601,450	1799	1,446		
PC	Contrast	,003	1	,003	,002	,965
	Error	2601,450	1799	1,446		

Univariate Tests

Dependent Variable: Sales

Platform		Partial Eta Squared
Xbox 360	Contrast	,001
	Error	
Wii	Contrast	,000
	Error	
PS3	Contrast	,001
	Error	
PC	Contrast	,000
	Error	

Each F tests the simple effects of Homed within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

Profile Plots
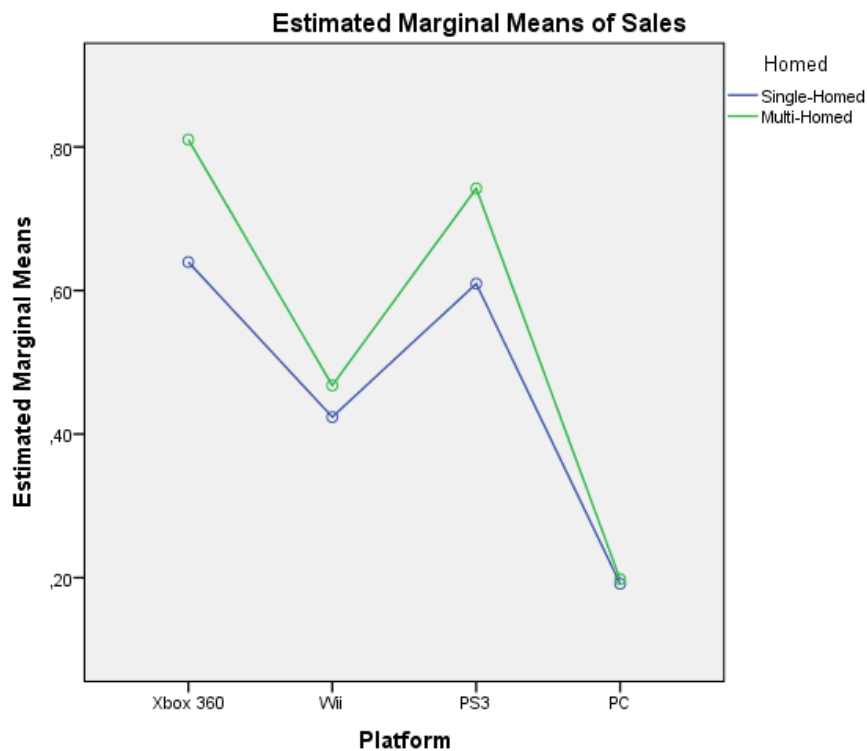
Independent Samples T-test for Genres

Group Statistics

Genres		Homed	N	Mean	Std. Deviation	Std. Error Mean
Action	Sales	Single-Homed	169	,5276	1,11886	,08607
		Multi-Homed	519	,6479	1,28210	,05628
Adventure	Sales	Single-Homed	140	,1967	,42596	,03600
		Multi-Homed	146	,4321	,83120	,06879
Fighting	Sales	Single-Homed	55	,4493	1,58334	,21350
		Multi-Homed	105	,6743	,58386	,05698
Misc	Sales	Single-Homed	244	,7068	2,49696	,15985
		Multi-Homed	205	,5813	1,06321	,07426
Platform	Sales	Single-Homed	52	1,7531	4,14775	,57519
		Multi-Homed	71	,3980	,47898	,05684
Puzzle	Sales	Single-Homed	62	,1965	,44446	,05645
		Multi-Homed	20	,1525	,30549	,06831
Racing	Sales	Single-Homed	104	,8362	3,53855	,34698
		Multi-Homed	183	,4753	,62709	,04636
Role-Playing	Sales	Single-Homed	127	,4054	,75675	,06715
		Multi-Homed	115	,8961	1,30785	,12196
Shooter	Sales	Single-Homed	122	,7887	1,88874	,17100
		Multi-Homed	323	,9986	2,13781	,11895
Simulation	Sales	Single-Homed	141	,3127	,55257	,04653
		Multi-Homed	62	,3458	,53129	,06747
Sports	Sales	Single-Homed	223	1,2240	6,31970	,42320
		Multi-Homed	405	,5452	,80326	,03991
Strategy	Sales	Single-Homed	113	,1788	,49695	,04675
		Multi-Homed	48	,2088	,22046	,03182

Independent Samples Test

Genres			Levene's Test for Equality of Variances		t-test for Equality of Means		
			F	Sig.	t	df	Sig. (2-tailed)
Action	Sales	Equal variances assumed	,338	,561	-1,092	686	,275
		Equal variances not assumed			-1,170	323,214	,243
Adventure	Sales	Equal variances assumed	16,802	,000	-2,995	284	,003
		Equal variances not assumed			-3,032	218,225	,003
Fighting	Sales	Equal variances assumed	,037	,847	-1,300	158	,195

Genres			F	Sig.	t	df	Sig. (2-tailed)
		Equal variances not assumed			-1,018	61,803	,313
Misc	Sales	Equal variances assumed	3,589	,059	,670	447	,503
		Equal variances not assumed			,712	340,317	,477
Platform	Sales	Equal variances assumed	17,484	,000	2,732	121	,007
		Equal variances not assumed			2,344	51,997	,023
Puzzle	Sales	Equal variances assumed	,742	,391	,411	80	,682
		Equal variances not assumed			,496	46,983	,622
Racing	Sales	Equal variances assumed	8,105	,005	1,345	285	,180
		Equal variances not assumed			1,031	106,690	,305
Role-Playing	Sales	Equal variances assumed	19,600	,000	-3,613	240	,000
		Equal variances not assumed			-3,525	178,736	,001
Shooter	Sales	Equal variances assumed	,022	,883	-,953	443	,341
		Equal variances not assumed			-1,008	244,888	,315
Simulation	Sales	Equal variances assumed	,089	,766	-,398	201	,691
		Equal variances not assumed			-,404	120,911	,687
Sports	Sales	Equal variances assumed	16,087	,000	2,132	626	,033
		Equal variances not assumed			1,597	225,957	,112
Strategy	Sales	Equal variances assumed	,989	,321	-,400	159	,690
		Equal variances not assumed			-,529	158,663	,598

Independent Samples Test

Genres			t-test for Equality of Means		95% Confidence Interval of the Difference	
			Mean Difference	Std. Error Difference	Lower	Upper
Action	Sales	Equal variances assumed	-,12033	,11019	-,33667	,09602
		Equal variances not assumed	-,12033	,10283	-,32263	,08198
Adventure	Sales	Equal variances assumed	-,23541	,07860	-,39013	-,08069

		Equal variances not assumed	-,23541	,07764	-,38843	-,08239
Fighting	Sales	Equal variances assumed	-,22501	,17308	-,56685	,11683
		Equal variances not assumed	-,22501	,22097	-,66675	,21673
Misc	Sales	Equal variances assumed	,12553	,18723	-,24243	,49349
		Equal variances not assumed	,12553	,17626	-,22116	,47222
Platform	Sales	Equal variances assumed	1,35505	,49598	,37312	2,33698
		Equal variances not assumed	1,35505	,57799	,19522	2,51488
Puzzle	Sales	Equal variances assumed	,04395	,10690	-,16878	,25668
		Equal variances not assumed	,04395	,08861	-,13432	,22222
Racing	Sales	Equal variances assumed	,36095	,26838	-,16731	,88921
		Equal variances not assumed	,36095	,35007	-,33304	1,05494
Role-Playing	Sales	Equal variances assumed	-,49073	,13581	-,75826	-,22320
		Equal variances not assumed	-,49073	,13922	-,76546	-,21600
Shooter	Sales	Equal variances assumed	-,20992	,22027	-,64281	,22298
		Equal variances not assumed	-,20992	,20830	-,62021	,20037
Simulation	Sales	Equal variances assumed	-,03311	,08323	-,19723	,13101
		Equal variances not assumed	-,03311	,08196	-,19538	,12916
Sports	Sales	Equal variances assumed	,67881	,31840	,05354	1,30407
		Equal variances not assumed	,67881	,42508	-,15882	1,51643
Strategy	Sales	Equal variances assumed	-,02990	,07477	-,17756	,11776
		Equal variances not assumed	-,02990	,05655	-,14159	,08179

Appendix E – Network graphs

All the network graphs created for this research project are listed here. There are two categories; platform network graphs and publisher network graphs.
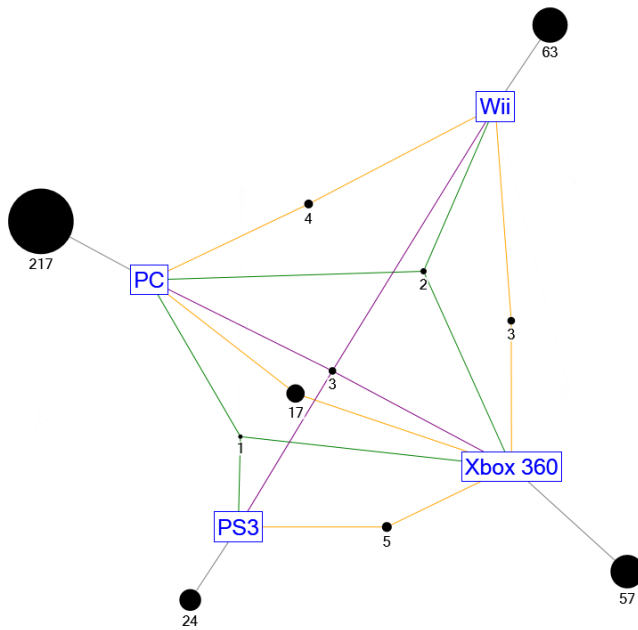
Platforms:

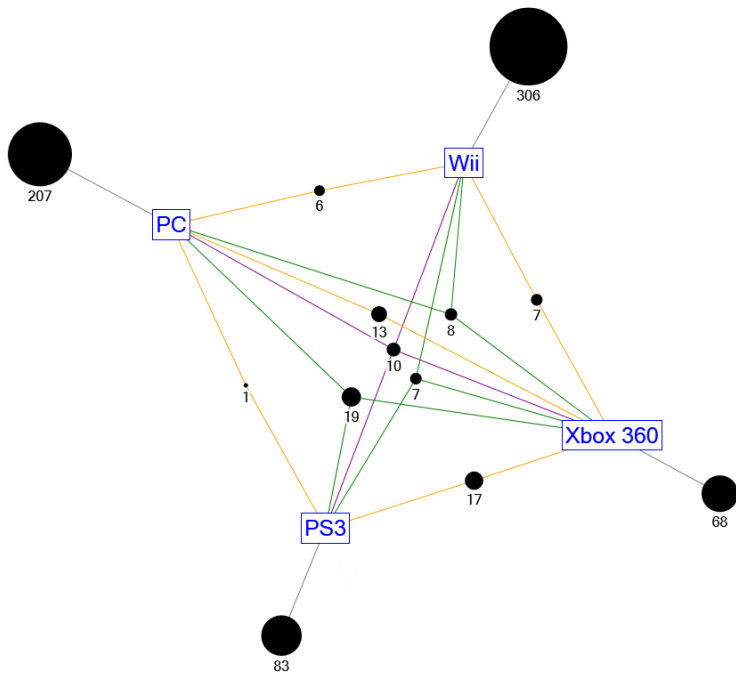**Figure E.1 - Platform Network graph 2006**

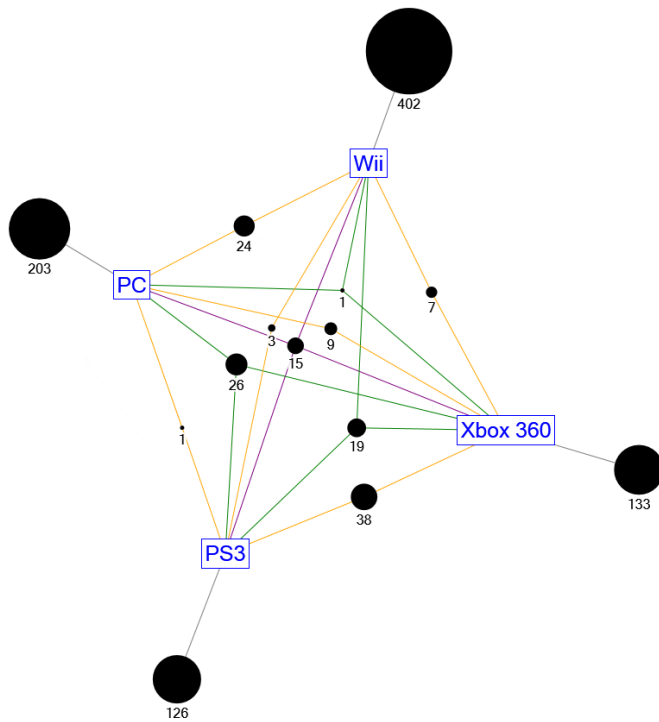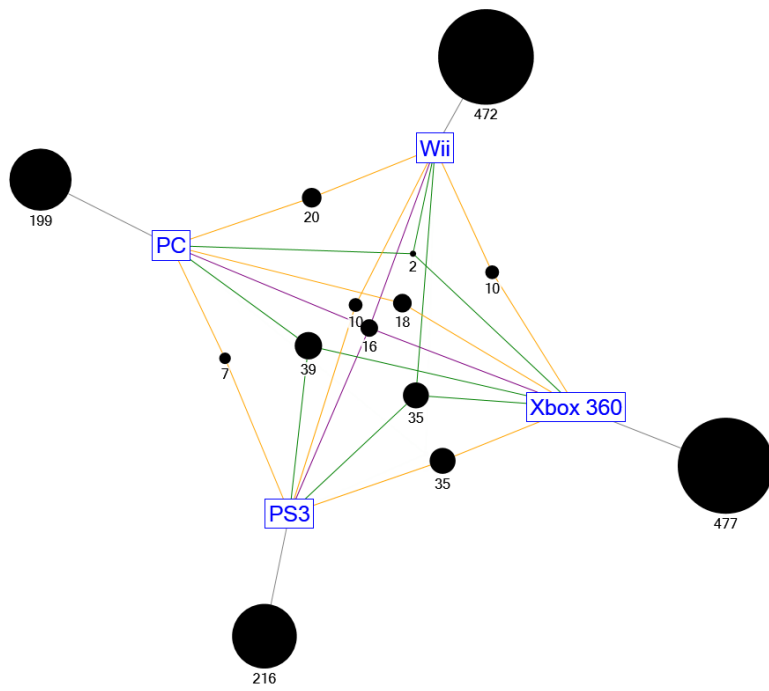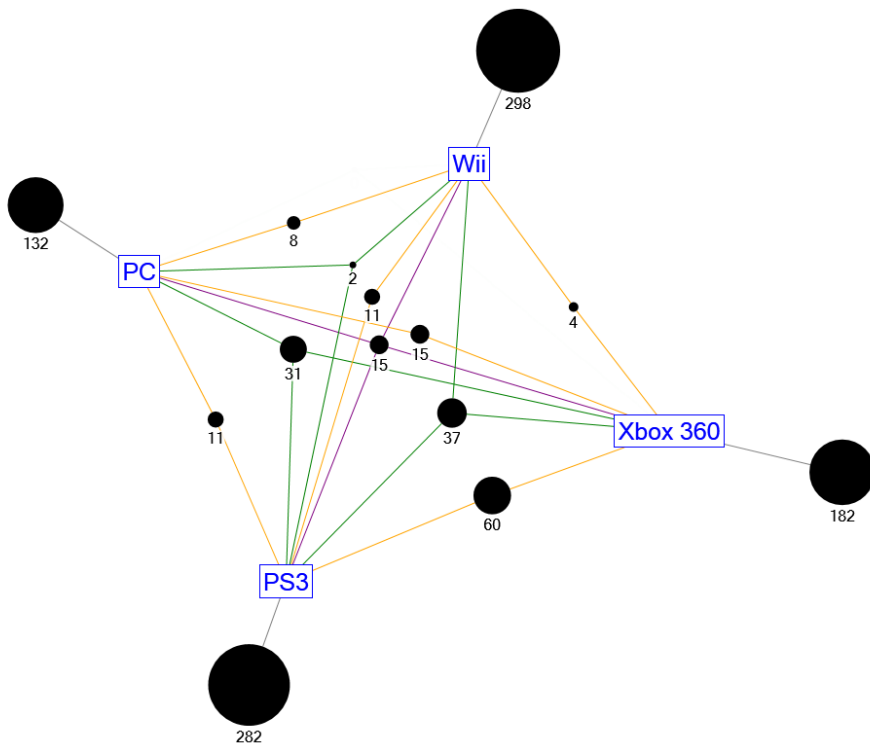**Figure E.2 - Platform Network graph 2007**

Figure E.3 - Platform Network graph 2008

Figure E.4 - Platform Network graph 2009
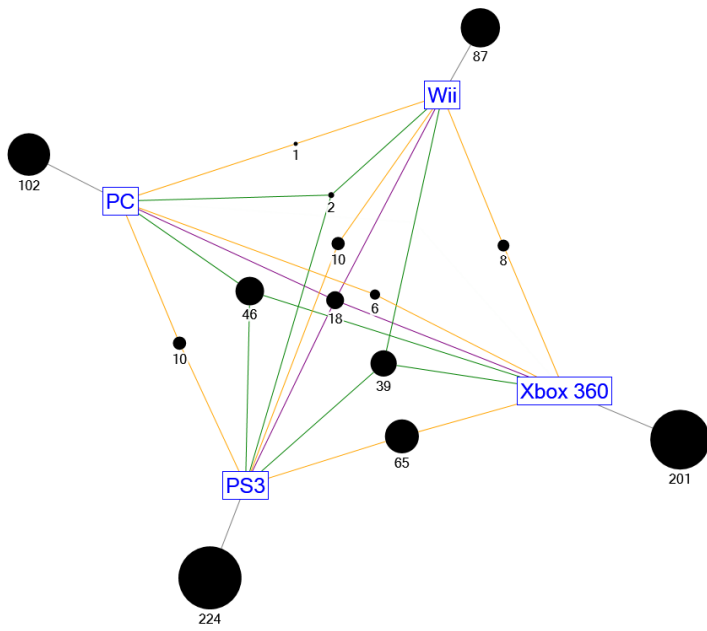

Figure E.5 - Platform Network graph 2010

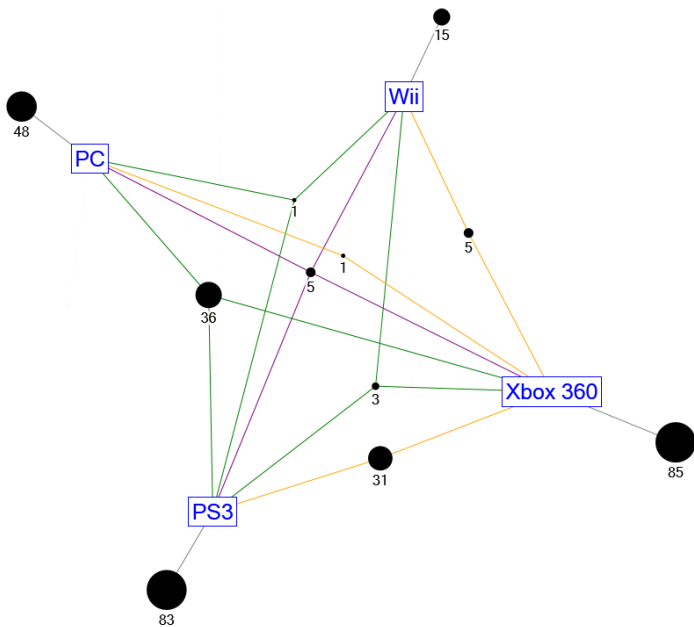**Figure E.6 - Platform Network graph 2011**
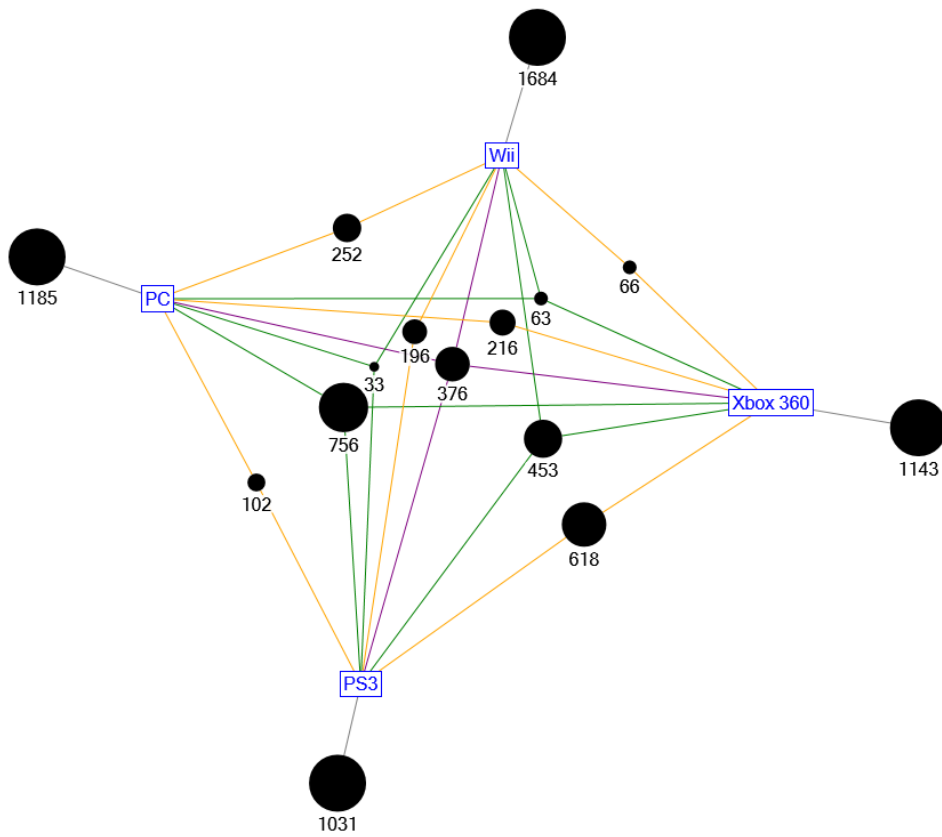

Figure E.7 - Platform Network graph 2012

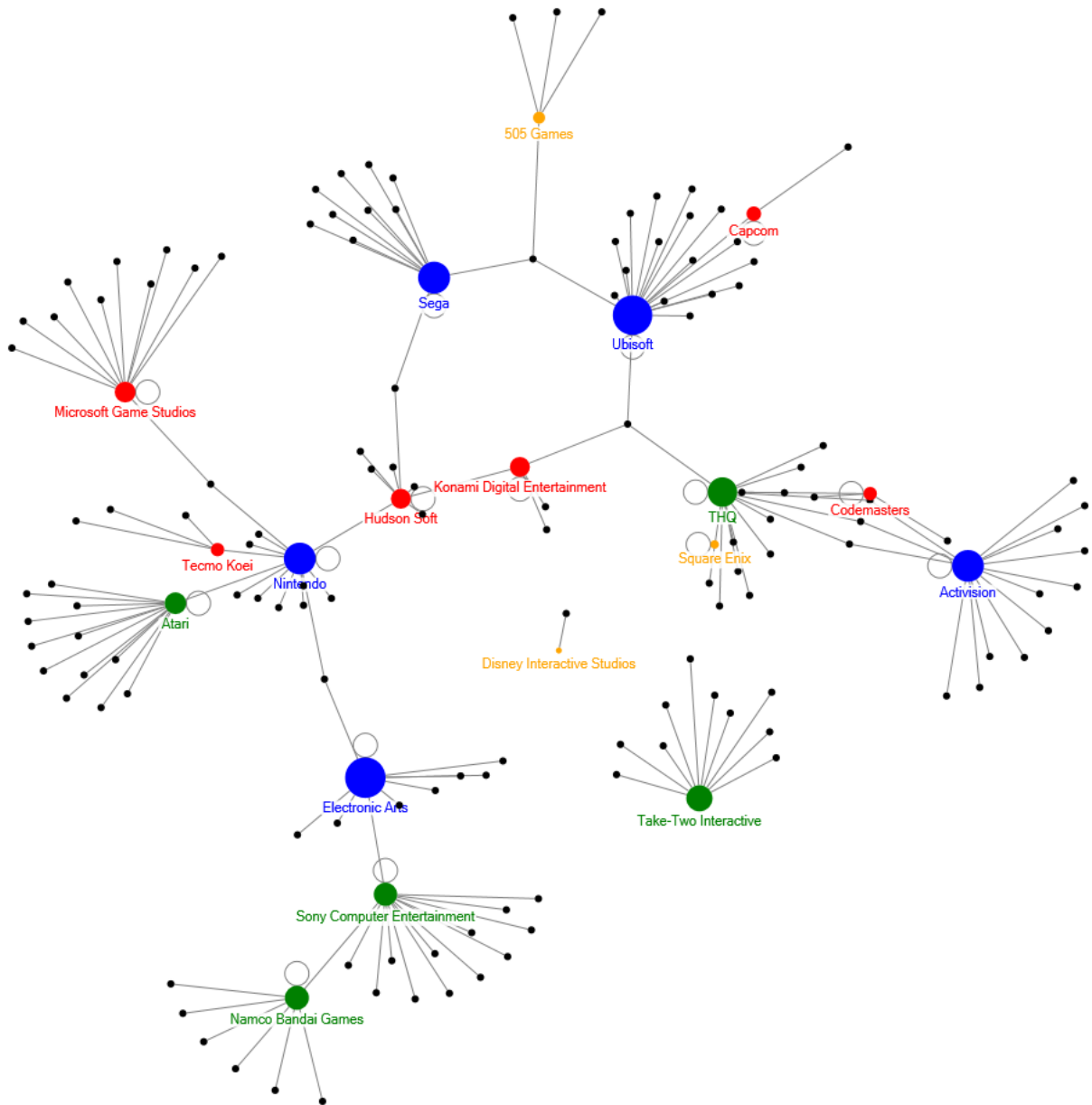**Figure E.8 - Platform Network graph total**

Publishers:
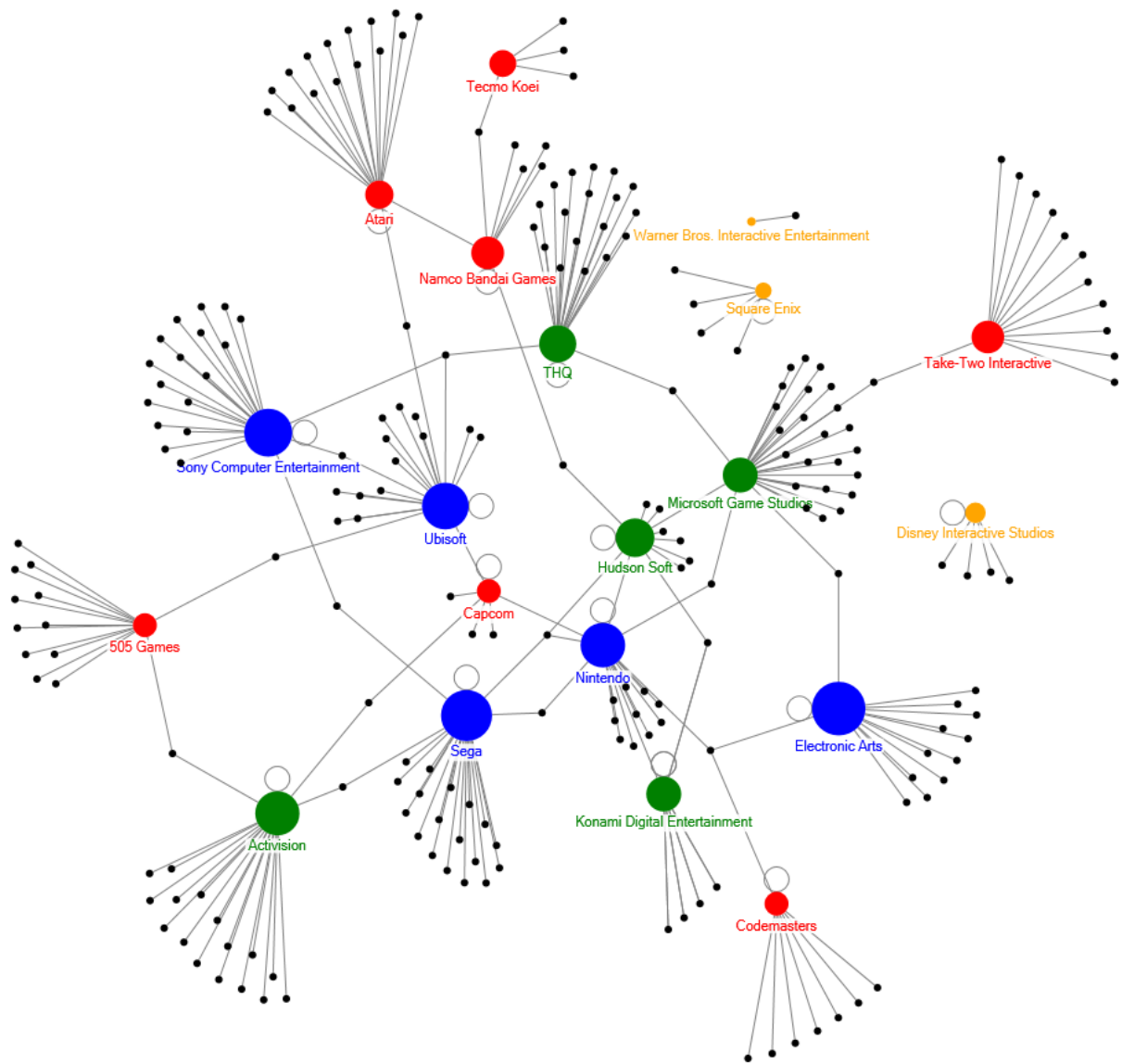
Figure E.9 - Publisher network graph 2006

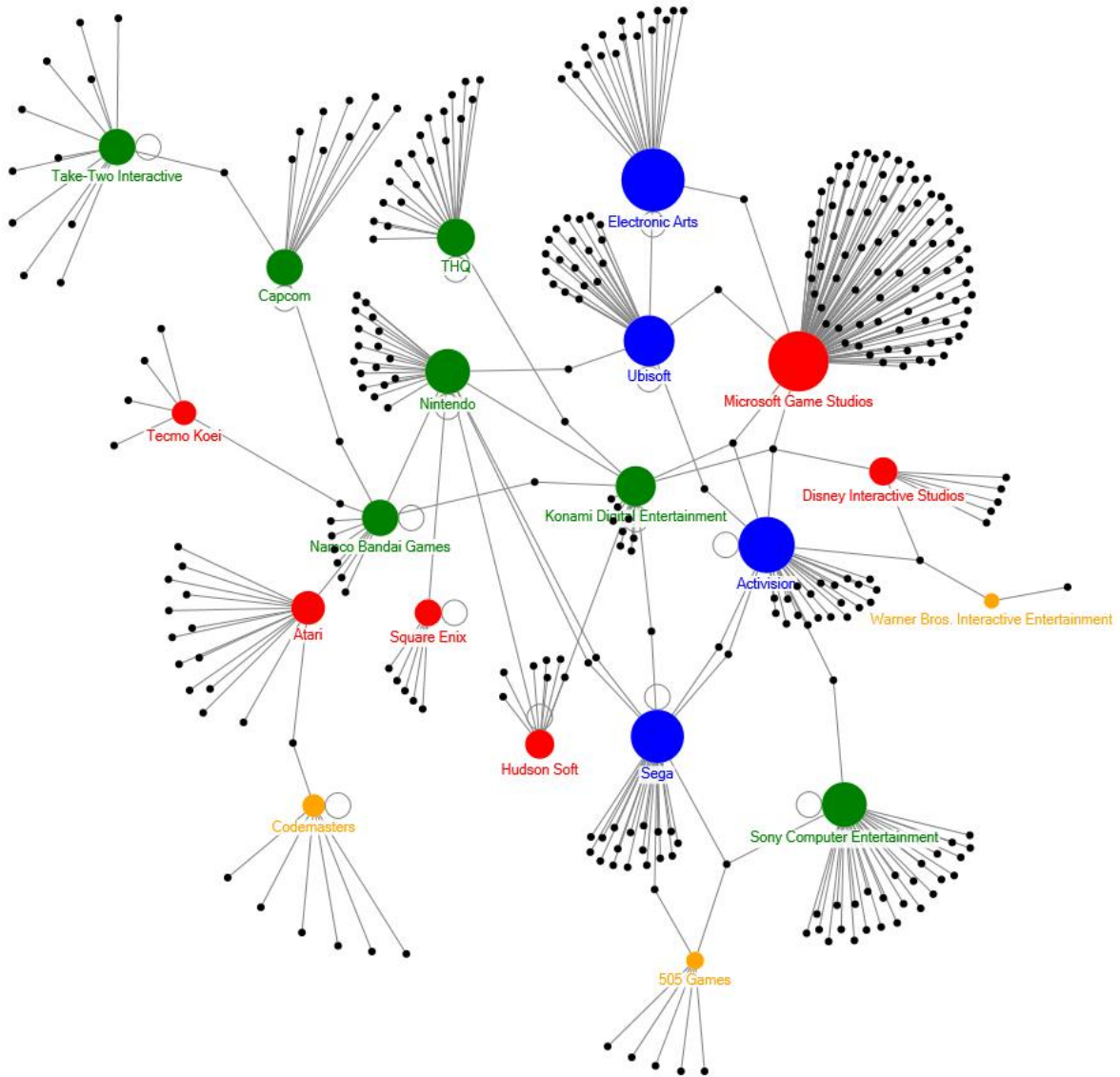**Figure E.10 - Publisher network graph 2007**

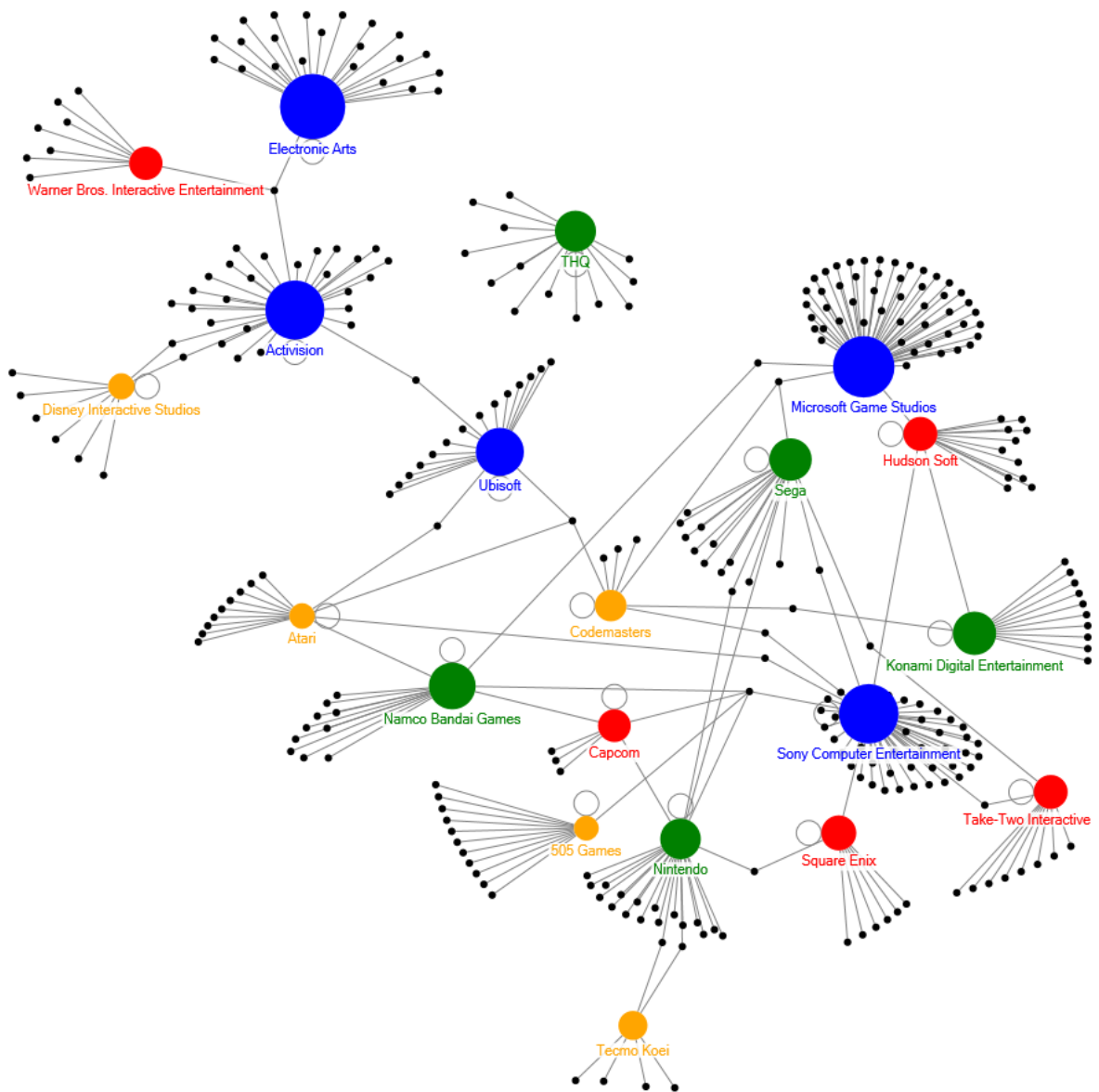**Figure E.11 - Publisher network graph 2008**

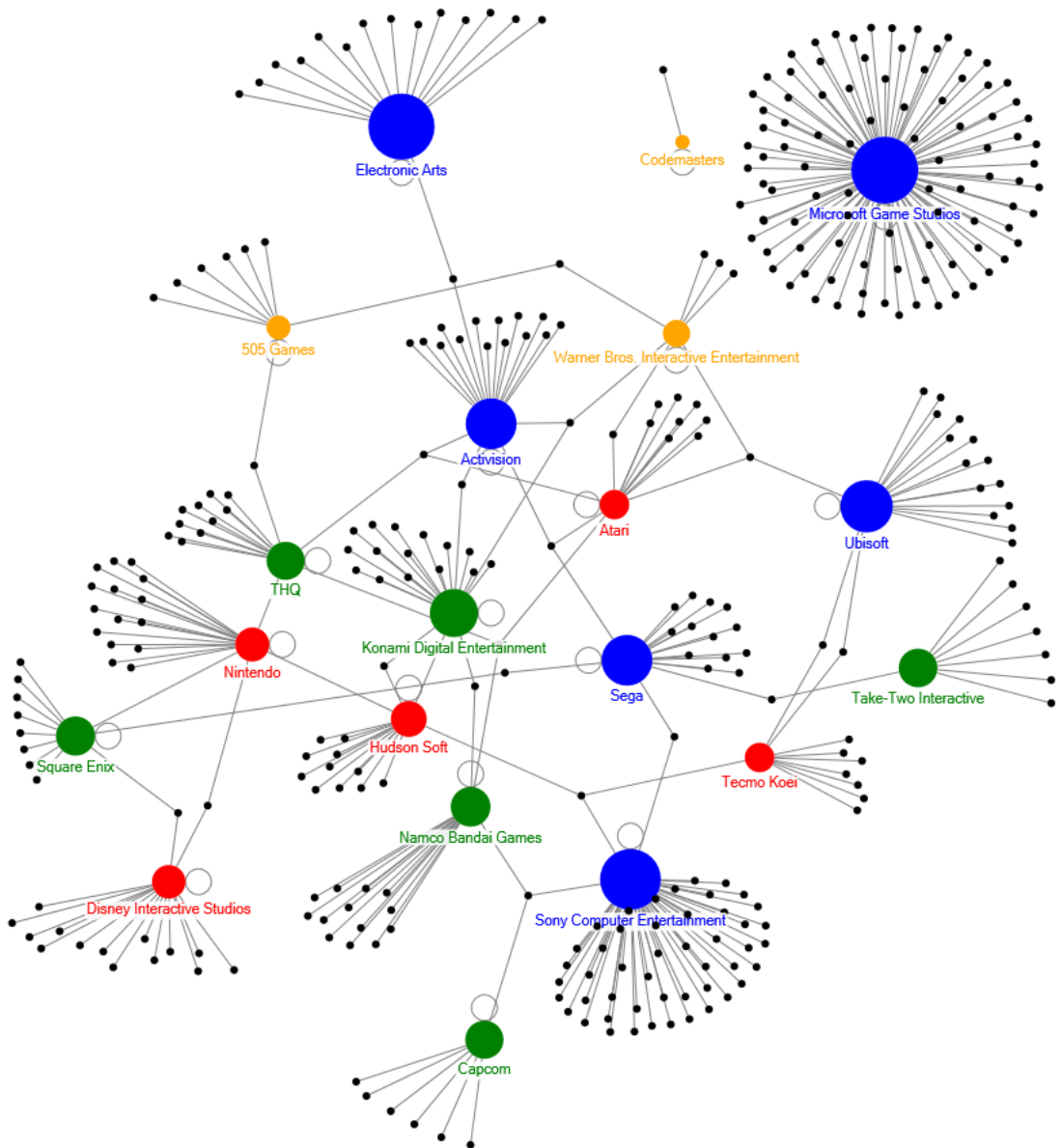**Figure E.12 - Publisher network graph 2009**

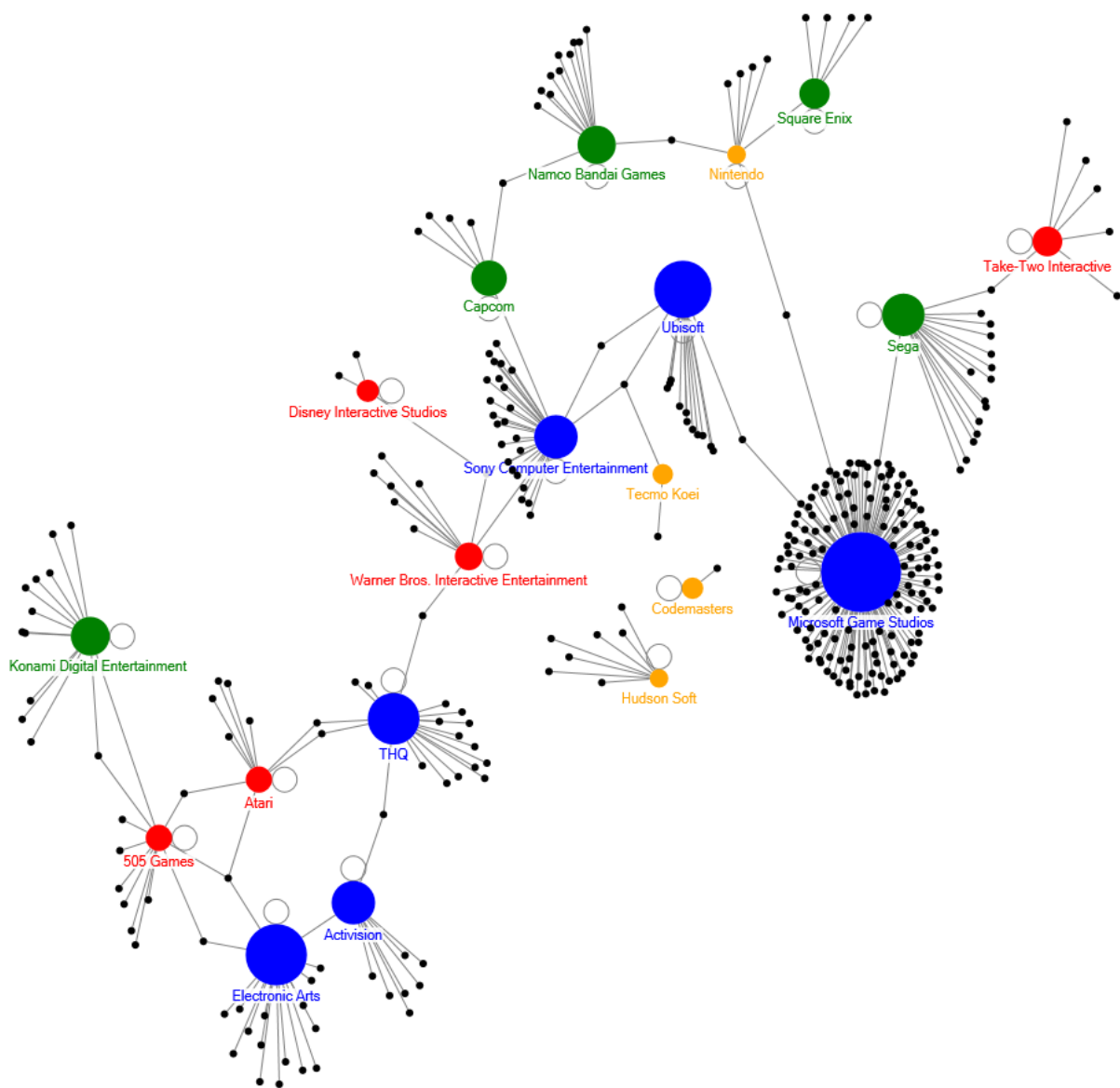**Figure E.13 - Publisher network graph 2010**
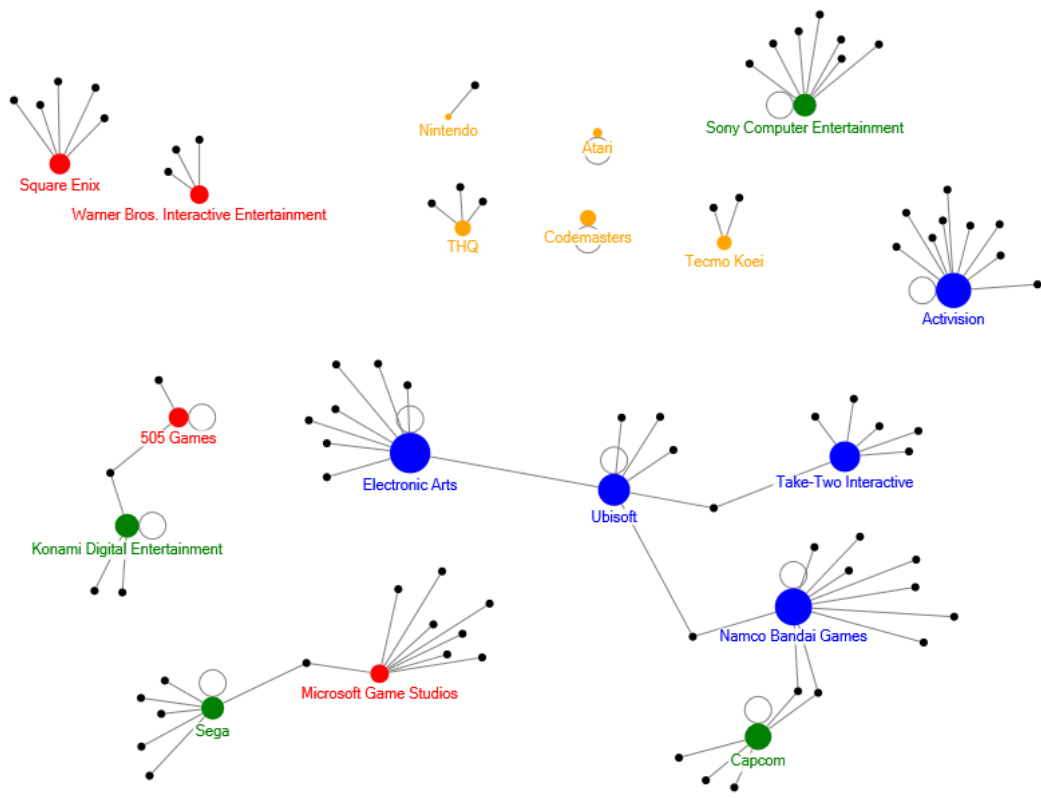
Figure E.14 - Publisher network graph 2011

Figure E.15 - Publisher network graph 2012

Appendix F – Strategy Model

The strategy model provides information based on sales figures. The information presented, is divided into single-homed and multi-homed and supports publishers and developers in the selection process for a development strategy. This model was excluded from the paper due to a time constraint.

Single of multi-homing	Genre	Platform(s)
- Single-homing - Multi-homing	- Action - Adventure - Fighting - Misc - Platform - Puzzle - Racing - Role-Playing - Shooter - Simulation - Sports - Strategy	- Xbox 360 - Nintendo Wii - PlayStation 3 - PC

Exclusive

Nintendo Wii

Xbox 360

PlayStation 3

PC

Best selling genres:

Platform	~copies sold per game
Sport	~copies sold per game

Good selling genres:

Misc	~copies sold per game
Racing	~copies sold per game
Fighting	~copies sold per game
Shooter	~copies sold per game
Simulation	~copies sold per game

Average selling genres:

Action	~copies sold per game
Role-Playing	~copies sold per game

Below Average selling genres:

Puzzle	~copies sold per game
Adventure	~copies sold per game
Strategy	~copies sold per game

Multiple Platforms

Xbox 360

PlayStation 3

Nintendo Wii

PC

Combination of selected platforms

Best selling genres:
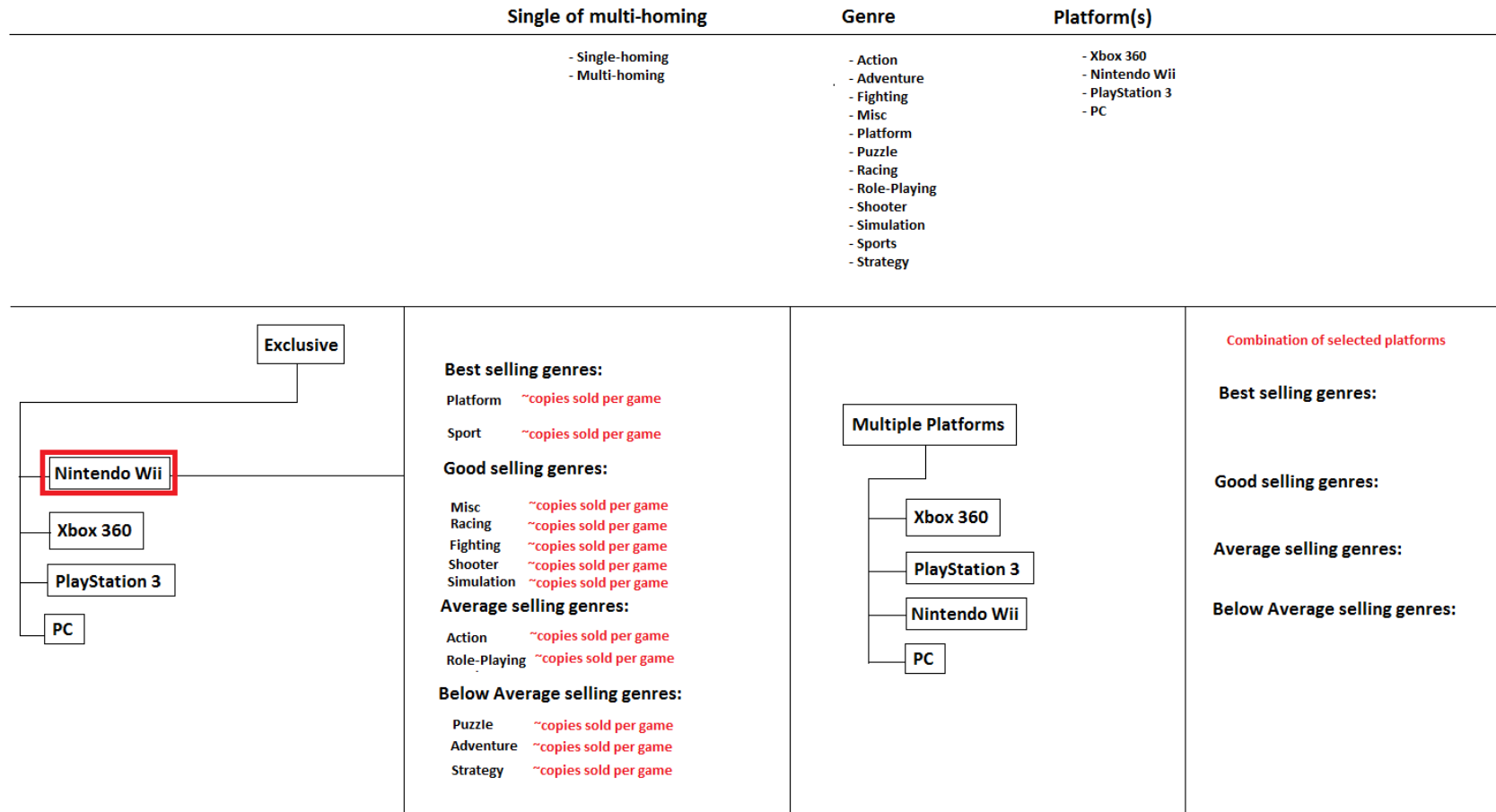
Good selling genres:

Average selling genres:

Below Average selling genres:

Figure F.1 - Strategy Model Concept